

供应商节能减排信息

1. 亚星锚链

主要环保工作情况：

1、公司对于新建的项目严格执行《建设项目环境影响报告表》的建议和环保局批复的相关要求,保证了环境建设与主体工程同时设计、同时施工、同时投运的“三同时”的原则。

2、在废水方面，我们建立了覆盖整个厂区的污水管网。生产过程中没有使用相关液体类原材料，没有生产过程中的废水排放，少量含油废水通过厂内管网流至污水处理站进行集中处理，处理达标后再次回收利用。

3、关于废气，我公司的废气由浸漆工序产生，浸漆工序配有油漆废气净化装置，采用活性炭吸附、热气流脱附和催化燃烧的工艺，并通过 15 米高的排气筒高空排放。原有的调质炉经过油改天然气的改造，做到了清洁生产。

4、关于噪音，公司所有的生产设备均采取了减震、消音以及砖混、钢结构厂房的隔音的措施，使厂界噪音达到标准要求范围。近期公司更是投入了专项资金，完成了厂界噪声的治理。

5、关于危险废物这块，生产以及项目过程中产生的残油固废，包括废矿物油等，我们依照要求网上申报，通过经处理后收集起来的废油等危废，储存于危废专用存储场所，不定期经由有资质的单位按照危险废物转移联单管理办法进行。

重大环境相关项目：

1. 升级生产废水治理设施

2018 年完成了对生产废水治理设施的升级改造，在原有达标排放的基础上实现了循环利用。

2. 分布式光伏项目

2021 年底推动了分布式光伏项目的进行，一期工程共计 5.2MW，2022 年 12 月已经投运其中的 2.48MW，剩余 2.72MW 在 2023 年投运，预计 2024 年度将全部投运 5.2MW。

3. 清洁能源改造

专用热处理设备、加热设备天然气改造于 2015 年开始，2020 年竣工。将原有使用原煤、柴油燃料油及高电耗的设备进行系统性改造，为地区环保低碳做出重要贡献。

4. 厂界噪声排放治理

2019 年完成了对公司全域的噪声排放治理，改善了员工工作、居民居住场所环境。

5. 浸漆废气综合治理项目

2023 年，开启了浸漆工序挥发性有机物排放的提升治理工程，预计 2024 年竣工投运。



生产废水治理升级

通过对生产废水治理设施的升级改造，在完善了原有达标排放的基础上，进一步实现了循环利用，极大减少了水资源的浪费，在做好环境保护工作的同时，实现了生态效益和经济效益的双赢目标。



厂界噪声治理

通过全方位的噪声排放整治，在达标排放的同时，不仅改善了公司内员工的工作生活环境，更为厂区周围居民的居住场所环境提供了很好的保障，维护了地区的社会稳定。



清洁能源改造

该项目是亚星公司认真落实科学发展观，立足自主创新，全力打造的精品工程。项目国产化程度高，以高新技术改造传统装备，促进了海洋工程装备制造产业发展与经济、环境协调，实现可持续发展。



分布式光伏

共计5.2MW的一期工程将于2023年全部投运，其中2.48MW已经于2022年底并网发电，每年可节约标准煤约625吨，减少二氧化碳排放约1625吨。经济效益和节能效益均非常显著。

