Sustainability Report 2022

MAN Energy Solutions
Future in the making

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MAN Energy Solutions in brief

The financial key figures continue to develop very positively. This result shows us that our strategic orientation and efficiency program, “Performance 2023,” is having an effect. Order intake increased significantly by over 10 percent in the reporting year. Revenue also substantially rose again in 2022.

As in the previous year, 5.3 percent of the revenue went into R&D, leading to an increase in the R&D budget. Profitability rose sharply by over 40 percent, resulting in an EBIT of €280 million. This result helps us to further drive the transformation of MAN Energy Solutions into a provider of climate-friendly energy solutions.

	2022	2021	2020
Orders received (in million €)	4 260	3 821	2 933
Turnover (in million €)	3 565	3 278	3 267
Workforce (Quantity on 31.12.)	14 571	14 062	14 782
CO_2 emissions (in t)	37 072	52 892	69 917
Energy comsumption from renewable energy sources, external procurement (in MWh)	78 414	41 165	37 491
Total amount of waste (in t)	20 234	21 865	23 857

Moving Big Things to Zero

Dear Readers,

We are committed to our company motto, **“Moving Big Things to Zero”**, and measure business success not only by financial metrics. We can only be a long-term successful company if we continue to generate societal value beyond the economic sphere. We are working on this with all our energy.

For instance, in the fight against climate-damaging greenhouse gases: If all the industries we supply were to utilize our technologies for CO_2 reduction without exception, global CO_2 emissions would decrease by around 10 percent, according to our estimate. Even if this ideal potential may not be entirely achievable, it motivates us. Each milestone we reach with our customers inspires us further. Here are a few examples: We welcome the world’s first methanol-powered container ship with Maersk. We are working on climate-neutral heating through large heat pumps with the Danish municipality of Esbjerg. For Heidelberg Materials, we are reducing the CO2 emissions of their cement production in Norwegian Brevik by 50 percent.

Our carbon footprint is also a challenge that we persistently work on. We aim to reduce the amount of greenhouse gases emitted at our production sites by 50 percent by the year 2030. Additionally, we are vigorously committed to developing and establishing circular economies:
We continuously optimize our waste and recycling management to minimize our waste generation and extend the lifespan and efficiency of our products through retrofits and upgrades, first-class service, and high ease of repair and maintenance. Fundamentally, our products' durability, high quality, and maintenance-friendliness make an essential contribution to resource efficiency.

But our responsibility does not end, nor does it begin, at our factory gates. Along our entire supply chain, we insist on compliance with legal regulations and guaranteed sustainable corporate governance standards. We see it as our duty to do more than just the necessary to ensure occupational safety, environmental protection, and human rights, and we expect this self-commitment from our business partners as well. In this regard, we want to be partners rather than merely imposing demants.on this path.

Our dedicated employees are at the core of our self-claim and all progress in implementing our sustainability strategy. Their innovative spirit, motivation, and self-directed work are essential for our joint mission of **“Moving Big Things to Zero”.**

The present sustainability report consolidates the information for the year 2022 on our progress and the business and technological milestones achieved on our path to sustainability. I invite you to form your opinion by reading it and accompanying us on our way to a more sustainable future.

Yours sincerely,
Uwe Lauber

Dr. Uwe Lauber
Chief Executive Officer
MAN Energy Solutions SE

The four focus areas of our sustainability strategy

As a company and a part of society, MAN Energy Solutions (called MAN ES in this report) confronts global challenges that substantially impact our future viability. Our primary goal is to commit to a sustainable corporate policy emphasizing secure jobs, healthy employees—internally and in our supply chain—and resource-efficient, environmentally conscious manufacturing processes, and safe products. With our products and services, we act where we identify significant drivers of economic and ecological progress. We recognize this responsibility, and therefore, we already offer system technologies that assist our customers in increasing the efficiency of their systems and applications while reducing emissions. We have organized our activities into four focus areas, which we present to you as follows:

"The greatest threat to our planet is the belief that someone else will save it."

Robert Swan
Polar researcher and environmentalist

Decarbonization

Circular economy

Responsibility in the supply chain

People empowerment

Decarbonization

Alignment and strategy

Climate change and the need for decarbonization are the most significant challenges of our generation. For MAN Energy Solutions, this presents two essential areas of action: On the one hand, we aim to reduce the CO_2 emissions we cause. On the other hand, we aim to offer products and solutions that drive decarbonization forward. According to our estimate, if all the industries we supply were to utilize our CO_2 reduction technologies without exception, global CO_2 emissions would decrease by around 10 percent.

Decarbonization through our products and solutions

Our goal is to lead in our business areas as a pioneer and enabler of global decarbonization and to pave the way to a climate-neutral future with our products – in the maritime sector, the energy industry, and industrial applications. We provide new technologies and solutions for a CO_2-neutral economy to avoid and reduce CO_2 wherever possible and to compensate for unavoidable emissions.

In concrete terms, this means: By 2030, sustainable technologies and solutions will make up most of our business, and our portfolio for our main applications will each include at least one technological solution for CO_2-neutral product operation. By 2030, we want to offer products for the maritime industry that enable complete decarbonization.

We are working to enable our customers to use a variety of synthetically produced, climate-neutral fuels. Many of our gas and dual-fuel engines can already be operated with climate-neutral fuels, such as synthetic natural gas (SNG). Other so-called “Future Fuels” like ammonia or green methanol will play an essential role in the future. They are not yet available in sufficient quantities in the market. For this reason, we are also preparing corresponding solutions for producing these fuels to enable their use in our engines. Hydrogen is prominent in the energy transition as an indispensable raw material for profound decarbonization.

Where direct electrification is not sensible or technically impossible, green power and fuels derived from hydrogen point the way to a climate-neutral future. MAN Energy Solutions will invest up to 500 million € in its subsidiary H-TEC SYSTEMS over the coming years to develop the hydrogen specialist into a large-scale manufacturer of PEM electrolyzers as quickly as possible. H-TEC SYSTEMS is already successful in the market with solutions for hydrogen electrolysis and offers its customers integrated container solutions in the megawatt range. With its electrolysis solutions, H-TEC SYSTEMS will significantly contribute to reducing global CO_2 emissions.

Not all emissions can be effectively reduced or entirely avoided. These so-called “Hard to abate” sectors cause around one-third of the world's emitted greenhouse gases. Against this background, technologies for capturing, reusing, or storing CO_2 provide a strong lever and are becoming increasingly strategically important for MAN Energy Solutions. Our Carbon Capture Utilization and Storage solutions, known as CCUS, offer energy-intensive industries the opportunity to minimize their greenhouse gas emissions, make their processes more efficient, and thus contribute to decarbonization. We will continue to expand our commitment in this area.

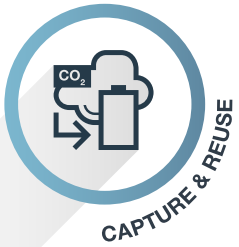
Avoid

Hydrogen
Power-to-X
Synthetic fuels
Heat pumps

Reduce

Retrofits
Upgrades

Compensate
Capture & Reuse



Carbon Capture Utilization and Storage (CCUS)

Compensate
Natural

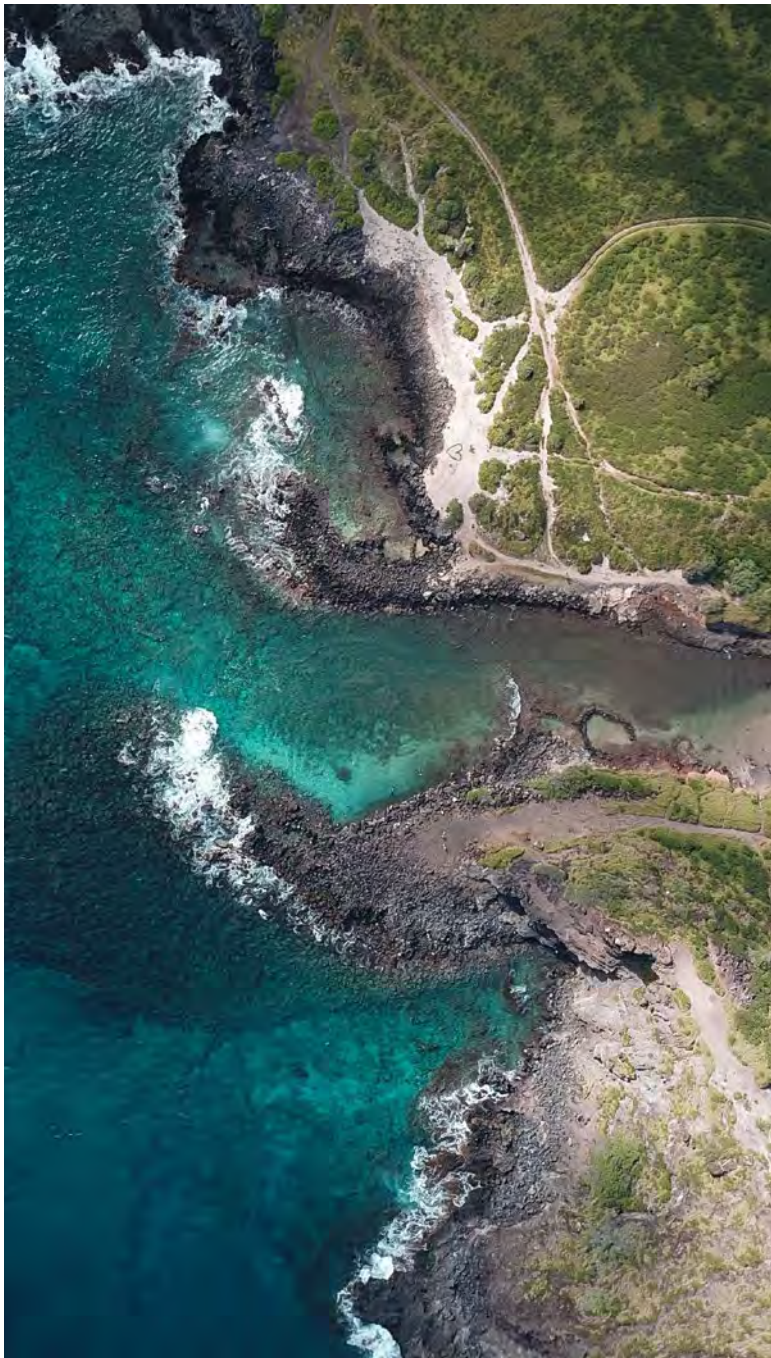
Climate protection projects

Our retrofitting business, i.e., the business of technological retrofitting of existing products and systems, makes another vital contribution to the maritime energy transition and to the decarbonization of the global power plant park: Upgrade and conversion is an essential part of the range of services from MAN PrimeServ, our aftersales Brand. Retrofitting not only extends the service life of engines and systems but can also significantly reduce their CO_2 emissions by converting them to run on alternative fuels. We continuously expand our retrofit solutions to promote the decarbonization of existing systems. We are pursuing quadrupling sales in this area by 2025 compared to 2019 (see also the “Circular Economy” chapter). We are on a good trajectory here and have tripled our retrofit sales since then.