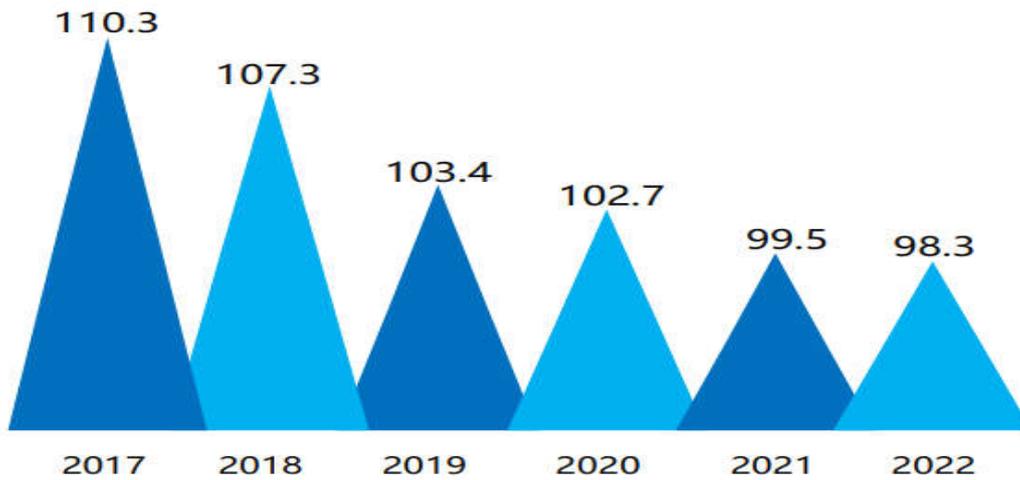


浸漆废气排放综合提升治理

该项目是亚星公司认真落实社会责任，推进节能降耗，降低职业病危害因素影响，大力推进的项目。挥发性有机物（VOCs）是形成细颗粒物（PM2.5）和臭氧（O3）的重要前体物，类似于我公司浸漆工序的工业涂装是其排放源之一。国家生态环境部门对于挥发性有机物的治理也已多次发文，提出相关渐进性的治理要求，我公司积极响应，邀请多方专业人员深入现场，最终确定了提升方案并按计划实施，力争为国家打赢蓝天保卫战、进一步改善环境空气质量贡献我们的一份力量。
设备主体为RCO催化燃烧装置，配合针对我公司工艺专门设计的收集装置，处理效率达到领先水平。

低碳指标控制情况：

亚星锚链始终致力于为地区和行业的环境保护、节能低碳做出贡献，近年来，公司不断大力推动技术改造和转型升级，从产品、工艺、设备、人员等各个方面推动节能降耗、降本增效工作，取得了很好的效果。单位能耗强度指标从2017年的每万元110.3千克标准煤持续下降至2023年的每万元98.3KG标准煤。



2. WÄRTSILÄ

[Sustainability at Wärtsilä](#) [Sustainability data](#) [Report profile](#)

Climate change and environment

Contributing to the following United Nations Sustainable Development Goals:



We strive to support our marine and energy sector customers on their decarbonisation journey. For this, we continuously invest in innovation and product development to deliver sustainable technologies and solutions. Furthermore, we also do our part as an organisation to minimise our own environmental footprint. Our goal is to become carbon neutral in our own operations and to provide a product portfolio ready for zero carbon fuels by 2030.



Core elements of Wärtsilä's decarbonisation actions



INNOVATING FOR SUSTAINABILITY

R&D and innovation

Decarbonisation requires a broad range of solutions. We offer technologies and solutions that enable the transition to decarbonised shipping and 100% renewable power systems. Our product and solution portfolio includes technologies related to efficiency optimisation, fuel flexibility, emission and noise abatement, waste treatment, effluent and ballast water treatment, as well as flexible energy storage systems, engine and hybrid power plant solutions, and lifecycle services. Our proactive approach to meeting future demand has resulted in the development of both primary and secondary abatement technologies, and has broadened the range of usable fuels. With the help of intelligent digital solutions and services, data can be collected, analysed, monitored and reported, allowing us to optimise operations and reduce environmental impact.

Our sustainable solutions and services include the following features:

- Low emission and noise levels
- High efficiency
- Digital intelligence
- System level optimisation
- Compliance with environmental regulations
- Fuel flexibility
- Renewable energy integration with engines and storage systems
- Dynamic capabilities
- Low water consumption
- Lifecycle support and optimisation
- Reliability, safety, and an extended lifespan

As our products have a long operational life, identifying the lifecycle impacts of our products is essential for understanding

their total environmental impact. We manage the lifecycle of our products through their design, the careful selection of suppliers, production methods, and by optimising transportation, maintenance, and repairs during their operational life. The reconditioning of products and components increases their reliable service life, while modernising improves the existing operational performance of installations.

Decarbonisation is a priority in our product and product portfolio development, including abatement technologies. We are developing a broad range of technologies and solutions to support our customers in their decarbonisation transition. Carbon neutral fuels can be used already today, and we are developing our portfolio further so that zero carbon fuels, for example, ammonia and hydrogen, can be used before 2030. Our sustainability ambitions include targets for our product development. In addition to a product portfolio ready for zero carbon fuels, our [sustainability targets](#) are related to reducing methane slip, a power-to-X and X-to-power demonstrator project, and increasing our energy storage project capacity.

Strategic partnership agreements with universities

[Wärtsilä and Aalto University](#) in Finland signed a new three-year strategic partnership contract. The agreement covers three themes: research and insight, business development, and talent recruitment and educational collaboration. The long-term research cooperation in fossil-free fuels and their combustion phenomena continues, but the aim is to expand cooperation also to other fields. [Wärtsilä and the University of Turku](#), Finland also signed a strategic partnership agreement aimed at enhancing long-term collaboration on sustainable well-being, competitiveness, and vitality through research, education and societal interaction.

Innovations and partnerships in 2022

In 2022, Wärtsilä continued pioneering the adoption of sustainable fuels with encouraging testing results. We anticipate having an engine concept operating with pure ammonia fuel in 2023, and an engine and power plant concept for operating with clean hydrogen by 2025.

During 2022, four new engines were released: the Wärtsilä 315G Balancer, the Wärtsilä 25, the Wärtsilä 32 methanol engine, and the Wärtsilä 46TS-DF. Together with a partnering company, a new system designed to tackle the amount of microplastics in the world's oceans, was unveiled.

We also published studies and modelling scenarios on how we can take 100% renewable energy sources into use in different parts of the world. Our new technology centre, the [Sustainable Technology Hub](#), was inaugurated, which enables us to accelerate our contribution to decarbonising the marine and energy sectors.

Furthermore, we joined forces with leading companies and other organisations to put our purpose and strategic goals into action. These partnerships aim to enhance new research and cooperation on innovative sustainable solutions, improve efficiency, and accelerate the decarbonisation of shipping and the development of clean fuels.

Digitising 21 ports in the United Kingdom

Wärtsilä signed a five-year framework agreement with Associated British Ports to [digitalise operations at its 21 ports](#). Wärtsilä's solutions accelerate the digital transformation of port calls and operations, making them as efficient, sustainable, and safe as possible.



Wärtsilä and Anglo-Eastern reach major milestone in 'connecting ships' to improve safety and environmental sustainability

In April 2022, Wärtsilä Voyage and ship manager Anglo-Eastern announced a significant milestone in their joint project to [improve safety and environmental sustainability](#) at sea. More than 500 vessels in Anglo-Eastern's fleet have been fitted with Wärtsilä Voyage's Fleet Optimisation Solutions (FOS), a decision support software platform for voyage planning, charter-party compliance, fuel efficiency, and fleet performance management. The original order for the FOS deliveries was placed in October 2019 and was reported at the time to be the maritime industry's largest software contract ever.



Significant CO₂ emissions reduction with Wärtsilä's fleet optimisation solution

In November 2022, Wärtsilä announced that its customer, Carisbrooke Shipping, has reported [savings of more than 600 tons of CO₂ emissions](#) since the beginning of the year with the help of Wärtsilä's Fleet Optimisation Solution (FOS). Since implementing FOS across 31 vessels in 2019, Carisbrooke Shipping has been using the platform to gather insights that have supported the UK-based dry bulk and general cargo ship operator in its objectives to reduce carbon emissions and ensure optimal fleet performance, which are core to the company's current strategy.

INNOVATIONS AND PARTNERSHIPS IN 2022 - MARINE

Tackling ocean microplastics

Wärtsilä and Grimaldi Group unveiled a new system that uses exhaust gas scrubber washwater to tackle the amount of microplastics in the world's oceans. Grimaldi has developed and patented a system that filters out microplastics from open loop scrubber washwater, which Wärtsilä in partnership with the Neapolitan group, will take to market.



New large bore 46TS-DF engine for decarbonisation:

Wärtsilä announced the launch of the Wärtsilä dual-fuel 46TS-DF medium-speed marine engine, which offers a future-proof solution for owners and operators to reach decarbonisation targets. In gas fuel mode, the engine has the highest efficiency thus far achieved in the medium-speed engine market. The engine can operate with LNG, which dramatically reduces air pollutants as well as offering a viable platform for further decarbonisation through the use of bio- or synthetic methane in the future.



Methanol milestones: Wärtsilä launched the new Wärtsilä 32 methanol engine and developed a dedicated fuel supply system for methanol, the MethanolPac, to address growing interest in the methanol pathway to decarbonisation. These developments extend Wärtsilä's leading position in supporting the maritime industry's decarbonisation ambitions, and in the use of this particular fuel, which is among the most promising sustainable fuel candidates.

Next generation medium-speed W25 engine: The marine modular W25 engine offers shipowners and operators maximised flexibility, while the engine's efficiency and fuel economy deliver minimised emissions. The engine is already capable of operating on diesel, LNG, or either gas or liquid carbon-neutral biofuels, and can easily be upgraded to operate with future low or zero-carbon fuels as they become available. The Wärtsilä 25 is intended to be the first Wärtsilä engine to run on ammonia as a fuel.