Various regulations and legislative changes support the trend towards retrofitting products and installations already in the field to a lower-emission or emission-free fuel variant. For example, the International Maritime Organization (IMO) introduced the Energy Efficiency Existing Ship Index (EEXI) on January 1, 2023, under which commercial and cruise ships over 400 GT must have an energy efficiency certificate. Along with the EEXI, the Carbon Intensity Indicator (CII) also came into effect. The goal is to align the operation of ships with strict CO_2 emission values so that the entire shipping industry significantly contributes to achieving the 1.5-degree goal of the Paris Agreement. Against this background and given further upcoming regulatory requirements, there is enormous potential in our retrofit area: Since the average lifespan of ships is often more than 25 years, we can only achieve decarbonization by retrofitting older vessels.

In addition to our product-side efforts for decarbonization, we are committed to implementing regulatory and market-related framework conditions, for example, by adapting rules and regulations and expanding infrastructure or through our membership in the National Hydrogen Council of the Federal Ministry for Economic Affairs and Energy. With this, we support the goal of making the required fuels available to the market in the future at competitive prices.

The construction of large heat pumps is another strategic area: Instead of burning fossil fuels for heating and cooling, electrically driven heat pumps use various heat sources such as lakes, rivers, seas, wastewater, industrial waste heat, geothermal heat, or ambient air, efficiently and with low emissions. If operated with green electricity, they are even largely emission-free. Our large heat pumps consist of compressors, expanders, and companders. With MAN's electrothermal energy storage technology (ETES), customers can generate, store, and convert heat or cold as an additional option. The market for heat pump solutions has experienced double-digit annual growth over the past ten years. The most significant potential is located in the industrial sector, responsible for about half of the world's CO_2 emissions from heat generation, and in district heating. Here, we see great potential for our solutions.



Decarbonization in our production and at our sites

Our voluntary commitment to reduce absolute CO_2 emissions at our production sites by 50 percent by 2030 (compared to 2018) still applies. This commitment includes emissions inside and outside production. It also includes emissions caused by our administrative areas or those resulting from engine test runs.

To achieve this goal, we continue our centrally coordinated measures management for energy reduction and energy efficiency enhancement, which has been established for many years. With all the construction measures we undertake, we thus ensure sustainable energy usage.

We remain committed to the introduction of an energy management system in accordance with ISO 50.001. We will align the timetable for the introduction and the scope of the sites to the final requirements resulting, for example, from the Energy Efficiency Act.

In addition to reducing overall electricity consumption, we are also working to increase the proportion of electricity from renewable sources continuously. Since January 1, 2022, all the electricity we purchase for all our European production sites has come from renewable sources. Since 2022, a photovoltaic system has also been in operation at our site in China. One location in India followed in 2023. More will follow. We expect to generate at least six percent of our electricity demand by ourselves by 2030.

Activities and actions in 2021

Initiatives relating to decarbonization

The International Maritime Organization (IMO) puts the annual emissions from shipping at around 1 billion tons of carbon dioxide – this corresponds to almost 3 percent of all greenhouse gas emissions worldwide. The IMO calls for these emissions to be reduced by 50 percent by 2050 and 40 percent by 2030, compared with their level in 2008, and indicates the need for action.

MAN Energy Solutions has advocated for a maritime energy transition towards climate-neutral shipping for many years. For us, it's clear: The development of engines and the associated infrastructure that enables the industry to use carbon-neutral and carbon-free fuels on a large scale is the key to establishing a more environmentally friendly shipping industry. We are committed through our products and solutions and by participating in the relevant research projects and innovations that define this field.

One of these crucial projects for CO_2-neutral engines is the development of the ammonia engine, which began in 2019 and is still ongoing, in which we see an essential technology for the maritime energy transition. For this initiative, we were able to win the Trafigura Group Pte. Ltd. as a co-sponsor.

By 2024, the two-stroke ammonia engine for large ocean-going vessels should be commercially available. A retrofit package will follow, with which ships can be converted for operation with ammonia by 2025. With this project, we are demonstrating one of the paths to decarbonizing the entire maritime industry.

Since 2022, we have offered a solution that significantly reduces the methane slip in LNG engines. LNG is considered a bridge technology for transitioning from fossil fuels to Future Fuels, as it produces 25 percent fewer emissions. Today, LNG-powered engines make up the majority of orders for MAN ES in the maritime sector. However, LNG releases the greenhouse gas methane during combustion. This methane slip is reduced by our first dual-fuel ME-GA engine from MAN ES, which has complemented our portfolio of dual-fuel engines since 2022. It is a 70-Bore engine mainly for the LNG container ship segment. Its exhaust gas recirculation solution (EcoEGR system – Exhaust Gas Recirculation) increases the engine's performance efficiency and significantly reduces methane slip when it is operated with LNG – up to 50 percent. Thus, our ME-GI engines set a new standard for reducing emissions from LNG-powered ships to a minimum. In 2022, more than 50 percent of the two-stroke engines ordered from us were dual-fuel engines, with large ships acting as 'first movers' of these essential technologies.

Generally, last year we noticed a significant increase in interest in low-emission solutions for shipping and were able to commercialize our climate-friendly fuel technologies increasingly. Here, the LGIM methanol engine, of which more than 100 engines have been sold, should be mentioned. MAN Energy Solutions has developed a dual-fuel ME-LGIM engine that can be operated with both methanol and conventional fuel. The engine is based on our proven ME series, of which around 5,000 engines are in operation. The engine enables the almost climate-neutral operation of large ocean-going vessels by running on green methanol.

By the end of 2022, we had a total order backlog of 78 ME-LGIM engines with different bore sizes, of which 24 were firm orders for G95 variants. Of our 50-Bore variant, 19 engines are already in operation and have completed more than 140,000 operating hours with methanol alone.

Initially, there was interest mainly from the high-end container ships. However, operators of smaller tankers and bulk carriers are also interested in this solution, as they want to future-proof their business against the backdrop of current and expected legislation and regulations. According to our estimations, the proportion of methanol in all dual-fuel engines will rise to about 30 percent in a few years. This business field has a significant lever concerning the decarbonization of shipping. You can learn more about it by reading the section on our lighthouse projects.

Hydrogen plays a unique role in the production of alternative, climate-friendly fuels. We are now the sole owner of our former subsidiary H-TEC SYSTEMS, thus completing our offering in the hydrogen value chain. We aim to drive the industrialization of electrolysis with H-TEC SYSTEMS and bring green hydrogen to the mass market.

Our commitment to the field of hydrogen also means that our gas-powered four-stroke engines in power plants are already “H2-ready”: This means they can be operated with a hydrogen content in the gas mixture of up to 25 percent by volume. The adaptive combustion control (ACC) required for the hydrogen admixture in MAN engines reacts fully automatically to varying hydrogen percentages in natural gas. It thus compensates for possible efficiency losses when operating with fluctuating H2 percentages. This way, we enable the use of hydrogen, e.g., in power plants, and thus significantly reduce CO_2 emissions. Gas engines already in operation can be upgraded to so-called hydrogen blend operation by upgrading the automation and retrofitting additional ACC sensors. By 2025, the units should also be updated to operate with up to 100 percent hydrogen.

Also, in the area of eFuels, we achieved an important step in 2022: Our methanol reactor for the eFuels pilot plant 'Haru Oni' of Porsche AG in Punta Arenas, Chile, went into operation. The over ten-meter high reactor system assembly at the MAN ES Deggendorf site took five months. After eight weeks more at sea, the methanol synthesis unit arrived in southern Chile in May 2022. At the end of 2022, the plant, realized by the Chilean company HIF in collaboration with Siemens Energy and other project partners, went into operation. It is the world's first commercial large-scale facility of this kind for producing synthetic, climate-neutral fuels: Green hydrogen is produced with the help of wind energy, which is then combined with CO_2 filtered from the air in the methanol reactor. The reactor will produce up to 750 tons of green methanol from wind power annually, which is to be largely converted into climate-neutral gasoline. In an initial pilot phase, around 130,000 liters of eFuels will be produced, with the capacity to be gradually increased to an industrial scale by the middle of the decade. Porsche plans to use the eFuels initially in motorsports and the Porsche Experience Centers.

A business area that gained further importance in 2022 is Carbon Capture Utilization and Storage (CCUS). In some industrial and combustion processes, large amounts of CO_2 are generated that cannot currently be avoided due to the process. Cement production accounts for around six to seven percent of all global emissions, making it a key sector on the path to a decarbonized global economy – and requiring unique solutions.

For the HeidelbergCement site in Brevik near Oslo, MAN ES, in cooperation with Aker Carbon Capture, will implement a jointly developed, energy-efficient technology solution to reduce carbon emissions by mid-2024. The new technology, Carbon Capture Heat Recovery (CCWHR®), uses the compression heat of the RG compressor for steam generation, which is used in the CO_2 separation process.

In this way, around 400,000 tons of CO_2 will be captured annually at the Brevik plant, corresponding to approximately 50 percent of the site's total emissions. The CO_2 gas is compressed, liquefied, and transported to an onshore terminal near Bergen in western Norway using new tankers. From there, a pipeline leads to an underground storage site in the North Sea. This project by MAN ES is part of the Norwegian government's Longship project and aims to demonstrate that the technologies to implement a continuous CO_2 chain, from capture to transport to storage or even usage, exist and can be employed at larger industrial facilities. They are setting a new standard for future industrial projects.

Further activities to decarbonize our production sites

In 2022, we increased the share of purchased electricity from renewable sources to 100 percent at our European production sites. In conjunction with our energy efficiency and reduction measures, this enabled us to reduce CO_2 emissions by a further 15,000 metric tons relative to the previous year. Compared to our reference year, 2018, the reduction thus amounts to 70,000 metric tons.

In 2022, we have again taken measures to modernize buildings and infrastructure, such as improving lighting technology or insulation. In addition, we have made improvements in the energy-intensive intensive area of test benches.

Concerning electrifying our fleet, we also made some progress: Our forklifts in Augsburg's factory transport (material distribution) already run on 100 percent electricity from renewable sources. We also continue to use the train for heavy transports and the shipment of the engines produced in Augsburg whenever possible. The conversion of our company car fleet to electric drive is progressing: At the Augsburg location, more than 30 percent of the company car fleet are hybrid or electric vehicles.

Due to the continued very high proportion of mobile work and the virtual execution of conferences and meetings, we have been able to keep the number of business trips and journeys to the workplaces and, in this context, the resulting CO_2 emissions at a very low level. Since we want to continue this approach sustainably, a shared desk model, in which several employees share a desk in the office. You can read more about this in the chapter on people empowerment.

100 %

Electricity from renewable sources

Over 70 k

Tons of CO_2 saved

Lighthouse projects

New combined heat and power plant with gas engine system from MAN ES in Frankfurt (Oder) saves 50,000 tons of CO_2 annually

**Environmentally friendly heat and power supply for the region:
In March 2022, MAN Energy Solutions and Stadtwerke Frankfurt (Oder) commissioned the new combined heat and power gas engine power plant of Stadtwerke Frankfurt (Oder). The combined heat and power plant is powered by five MAN 20V35/44G gas engines. In addition to 51 MW of electrical energy, they also provide 50 MW of district heating. In addition, MAN ES installed a hot water boiler with a capacity of 20 MW, increasing the plant's total thermal capacity to 70 MW.**

The new gas engine power plant is part of a comprehensive modernization of the Am Hohen Feld cogeneration plant, which has already supplied approximately 33,000 households and commercial customers with electricity and about 19,000 homes and businesses in Oderstadt with district heating since 1997. Until now, the power plant was operated with around 60,000 tons of lignite dust and natural gas annually. The new facility uses not only the more climate-friendly natural gas but also operates with an overall efficiency of over 90 percent, making it particularly efficient.

In total, Stadtwerke Frankfurt (Oder) has invested almost 60 million € in the modernization of the power plant location – the most significant investment project of the company in the last 20 years. With this project, the municipal utilities demonstrate that cogeneration with district heating is a long-term economic concept for the immediate reduction of CO_2 emissions while ensuring the reliable supply of electricity and heat to the population. We also see such flexible gas plants as an indispensable transition technology on the way to energy and heat transition, which is necessary to reduce greenhouse gas emissions and phase out the use of coal. In perspective, it is possible with the new plant to further reduce the emissions of the gas engines, as they can also be operated with a mixture of green hydrogen and natural gas – up to a completely climate-neutral operation with hydrogen-based synthetic natural gas (SNG).

And even after commissioning, we remain a partner of the project: Our global aftersales brand MAN PrimeServ takes over maintenance together with the municipal utility's personnel.

Methanol engines on the rise: Another major order for MAN ES

Methanol from renewable energies plays an essential role in the decarbonization of shipping because it is a clean, efficient, and safe fuel. It is particularly suitable for ships that have so far been operated primarily with conventional fuel and LNG. While two such ME-LGIM engines had already been ordered for Maersk container ships in 2021, an additional order for six more was placed in 2022.

The Hyundai Shipbuilding Division (HHI-SBD) has ordered six MAN B&W G95ME-C10.5-LGIM dual-fuel main engines along with the construction of 6 × 17,000 TEU container ships for the Danish logistics company A.P. Moller-Maersk. The Hyundai Engine Machinery Division (HHI-EMD) will build the engines, which can be powered by green methanol, under license in Korea.

There are several reasons for the noticeably increasing acceptance of methanol drives: Methanol can reduce pollutant emissions by up to 90 percent if the fuel is made from renewable energy sources and biogenic CO_2.

The production capacities for such green methanol are increasing significantly but must be increased to meet the demand. Moreover, it is liquid under ambient conditions, simplifying tank construction and minimizing costs. Finally, our methanol engine requires only a fuel supply pressure of 13 bar, and numerous manufacturers already offer such fuel supply systems today.

MAN ES's ME-LGIM engine has proven itself in practice, offering high reliability and fuel efficiency. Methanol tankers have been at sea with this engine for many years.

Circular economy

Alignment and strategy

By circular economy, we mean a regenerative system in which the use of resources and energy, on the one hand, and the production of waste and emissions, on the other, are minimized. The circular economy is needed because our natural resources are finite. Sustainable growth is only possible if valuable resources are decoupled from consumption. To achieve this, resources and materials must be transferred into a cycle that ensures their utilization for as long as possible.

Circular economy as a central element of sustainability at MAN Energy Solutions

Reduced use of resources, for example, contributes positively to a responsible supply chain, as it is associated with optimized material efficiency and fewer environmental impacts and CO_2 emissions.

By extending the life of our products already in circulation through upgrades (product improvements through retrofitting), retrofits (conversions of products, such as to more environmentally friendly fuels), and optimal service and maintenance, we contribute, in most cases, to a reduced CO_2 output among our customers. This kind of reduction is also an essential aspect in terms of decarbonization.

In the circular economy, we operate in two critical fields of action: On the one hand, we align our production with energy and resource efficiency and continuously optimize our waste and recycling management. On the other hand, the high quality and technological performance of our products and solutions ensure long service life. This longevity is also an essential aspect of the circular economy.

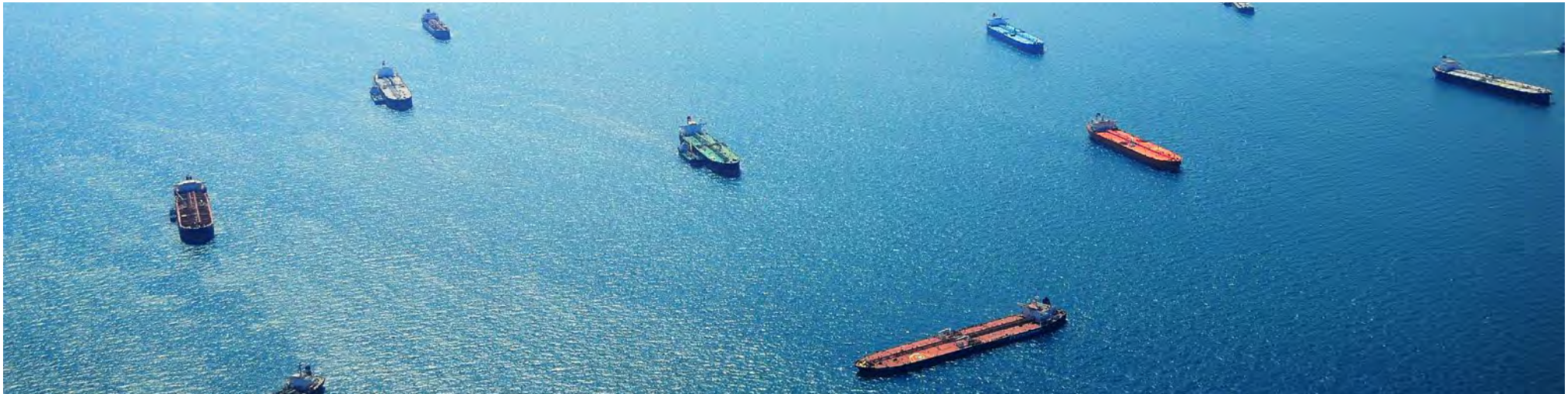
Our facilities, with appropriate design, maintenance, and upkeep, can have a lifespan of over 25 years, sometimes up to 50 years. Therefore, from the outset of development, their durability and a service concept that anticipates easy maintenance, upkeep, and repair, as well as retrofitting in many cases, are prioritized.

We maximize our efforts to support our customers in operation, maintenance, upkeep, repair, and possibly even the conversion of our products to more efficient technologies or other fuels to ensure the longest possible operating time with minimal environmental impact. All these after-sales services are covered under our independent brand MAN PrimeServ. Under this umbrella, there are various areas of particular significance: MAN PrimeServ Assist as a digital service solution for our customers, the reconditioning of components, and the retrofit area.

Various regulations and legislative changes support the trend toward converting products and equipment already in the field to a lower-emission or zero-emission fuel variant. From January 1, 2023, merchant and cruise ships over 400 GT must comply with the Energy Efficiency Existing Ship Index (EEXI). At the same time, the Carbon Intensity Indicator (CII) will apply to bring shipping up to strict CO_2 emission standards.

The goal is to align ship operations with stringent CO_2 emission values so that the entire shipping industry significantly contributes to achieving the 1.5-degree goal of the Paris Agreement. This overarching goal for the entire industry cannot be achieved solely through new ships: Since the average lifespan of vessels is often over 25 years, retrofitting ‘old’ engines plays an essential role.

This situation has created strong demand for our retrofits, meaning the conversion of existing fleet ship engines and systems in power plants or industrial applications. From 2021 to 2022, we doubled our sales in this area. There is still enormous potential here. Today, our engines provide



around half of the propulsion power of the world merchant fleet. Of these engines, around 3,500 are fully electronically controlled and can be converted to run on alternative, environmentally friendly fuels such as methanol or ammonia. About two-thirds of these ships are suitable for climate-friendly retrofitting. Operating ships with carbon-neutral fuels would lead to a reduction in CO_2 emissions of up to 86 million tons per year.

Retrofits, on the one hand, significantly contribute to an effective circular economy by substantially extending the operating life of engines. On the other hand, they also support the decarbonization of shipping. This makes the area a vital component of our efforts to significantly contribute to reducing greenhouse gas emissions with our solutions.

Activities and actions in 2022

Activities related to the circular economy

In 2022, we strengthened the topic of lean management at the Augsburg site and dovetailed it even more closely with our sustainability claim. The aim of lean management - embedded in the Operational Excellence division - is to continuously identify and implement potential for improvement in cost reduction, resource conservation, and waste and overload prevention, both in production and administrative areas.

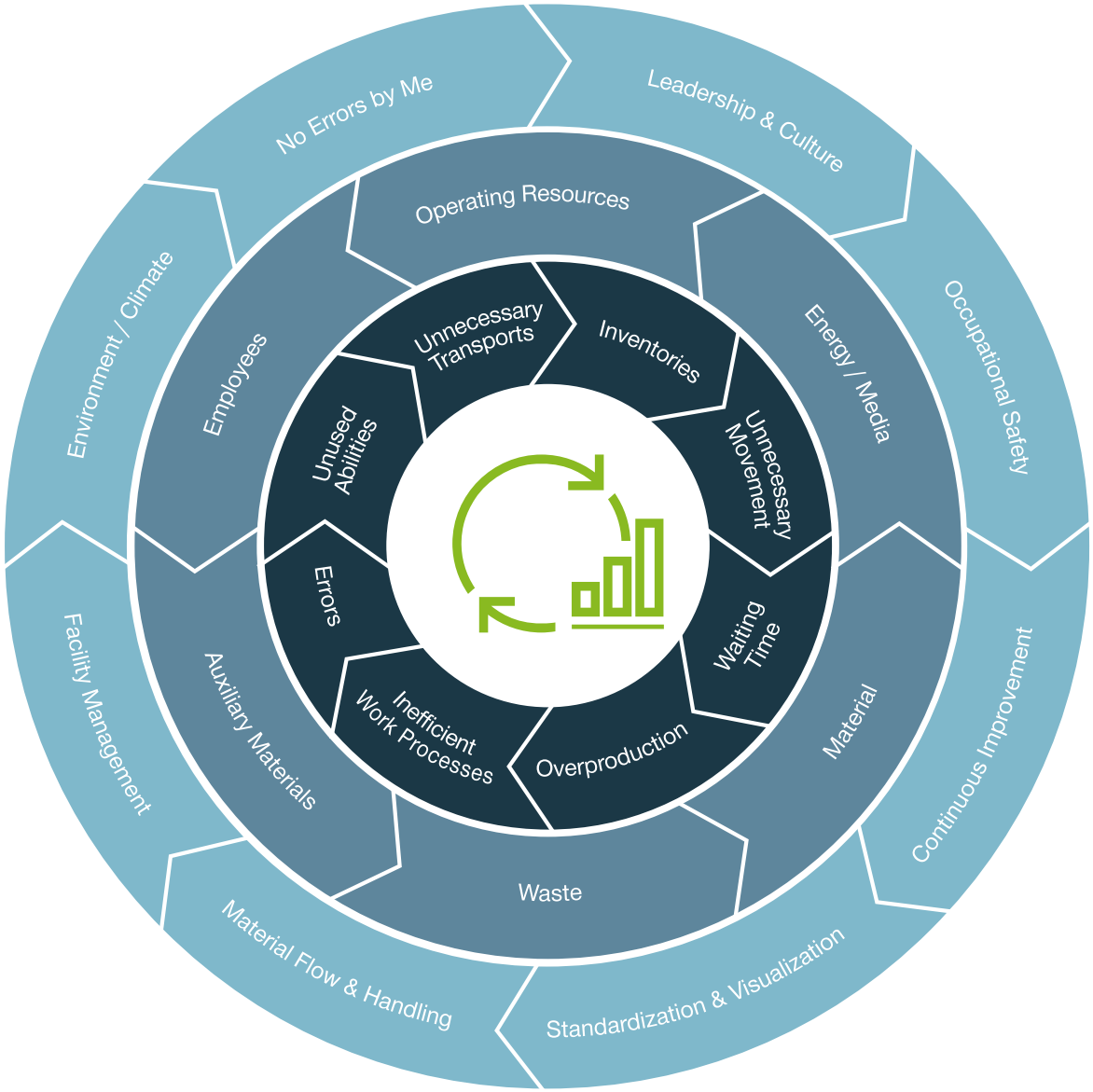
We aspire to include environmental protection and resource conservation in our considerations alongside economic criteria in all optimization projects. That's why we have even more closely intertwined the aspects of “Lean” and “Green” which we see as inseparably connected, strategically, organizationally, and methodically. In this way, they are to be anchored in the daily actions and awareness of the employees and establish a natural, lived “Lean & Green” culture within the company.

For this, we developed new methods, tools, and processes or revised existing ones in 2022. In addition, we designed corresponding information and training for employees, individually tailored to the respective target groups.

One example of such a revised process is the so-called “Gemba Walk”, where the production manager visits a production cost center, the place of value creation (Japanese: Gemba), once a week. Important sustainability criteria have been integrated into the points that are routinely checked during this tour. Similarly, we have included various Lean & Green aspects in the annual MAN ES production system check. This serves to evaluate production regarding the implementation of Lean principles and the achievement of objectives. This review now also covers environmental and climate protection questions: specific key figures and consumption are queried and checked, such as how deeply employees are integrated into the processes.

To live this new “Lean & Green” approach across the entire company, we rely on an intensive exchange of experiences and best cases across our locations: Good solutions relating to resource conservation and energy savings are systematically recorded and elaborated, and prepared for a group of about 200 executives at various locations. A corresponding network serves for the exchange of experience and inspiration. In addition, we encourage our employees to identify and utilize potential improvements – no matter how small they may be.

All of this contributes to the circular economy and aligns with our corporate strategy and goal to drive decarbonization forward significantly.



The infographic shows the various types of waste or grievances in the inner circle. The middle circle shows the resources that are affected by them. And in the outer circle, the principles of lean management that can counteract these grievances are shown.

Activities related to product use

MAN PrimeServ takes care of our customers and our products and solutions in the field. This way, too, we have great leverage to improve the circular economy.

For example, through MAN PrimeServ Assist, we ensure the highest possible product reliability for our customers. The basis is the digital platform CEON, on which algorithms collect and analyze product data. Irregularities in operation are quickly and reliably detected. Our experts, organized in a global network and available to our customers around the clock, proactively evaluate the results and provide operators with recommendations or an action plan. Through this condition-based maintenance approach (CBM), we can increase the availability and overall efficiency of the facilities in the field, optimize maintenance intervals, and prevent repair-intensive and, thus, resource-intensive damages. This approach also ultimately contributes to ensuring a safe working environment for our customers' employees. In many cases, remote maintenance can solve the problem. This digital collaboration eliminates many trips – another significant contribution to saving CO_2 emissions.

With more than 1,200 signed PrimeServ Assist contracts in the marine and industrial segments, we are recording steady growth as we continue to expand in the market. All future new systems should also be delivered “CEON-ready”.

With a focus on developing and expanding the PrimeServ Assist portfolio in 2022, we have included various additional service packages to optimize efficiency. We have developed a series of new features and updates for PrimeServ Assist that we will release in 2023. These include the monthly report, the Performance Calculation Update, and the SFOC Score (Specific Fuel Oil Consumption). These updates give our customers an overview of the costs incurred by suboptimal engine operation, thus securing engine performance to avoid excessive fuel consumption. In addition, following the new performance calculation, we have improved the data quality value (accuracy indicator), significantly enhancing the accessibility of performance values for customers. Our customers now have a transparent overview of the data quality level for the calculations. This overview enables them to make better comparisons and informed decisions.

Furthermore, through our digital partnerships, we want to drive innovations and decarbonization in the maritime sector by collaborating with industry players on both large and small scales.

Retrofit with focus on dual-fuel

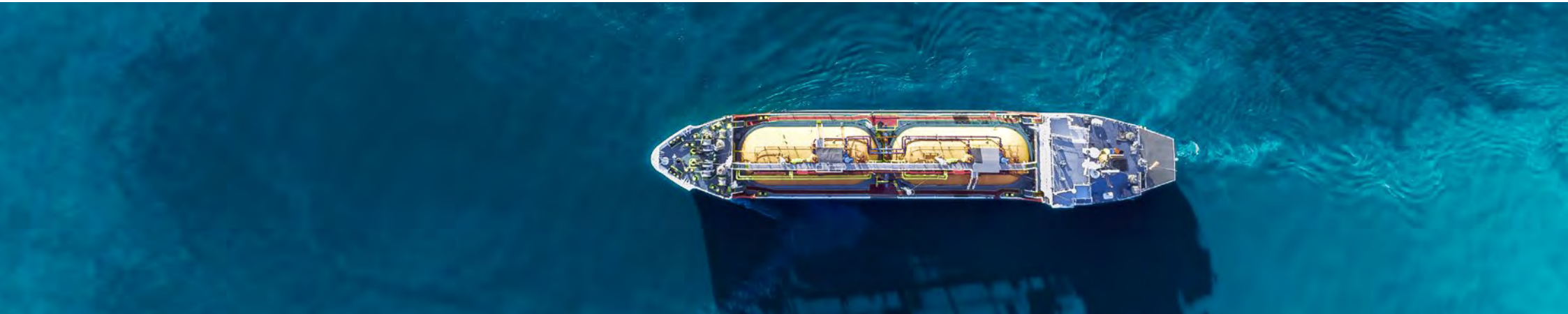
We utilize an enormous lever for a sustainable circular economy through retrofit measures for ship and power plant engines for a more emission-reduced and efficient operation.

Our product portfolio in this area includes various solutions, depending on the product, the applicable regulations, or the goals to be achieved.

One measure is, for example, our MAN oPL solution (overrideable Power Limitation), which limits the engine's performance through electronic engine control but can still provide full engine power in justified exceptional cases. We developed MAN oPL to meet the regulatory requirements of the Energy Efficiency Existing Ship Index (EEXI) of the International Maritime Organisation (IMO). The solution is available for both mechanically and electronically controlled ship engines.

The Dual-Fuel division plays a unique role in the retrofit area. Due to their modular design, conventionally diesel or heavy oil-operated, slow-running ME-C engines from MAN Energy Solutions can easily be converted to run on alternative, environmentally friendly fuels. We currently offer several options for retrofitting ME-C engines, including LNG, ethane, LPG, and methanol variants. Work is now underway on an ammonia option. Such Dual-Fuel engines ensure seamless switching between different fuels.

An example of a Dual-Fuel retrofit project from the past year is the conversion of the now third ferry of the shipping company Baleària: After the MV Napoles and the MV Sicilia were converted to the latest Dual-Fuel technology a few years ago, MAN PrimeServ completed the third retrofit of this kind in 2022 with the MV Hedy Lamarr: The 48/60 engines were completely dismantled and then rebuilt as MAN 51/60DF engines and their automation components – including turbochargers and commissioning. The result supports Balearia's goal of reducing CO_2 and NOx emissions and extends the life of the engines and, thus, the ferries themselves.



Lifecycle Upgrade

A key retrofit project to be implemented for the first time in 2022 is the lifecycle upgrade for older type 48/60 marine and power plant engines.

This new service is a kind of ‘intermediate step’ or ‘readiness package’: With the completion of the Lifecycle Upgrade, the retrofitted engine is at the technical level of a newly built MAN 51/60 and already achieves significant savings in fuel consumption, CO_2, and pollutant emissions, as well as an increase in reliability. In a further step, the engine can then be adapted for operation with synthetic, climate-neutral fuels without great effort and flexibility, as 80 percent of the necessary measures for this have already been carried out as part of the Lifecycle Upgrade. All of this makes the Lifecycle Upgrade a future-proof investment.

The duration for a Lifecycle Upgrade varies between 25 to 45 days, depending on the engine type and number of cylinders, and is thus only about 30 percent longer than the duration of a major maintenance. The return on investment occurs within 1.5 to 4 years, depending on the customer-specific application. A significant advantage is that a Lifecycle Upgrade significantly extends the life of the engine and already makes an essential contribution to decarbonization today. In any case, a Lifecycle Upgrade is a customer-specific product and requires a specially assembled project team with different competencies, selected both from headquarters and especially from decentralized locations on-site.

In the first step, our Lifecycle Upgrade offering focuses on power plant engines. In 2022, we carried out the first project for a Southern European customer: Four power plant engines of the type MAN 18V48/60A with over 100,000 operating hours were converted into a modern MAN 18V51/60. Two more engines of the same customer followed in the first quarter of 2023. We have already received further requests for this service.

We are currently seeking approval for the marine engine process and have prepared accordingly in 2022. There is already massive interest in this process among ship operators. If several engines with the corresponding power are available on a ship, the conversion will be possible while the ship is still at sea. An essential part of the Lifecycle Upgrades project is establishing a process for reusing parts generated by this measure. If necessary, parts will be bought back so that the ship owner does not have to dispose of or scrap them.

In 2022, we will continue to implement the fundamental idea of the reusability of components in the sense of the circular economy with our existing comprehensive reconditioning offers for the overhaul, repair, or calibration of old or defective parts. Reconditioning extends the service life of components, and customers receive their components back in full working order. In principle, the costs for reconditioning a component are significantly lower than for manufacturing a new component, and resource consumption and the carbon footprint are also reduced. For example, the ecological footprint for the new production of a MAN 48/60 cylinder head is around 7,600 kg of CO_2. Reconditioning produces only 700 kg of CO_2 here, corresponding to a CO_2 saving of about 90 percent.

Lighthouse projects

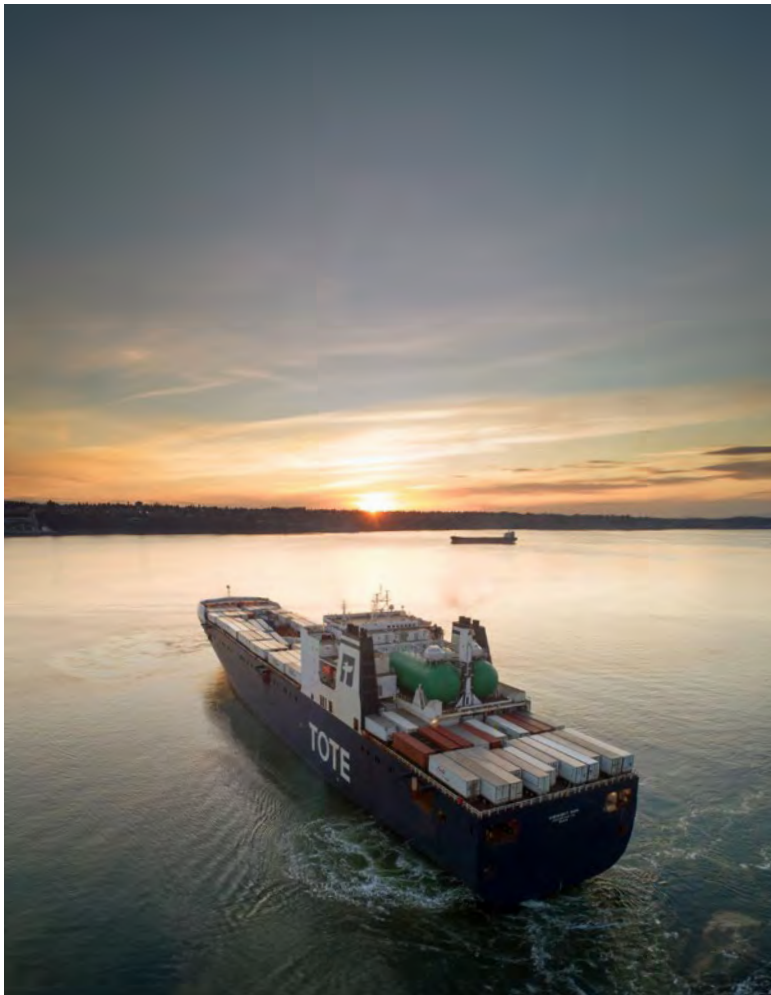
Dual-fuel retrofit on the high seas: MAN PrimeServ Power & Marine converts two cargo ships during operation

The fleet of the shipping company TOTE Maritime operates between Anchorage (Alaska) and Tacoma (Washington), playing a vital role in transport essential food supplies, equipment and large industrial cargoes goods between the two U.S. states. We made these two roll-on/roll-off ships, the MV North Star and the MV Midnight Sun, more environmentally friendly and future-proof with a dual-fuel retrofit in the course of 2022 – while they were at sea.

In times of crisis, the shipping company TOTE Maritime wanted to invest in future-proof technology. MAN PrimeServ Marine & Power proposed a Dual-Fuel retrofit to TOTE Maritime. The advantages: The gas conversion ensures efficient and low-emission operation. All pending regulations are met, and cost savings are possible – especially when the gas price is low, as is the case in the American markets.

Between 2019 and 2022, we converted the two ships' respective four 9L 58/64 engines to Dual-Fuel engines 58/64 DF. To make the 58/64 engine fit for operation with gas, it has received a new turbocharger, charge air cooler, pistons, camshaft, cylinder liners, and newly designed cylinder heads – to name just the most essential parts.

What was unique about this project was the customer's desire to avoid any downtime of the ships. Therefore, the conversion process, including all mechanical and electronic work, occurred during ongoing operations, which posed a challenge for TOTE and MAN PrimeServ Marine & Power. The challenge was especially pronounced in terms of logistics and tight scheduling. However, thanks to the excellent cooperation between MAN PrimeServ Germany and PrimeServ Los Angeles, the conversions were carried out on schedule: The MV Midnight Sun was commissioned in October 2022, and the sister ship MV North Star was completed at the beginning of 2023.



Responsibility in the supply chain

Alignment and strategy

As a large manufacturing company, we have enormous human rights and ecological responsibilities in our internal and external supply chain.

We fulfill this responsibility by adhering to regulations, standards, and voluntary self-commitments concerning occupational safety, the environment, and human rights. These are decisive for our actions and essential to our strategic guiding principle. Specifically, we implement this through corresponding programs, management systems, and initiatives. A significant influence on our efforts in this area is the new “Corporate Due Diligence Obligations in Supply Chains Act” (Lieferkettengesetz, LkSG), which came into force in Germany on January 1, 2023.

For the first time, it imposes new, stricter requirements on companies of a specific size about environmental protection and compliance with human rights throughout the entire supply chain – both internal and external. Therefore, during the year 2022, we focused on preparatory work for the implementation of this law.

Internal supply chain

Generally, we interpret our obligations in many areas far beyond what legal requirements dictate. Our Integrated Management System (IMS) is the strategic framework for our actions within our internal supply chain. At its core, it encompasses the three standards of Quality Management, Environmental Management, and Occupational Health and Safety. All our production sites are certified. In addition to the HSE Management System (Health, Safety & Environment) according to ISO 14001 and 45001, we want to expand our energy management. We are also planning the certification of our two sites in Augsburg and Oberhausen as part of the amendment of relevant standards and regulations.

Here, too, we are continually expanding our requirements of ourselves and, therefore, our efforts: for example, since 2021, we have used a new Compliance Management System Health, Safety & Environment (CMS-HSE) that has expanded our requirements concerning environmental protection and occupational safety by additional aspects and has established a unified, transparent process through which employees can report suspected irregularities quickly and effectively.

We have further intensified our efforts in the central management of energy measures. As a company that sees itself as a key player on the way to a decarbonized world, it is a concern for us to live up to the protection of the environment and resources ourselves.

A key focus in the area of Central Energy Measures Management is currently on the feasibility study, planning, and implementation of measures for the self-generation of electricity from renewable energies, mainly photovoltaic. In perspective, we want to generate at least six percent of our consumed electricity ourselves by 2030. In absolute terms, what may sound relatively small is a considerable amount that also represents a significant lever concerning the avoidance of CO_2 emissions. Heat pump projects of our own are also recorded in the measures management.

External supply chain

MAN ES has had comprehensive regulations, processes, and audits for responsibility in the external supply chain for years. In the fiscal year 2022, the procurement organization additionally subjected itself to a self-imposed audit of the internal revision with a focus on sustainability and LkSG. An external expert also assisted in the conceptualization of risk management.

Our Code of Conduct plays a crucial role in risk management for suppliers and business partners, which is binding for all. This agreement already sets out a very concrete framework concerning the observance of human rights and environmental protection.

In the area of the external supply chain, it was essential in 2022 to optimally prepare the company for the coming into effect of the “Law on Corporate Due Diligence in Supply Chains” on 01.01.2023 – and this with consideration of the draft already available today for the overarching EU Supply Chain Law, which will contain further requirements beyond the German LkSG.

Activities and actions in 2022

Initiatives related to supply chains

External supply chain

As in 2021, the year 2022 was marked by engagement with the requirements and preparations for the coming into effect of the new Supply Chain Law. Our work focused on aligning the requirements with our already existing measures, processes, and initiatives and adapting both to each other. A central result already developed in 2021 is the four-phase risk management process, which incorporates many existing measures, supplements them with actions required by the new legislation, and integrates both into a new systematic approach. In 2022, the concrete implementation of this concept was at the forefront.

Evaluate stands for regular risk analysis in human rights and the environment. This risk analysis has been firmly established in the company for many years and is now being expanded to include topics relevant to the LkSG.

Prevent includes our suppliers' transparent information and training about our sustainability requirements based on their respective risk exposure. This process step, which was comprehensively implemented in 2021, also includes audits for new suppliers as part of the existing QHSE audits.

Detect means checking the communicated expectations and the continuous screening and monitoring of suppliers by external service providers. This process step also includes a sustainability rating depending on their risk exposure.

React means a goal-oriented approach to identified risks or misconduct. This includes, for example, the creation of action plans for the respective suppliers. Preparations and planning for this took place in 2021, and implementation is currently being prepared.

Risk analysis was also at the center of our activities in the external supply chain in 2022 to meet the requirements of the Supply Chain Law. In the first step, we evaluated all suppliers of MAN ES's external supply chain for relevant risks against the background of the Supply Chain Law. For this purpose, we chose different approaches for our production or general material suppliers (energy, electricity, office supplies, consulting, among others) to address their respective risks separately.

In the area of general materials, a matrix was used for risk analysis to evaluate the risk exposure of specific industries or sectors. For example, this matrix rates areas like Security Services or IT as more critical regarding potential human rights violations than other areas.

For production material, we used the Human Freedom Index (HFI) and the Environmental Performance Index (EPI) to classify suppliers with a country focus concerning their potential risk. This systematic approach to supplier categorization was supplemented by individual workshops with our various purchasing departments to include individual risk perceptions of our experienced purchasers.

Suppliers with high-risk exposure must, in the next step, disclose extensive information about their business practices through detailed self-disclosure forms via an external service provider. We examine these details and initiate appropriate measures if necessary. Suppliers are rated using a “traffic light system” with green, yellow, or red colors.

The results of this risk analysis will be considered in our award processes starting in 2023, such as in the weekly award meeting of our sourcing committee.

Since mid-2023, the following procedure has been in place: If an order is to be awarded to potentially risky suppliers, the fulfillment of sustainability criteria must be closely examined, and consultations must be held with the divisional managers of the supply chain. We implemented the corresponding preparations for this process in 2022. In addition, we are currently integrating the requirements of the LkSG into other internal company processes, such as revising the Code of Conduct in light of due diligence in the supply chain.

Overall, in 2022, the company developed and anchored the legislative requirements for monitoring the supply chain. This adaptation enables us to assess all suppliers regarding compliance with relevant criteria. This process requires continuous development and a risk-based focus in the coming years.

Internal supply chain

The Supply Chain Act, which came into force on 01.01.2023, catalyzed numerous activities and measures within our internal supply chain in 2022. For example, we adapted the relevant MAN ES guidelines and instructions related to the legal positions that needed to be protected as part of a Group-wide project.

In addition, for the first time, we conducted the risk analysis centrally mandated by the law. Various informational events and workshops at our numerous international sites accompanied this effort. We also updated the content of the aforementioned Code of Conduct for suppliers to align with our growing expectations and ensured its contractual incorporation worldwide. The same applies to our other communication channels. For example, we relaunched our sustainability website with information related to activities and expectations within the supply chain.

We further developed and optimized the central management area of energy measures in the reporting year. Its fundamental task is to track energy consumption in the company and document savings achieved through improvement measures such as retrofitting devices, replacing them with higher efficiency class ones, or using heat sources with lower CO_2 emissions. This information allows us to make forecasts, identify further savings potential, and derive concrete measures.

In 2022, we again improved the systematics and analytics of energy measure management. Transferring the data to Quentic software significantly contributed to this improvement: Quentic is a cross-sectional software for all environmental and occupational safety topics and the associated measure management. Using Quentic makes the central maintenance of data from the twelve global production sites and reporting much simpler and more efficient. For example, the calculations of the savings results in Quentic are continuous and automatic. This software can create reportings and forecasts more efficiently, simplifying the monitoring of target achievement - including efficiency targets for the sites and overarching CO_2 savings targets. The data representation in Quentic received special recognition from our parent company VW, which has acknowledged our energy measures management as being of very high quality.

To continuously develop energy measure management and identify further potential for improvement at all sites, we launched a special web-based training program in 2022 to raise our employees' awareness of the issue, minimize sources of error and achieve even greater energy efficiency at all sites, both nationally and internationally.

The exchange of information across location and company boundaries is essential in energy measure management. A vital platform for this discussion is the group-wide network on decarbonization, where representatives from Porsche, Audi, and other brands also participate. This collaboration allows us to share diverse experiences and positive examples across the group.

One focus area where we made significant progress in 2022 is the generation of electricity from renewable sources at our own sites. Our current focus is on photovoltaics, which has proven to be the most feasible technology. We also explored wind power, but it proved challenging to implement. Wherever possible, we aim to significantly increase the proportion of self-generated electricity through photovoltaic systems in the future. In the reporting year, we reached two milestones: Our plants in Changzhou and Aurangabad commissioned photovoltaic systems with a combined potential to save around 2,000 metric tons of CO_2 annually. We will also soon install the next PV system at the Augsburg site on the structure designed for heavy loads. Additionally, we've begun using heat pumps to replace heating oil and gas in the low-temperature range, with initial plans drawn up for the Augsburg and Deggendorf sites, and the pumps are scheduled to be operational by 2024.

Lighthouse project

“Sustainability Maturity Assessment”: Analysis by external specialists shows us further improvement opportunities for sustainability in the area of purchasing

To address the issue of sustainability in the supply chain within our purchasing department even more comprehensively and purposefully, we conducted a comprehensive analysis and benchmarking for these areas, which was carried out with external support in 2022. The goal was to gain clear insight into the status quo in various subject areas through an industry comparison and to identify specific potential for improvement.

This so-called “Sustainability Maturity Assessment” was based on interviews with various company departments at all levels and an industry comparison. It showed that our activities and internal interfaces in sustainability demonstrate different maturity levels and that we must intensify our sustainability efforts in some fields.

Through the analysis, we identified specific areas for action within purchasing where we will make improvements and derive measures to further professionalize ourselves in the field of sustainability. We also created a roadmap with a timeline, ensuring that the measures are implemented quickly and effectively. For example, this roadmap includes the already explained integration of sustainability criteria into the awarding process or an expansion of our tool landscape for analysis and monitoring purposes in the supply chain, such as in CO_2 emissions.

Our conclusion: An external perspective from independent specialists is beneficial and has revealed further potential to strengthen the issue of sustainability in purchasing even more in the future. Especially concerning CO_2 emissions and sustainability in our supply chain, we want to make improvements and contribute even more to decarbonization.

People empowerment

Alignment and strategy

MAN Energy Solutions will continue implementing the "Performance 2023" program until the end of 2023. Its goal is to ensure the company's long-term viability and to support and economically safeguard the transformation towards being a provider of environmentally friendly solutions for the maritime industry, energy sector, and industrial production.

In 2022, "Performance 2023" also shaped the strategy, goals, and activities in Human Resources. The focus here is primarily on closely involving all employees in the change process, supporting the transformation, and fostering individual growth.

A nationwide qualification initiative continues to play a vital role in our transformation process in Germany. We started this initiative in 2021 in cooperation with the Works Council and extended it into 2022. Its dual purpose is to secure essential core competencies within the company while also developing further future-oriented skills. In the next step, we expanded many successful training measures introduced in Germany in 2021 and rolled them out internationally in 2022.

Also related to transformation and change is the extensive international training initiative Driving Change@MAN ES, which we launched in the fall of 2022. It provides managers around the globe with change competencies and prepares them optimally for the changes and challenges that the company faces.

In addition, with the “Future Makers” initiative, we implemented various programs in Germany and at our international locations in 2022 to engage our employees in the transformation process. Another emphasis in 2022 was on diversity. We see diversity as an opportunity, especially in a highly dynamic business environment. We aim to cultivate a culture of diversity and acceptance within the company more than ever before, to create optimal working conditions for all, and, not least, to enhance the appeal of MAN ES as an inclusive employer.

Activities and actions in 2021

Initiatives relating to people empowerment

Diversity

Strengthening the diversity of the workforce in terms of age, gender, origin, disability, worldview, and many other aspects is a goal at MAN ES that has come back into focus in 2022. At its core, it is about creating an even more diverse working environment and cultivating respect and acceptance even further. Diversity in the workforce offers advantages: Different perspectives and cultural backgrounds help optimize processes and products. Additionally, a culture where everyone is welcome is one of the best prerequisites for positioning oneself as an attractive and inclusive employer for all, thus addressing the shortage of skilled workers.

To reduce language barriers, we have held networking events since 2022 for employees, where they can meet 'language buddies' or other colleagues willing to support them with language challenges in their day-to-day work.

In 2022, a particular focus for supporting people with disabilities was strengthening the sense of community. We have identified ways to enhance support in this area in the future. For instance, we examined available government services and how these can be coordinated with one another. Above all, the focus has been and continues to be on establishing the right conditions for inclusive work, creating adequate workspaces tailored to individual needs, and facilitating connections with the appropriate agencies.

Another essential goal of MAN ES is to further increase the proportion of women in the Company, particularly in management positions. The overall proportion of women in the workforce is currently around 15.7 percent. We implement various measures to increase this percentage. For example, we are putting an emphasis on the consideration of women in the promotion process. Another measure is the resumed international trainee program, designed to offer career opportunities for potential female managers. A fixed component of this program is a three-month assignment at another location, preferably abroad.

We expect the current proportion of women in the program, which stands at around 30 percent, to increase further in the future. The mentoring program also contributes to this goal, requiring engagement from women in both mentor and mentee roles (currently just under 20 percent each). In this program, a junior employee has the opportunity over a six-month period to engage in direct, non-technical exchange with an experienced manager. They can discuss experiences, ideas, and perspectives and learn from one another. We find it essential to foster interaction between the participants, providing flexibility in determining the duration, length, frequency, and nature of their meetings.

The existing internal women's network of MAN ES, which has been active for several years, also empowers female specialists and executives and was active at various German locations with events and meetings in 2022. To promote contact and exchange with other networks, a “Women in Automotive Industry Network” meeting took place at the Augsburg site at the end of 2022. Female specialists and executives from BMW, Bosch, Mercedes Benz, Porsche Consulting, Audi, and VW were present, among others. The agenda included keynote speeches, workshops, a brief factory tour, and above all, mutual exchange.

Employee participation and idea management system

In 2022, the Ideas Management sector, also known as the Improvement and Suggestion System, was redesigned. We conducted extensive preliminary work to replace the existing, outdated, and lengthy ideas management process with a new, contemporary one. The goal is to assist and motivate employees to recognize potential improvements and proactively introduce their ideas and proposed solutions. The new process, which will also have new software, is expected to launch in the fall of 2023 following the conclusion of the relevant company agreement.

The new Ideas Management system — which incorporates experiences from other companies and new scientific insights on ideas management — connects idea providers, departments, and their supporters more closely than before. Existing formats, such as the "Pulse Talks," will provide insights on exciting topics or share employee ideas, promoting knowledge and experience exchange within MAN ES. Additionally, we plan new formats like Social Funding and Investors' Meetings. Social Funding primarily aims to obtain additional support from the organization for implementing ideas. In contrast, during an Investors' Meeting, employees can present ideas to a selected expert audience to receive the necessary resources for realizing the ideas. The goal is to bring together the right people and create an environment where employee initiatives can be further developed collaboratively using the most appropriate methods and workflows. We placed particular emphasis on the autonomous implementation of ideas in designing the new process and on strengthening interfaces to existing processes, such as Lean Management and Group Innovation. These initiatives aim to prevent isolated solutions and create the highest possible synergy effects.

In addition to the redesign of the Ideas Management process, the first part of a two-year pilot phase of the new "Innoflex" process, developed by the MAN ES site in Zurich, took place in Augsburg in 2022. In contrast to the Ideas Management process, Innoflex aims to give ideas with high innovation potential but still at an early maturity stage, where the solution path remains unclear, a chance. Following the "Demand and Support" principle, the idea provider is expected to drive their idea proactively. Within the Innoflex process, they receive the necessary methodological, technical, and financial support to mature their idea for a decision. Coaches assist in networking with relevant experts, support the presentation of the idea to potential internal sponsors, and advise on creating the business case. If an idea is approved for implementation, the idea provider receives the necessary resources to conduct a feasibility study, create a prototype, or the like. Ideally, management decision-makers determine at the investor meeting that the idea will be implemented or rolled out in a project.

In 2023, the focus will be on evaluating the experiences from the 2022 pilot phase and the ideas that made it to the investor meeting. We also aim to integrate Innoflex into the new Ideas Management process.

Working conditions and fair pay

A topic that greatly preoccupied the Human Resources department in 2022 is the German Supply Chain Due Diligence Act, which came into effect on January 1, 2023. The law obliges companies to ensure that no human rights violations, such as slavery, discrimination, or child labor, occur within the supply chain, both externally and internally. This law had implications for human resources, as it necessitated a review and possible adjustment of the documentation of existing processes or the introduction of new ones for MAN ES at all locations and subsidiaries.

In preparation, 58 locations or subsidiaries of MAN ES were surveyed last year to identify potential weaknesses according to the German Supply Chain Due Diligence Act. The risk analysis revealed country-specific peculiarities that we will take into account regarding equal treatment and co-determination in the future.

Another project in the past year was the further standardization of collective bargaining conditions at all German MAN ES sites. The aim was to apply the collective agreements of the Bavarian metal and electrical industry uniformly at these five sites to create comparable working conditions. We continue harmonizing aspects such as the remuneration system, collectively agreed bonuses, or allowances at these sites. We started this process in 2021 and will continue with additional agreements with the employee representatives at the company level.

Training and development

In 2022, we placed a significant focus on the initiative for transformation qualification as part of “Performance 2023,” which we already launched in 2021. The goal is to retain valuable competencies for the company and develop competencies crucial for the future. The qualifications include various internal and external training sessions, some of which are tailored to the individual needs of the employees. While initially focused on Germany in 2021, we rolled out the continuing education initiative internationally in 2022. The focus was on measures designed in Germany but needed internationally.

A good example is our training measures for all purchasing staff in response to a dramatically changed market situation. We rolled out this concept internationally after a successful initial run in Germany.

We continued our “Future Makers” initiative, established in 2021, aimed at involving employees in the transformation process in various formats. For example, in 2022, five “Pulse Talk” events took place on topics like Future Fuels, Hydrogen, or Heat Pumps. More than 1,000 employees participated live online in the “Talks” or watched the videos afterward.

We also made progress in 2022 on modern workplace concepts: As many workplaces remained unoccupied due to increasing work-from-home solutions and mobile working, we introduced the “Shared Desk” concept in some areas as pilot projects. Here, various employees share a workspace. A general works agreement on this subject has now been adopted. Along with a suitable guideline, it is now easier for interested departments to implement the “Shared Desk” concept.

Lighthouse project

Life is change: Driving Change@MAN ES

In 2022, “Driving Change@MAN ES” occupied a significant space as a lighthouse project. This global training initiative for leaders and managers around change management is the largest that has ever existed at MAN ES. “Driving Change@MAN ES” aims to optimally equip leaders for the changes and challenges by imparting relevant change competencies. We developed the training concept with external experts and MAN ES departments. It launched with a large-scale kick-off event in October 2022.

Components include training modules that take place virtually. These address the six subject areas: “From Corporate Strategy to Action Plan,” “Leading Successfully in Times of Change,” “Making Decisions in Uncertainty,” “Tools for Successful Change,” “Leading with Resilience,” and “Foundations for Building Sustainable Business Branches.” To make the learning in the program sustainable, participants receive weekly “Microlearnings” after the training. These can introduce a new method, a video, or a self-test that stimulates reflection.

The launch of “Driving Change@MAN ES” in October 2022 coincided with the communication of the strategy update, allowing the training concept to help anchor the company's new goals and guiding principles.

In 2022, 233 leaders worldwide completed the training program. As of today (June 2023), the number is 461. There are plans to expand the initiative to additional target groups, such as project leaders, staff roles assisting in decision preparation, and employees moving towards a leadership position. All are engaging with the subject of transformation and driving changes, and the content is continuously supplemented and updated.

Selected key figures at a glance

Economic development

The financial key figures continue to develop very positively. This development shows us that our strategic orientation and efficiency program “Performance 2023” are having an impact. The order intake increased significantly once again, rising by over 10 percent in the reporting year.

Revenue also increased substantially in 2022. As in the previous year, 5.3 percent of revenue is invested in R&D, leading to a corresponding increase in the R&D budget. Profitability rose sharply by over 40 percent, resulting in an EBIT of 280 million €. This result helps us to further advance the transformation of MAN Energy Solutions into a provider of climate-friendly energy solutions.

	2022	2021	2020
Orders received (in million €)	4 260	3 821	2 933
Turnover (in million €)	3 565	3 278	3 267
Investments (in million €)	72	53	101
% of turnover	2,0	1,6	3,1
Research and development (in million €)	188	174	192
% of turnover	5,3	5,3	5,9
EBIT (in million €)	280	176	42[1)]
RoS (in %)	7,8	5,4	1,3[1)]

[1] Result before posting a restructuring provision for performance 2023

Employees

After a decrease in the workforce in 2021, it increased again but remained below the 2020 level. The increase in the female workforce was disproportionately high. As a result, the percentage of women in the core workforce rose to 15.7 percent. The proportion of value-creating employees also increased, particularly outside of Germany. The number of apprentices has slightly declined, but the percentage of women increased in this domain as well. Encouragingly, the retention rate for apprentices remains very high at 96 percent.

Structure of the workforce[1)]

	2022	2021	2020
Core workforce	13 836	13 331	13 978
of which female	2 166	2 012	2 112
of which male	11 670	11 319	11 866
of which part-time employees	516	480	505
of which female	320	304	346
of which male	196	176	159
of which temporary employees	413	377	458
of which female	73	70	76
of which male	340	307	382
Apprentices	488	519	583
of which female	80	81	107
of which male	408	438	472
of which in Germany	335	369	372
of which new hires in Augsburg	43	39	57
Augsburg retention rate in %	96	100	100
Employees in semi-retirement passive phase	247	212	221
Workforce	14 571	14 062	14 782
Temporary workers	200	137	149

[1] At the end of each year

Employees of MAN Energy Solutions

	2022[1]	2021	2020
Workforce (value-adding)	14 036	13 468	14 127
Germany	6 675	6 511	7 064
Abroad	7 361	6 957	7 063
Share abroad in %	52,4	51,7	50

[1] From 2022 incl. H-TEC SYSTEMS (calculated without H-TEC SYSTEMS: total 13,763, world 7,361, DE 6,402, share 53.5 %)

Age structure

	2022	2021	2020
Core workforce	13 836	13 331	13 978
≤ 30	1 828	1 615	1 483
31 – 40	4 080	4 013	4 156
41 – 50	3 794	3 615	3 806
51 – 60	3 395	3 361	3 586
> 60	739	727	947

Women in leadership positions

As in the previous year, the proportion of women in the core workforce also increased in the last reporting year. In parallel, after a slight decline in 2021, we were able to increase the proportion of women in management back to 8 percent last year.

	2022	2021	2020
Percentage of women in core workforce	15,7 %	15,1 %	14,8 %
Percentage of women in management group (MK)	10,4 %	9,3 %	11 %
Percentage of women in upper management group (OMK)	4,2 %	4,8 %	4,7 %
Percentage of women in top management group (TMK)	0	0	0
Anteil Frauen im Management (MK, OMK, TMK)	8,0 %	7,7 %	8,8 %

Vocational training/qualification

Continuous training of our employees is essential. Methodological, technological, and change competencies are necessary for our transformation into a solution provider and the expansion of new technologies. The training program set up for this purpose was in high demand. In total, we implemented over 5,200 initiatives and recorded almost 90,000 participants. As before, many of these training courses took place in our eAcademy or in web-based courses.

	2022	2021	2020
Initiatives implemented	5 257	3 367	2 586
Participants	89 696	51 115	52 155
Qualification hours	262 886	203 893	159 764
of which E-learnings/persons	70 047	32 240	34 030
of which E-learnings/hours	54 053	27 688	24 198
Ø Qualification days per employee	2,78	2,04	1,55

Occupational safety and environmental protection

The following key figures for 2022 apply exclusively to our 12 production sites: Augsburg, Oberhausen, Berlin, Deggendorf (Germany), Copenhagen, Frederikshavn (Denmark), Zurich (Switzerland), Saint-Nazaire (France), Velká Bíteš (Czech Republic), Aurangabad, Bangalore (India) and Changzhou (China).

Since the 2020 financial year, the Holeby site (Denmark) and since the 2021 financial year, the Hamburg site are no longer included in our production sites by definition. However, the figures for previous years still include the data for these sites (no retroactive changes have been made here).

Accidents at work

The accident frequency index RIF has fortunately improved again in 2022. However, the number of days lost due to accidents increased slightly. Therefore, we continue to place a significant focus on the issue of occupational safety. We aim to reduce the accident frequency index and the severity of accidents significantly. Numerous measures are already being implemented, and additional measures will be derived to supplement them.

	2022	2021	2020
Accidents at work with an absence of ≥ 1 day	145	141	136
Days of absence due to accident	2 513	2 170	2 822
Fatal accidents at work	0	0	0
Index of accident frequency - RIF (Recordable Injury Frequency)[1)]	11,21	12,17	11,90

[1] Number of recordable accidents at work requiring medical care x 1 million / hours worked

Energy consumption in MWh

The share of renewable sources in electric energy consumption again significantly increased from 2020 to 2022, reaching over 95 percent worldwide in the last reporting year of 2022 (100 percent at European production sites). In absolute terms, the most significant increase was in externally produced energy. In relative terms, we saw the most significant increase in the self-production of renewable energy. The heat energy consumption (approximately -22.5 percent) and the fuel usage at the sites (approximately -12 percent) have also developed positively.

	2022	2021	2020
Total energy consumption	267 099,76	292 913,74[1]	337 528,25[1]
Electric energy consumption	82 983,31	79 099,46	92 557,36
Elec. energy consumption from ren. energy sources - own generation	741,40	18,68	0,00
Elec. energy consumption from ren. energy sources - external generation	78 413,55	41 164,62	37 490,73
Elec. energy consumption from conv. energy sources - external generation	3 828,36	37 916,17	55 066,63
Thermal energy consumption	38 056,45	49 360,46	48 073,95
Thermal energy consumption from ren. energy sources - own generation	0,00	0,00	0,00
District heating consumption from ren. energy sources - external generation	0,00	0,00	0,00
District heating consumption from conv. energy sources - external generation	38 056,45	49 360,46	48 073,95
Fuel usage at the sites	143 348,83	162 507,56	193 147,68
Heating oil	1 270,22	1 018,17	641,32
Natural gas	111 772,34	136 017,70	139 297,68
Consumption of light and medium-grade mineral oils as fuel on test benches[2]	27 418,34	23 847,91	n/a
Heavy oil consumption as fuel on test benches[2]	961,05	142,14	n/a
Kerosene consumption as fuel on test benches[2]	444,80	560,70	n/a
Diesel for own vehicles[2]	1 482,08	920,94	n/a
Fuel gases for manufacturing processes	2 368,41	1 923,75	3 385,98
Acetylene (Ethin, C2H2)	1 846,14	818,79	1 147,92
Propane	437,34	1 051,63	2 182,47
Hydrogen	84,92	53,33	55,58

[1] The total energy consumption in 2020 and 2021 was adjusted by minor corrections to individual consumption values, such as natural gas. This is due to changes in the calorific values of suppliers that subsequently became known.

CO_2 emissions in t

Among other things, energy efficiency measures and the greatly increased share of renewable sources in electrical energy consumption enabled CO_2 emissions to be reduced by more than 15,000 metric tons in 2022 compared with the previous year. This continues the positive trend from the previous year.

	2022	2021	2020
Total carbon dioxide emitted	37 071,91	52 891,79	69 917,02
Directly emitted carbon dioxide	29 793,17	33 351,54	42 216,37
Indirectly emitted carbon dioxide	7 278,74	19 540,25	27 700,66

[2] Since 2021, the structure of the fuel use indicators has been differentiated according to the use of fuels on test benches and for vehicle operation. Until then, all test bed fuel consumption was summed up on the diesel fuel indicator (2020: 53 208,67 MWh).

Recycling and waste in tons

The total amount of waste developed positively and fell by approximately 1,500 tons from 2021 to 2022. Due to construction activities, the amount of construction waste increased in total and within the different categories.

	2022	2021	2020
Total amount of waste	20 234,03	21 865,28	23 856,65
Total amount of waste for recycling	9 015,96	11 537,13	12 141,99
Hazardous waste for recycling	1 590,58	2 060,41	2 298,96
Hazardous construction waste for recycling	1 451,40	166,30	82,94
Other hazardous waste for recycling	139,18	1 894,11	2 216,02
Non-hazardous waste for recycling	7 425,38	9 476,72	9 843,02
Non-hazardous construction waste for recycling	6 857,58	3 480,18	733,46
Other non-hazardous waste for recycling	567,80	5 996,54	9 109,56
Total amount of waste for removal	2 033,43	1 785,88	1 648,77
Hazardous waste for remova	865,94	903,11	960,19
Hazardous construction waste for removal	853,42	132,92	1,84
Other hazardous waste for removal	12,52	770,19	958,35
Non-hazardous waste for removal	1 167,50	882,77	688,58
Non-hazardous construction waste for removal	354,39	549,08	188,50
Other non-hazardous waste for removal	813,11	333,69	500,08
Metal waste	9 184,64	8 542,27	10 065,89

Water and waste water m³

Water consumption shows a stagnating trend. Although consumption increased slightly compared to the previous year, it is still slightly below the value for 2020. The consumption of surface water from lakes, rivers and oceans was significantly reduced.

	2022	2021	2020
Total fresh water volume	3 502 161,91	3 435 615,99	3 517 388,95
Fresh water volume from external supply including drinking water	108 333,01	102 375,29	147 438,95
Amount of fresh water from own sites (well water)	3 393 828,90	3 333 240,70	3 369 950,00
Surface water from lakes, rivers, seas	3 234 366,00	3 678 610,00	6 547 262,00
Waste water volume	328 815,27	302 836,87	400 353,14

Air pollutant emissions in t

	2022	2021	2020
Sulphur dioxide (SO2)	9,78	4,77	0,14
Nitrogen oxides (NOx)	145,05	123,80	15,35
Total dust	2,85	2,00	0,11
Emissions of volatile organic compounds (VOC)	36,08	37,07	39,24

Certificates for production sites

All our production sites are triple certified according to the mentioned standards. By definition, the Holeby (Denmark) and Hamburg (Germany) sites are no longer part of our production sites. However, the values from previous years still include the data from these sites; retrospective changes were not made here.

	2022	2021	2020
Site with ISO 14001	12	12	13
Site with ISO 9001	12	12	13
Site with ISO 45001	12	12	13

Final Note

The data listed in the chapter “Key Figures at a Glance” were subject to an independent business audit for the year 2019 as part of sustainability reporting process to obtain limited assurance. The key figures now published for the financial year 2022 are subject to the same selection and application of appropriate sustainability reporting methods.

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