Zero Emission Marine (ZEM) R&D project in Finland:

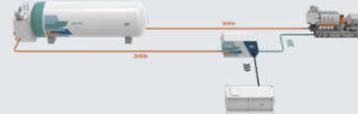
The Zero Emission Marine (ZEM) project, led by Wärtsilä, was kicked off in April 2022, together with close to 150 stakeholders. The project aims to develop sustainable technology solutions that can reduce greenhouse gas emissions in the marine sector by 60% by 2030.

Ammonia engine development:

The Ammonia 2-4 project secured EU funding of €10 million to develop demonstrators for two-stroke and four-stroke marine engines running on ammonia fuel. The project is coordinated by Wärtsilä, with participation from naval architect CJob, the classification society DNV, shipowner MSC, and the National Research Council (CNR) of Italy.

100% biofuel tests: Wärtsilä partnered with Carnival Corporation's Holland America Line and Netherlands based GoodFuels to carry out ship trials operating with biofuel blends. In addition to a 70% diesel / 30% biofuel blend, the tests were conducted with 100% biofuel to determine the effect on overall engine performance, as well as on engine emissions. This was the first testing by Wärtsilä on a cruise ship operating with 100% biofuel.

Blue hydrogen via capturing solid carbon: Wärtsilä entered into a joint development agreement with Hycamite TCD Technologies, a privately-owned Finnish company specialising in the development of a pioneering technology for producing clean hydrogen and solid carbon from methane. The two companies will work together to enable the cost-effective production of hydrogen from LNG onboard marine vessels.



Reducing methane slip: Wärtsilä together with eight partners launched GREEN RAY, a five-year EU funded project to develop solutions to reduce methane slip from Liquefied Natural Gas (LNG) in new and existing ships.



Strengthening decarbonisation collaboration: Wärtsilä strengthened its ongoing project partnership with the Maersk Mc-Kinney Møller Center for Zero Carbon Shipping by signing up as an official Mission Ambassador. The not-for-profit R&D centre is committed to driving sustainable decarbonisation of the maritime industry by 2050 through collaboration, applied research and regulatory reform. As a Mission Ambassador, Wärtsilä opens the way for collaboration between not only maritime stakeholders, but also fuel providers, universities, and governments.



Fleet decarbonisation programmes

In 2022, Wärtsilä joined forces with partners to decarbonise vessel fleets. For example, Wärtsilä announced its collaboration with Solstad Offshore on its fleet decarbonisation ambitions, the aim being to achieve a 50% reduction in CO₂ emissions by 2030 for Solstad Offshore's 90 vessel fleet. Wärtsilä and Carnival Corporation announced an agreement on a fleet decarbonisation programme to model solutions which could be applied to the entire Carnival fleet. Wärtsilä and Brazil's Companhia Brasileira de Offshore (CBO) also signed an agreement for Decarbonisation Modelling. The objective is to support and accelerate the decarbonisation of CBO's fleet of offshore support vessels. In addition, Wärtsilä and Capital Gas Ship Management Corp agreed to partner in the development of a new Fleet Decarbonisation Programme aimed at achieving defined decarbonisation targets.

INNOVATIONS AND PARTNERSHIPS IN 2022 - ENERGY

Power plant fuel tests using blended hydrogen in Michigan

Wartsilä in collaboration with US partners WEC Energy Group, EPRI, and Burns & McDonnell succeeded with power plant fuel tests using blended hydrogen. The tests were made at WEC Energy Group's 55 MW A.J. Mihm power plant in Michigan, USA using an unmodified 18 MW Wartsilä 505G engine. It was the largest internal combustion engine ever to operate continuously on a hydrogen fuel blend, representing therefore a world-first achievement.



Modelling power systems: Wartsilä published three power system modelling reports. These demonstrated how Europe could radically increase the share of renewable energy in electricity production by 2030, how Vietnam, the Philippines and Indonesia can transition to net zero emissions by mid-century, and how Nigeria, South Africa and Mozambique can leapfrog some developed nations with climate finance, effective planning and system reforms.

Introducing a decarbonisation services business model

Wartsilä introduced a [Decarbonisation Services business model](#) with the ultimate aim to help Wartsilä's customers decarbonise their assets. The service utilises the company's sophisticated power system modelling and optimisation tools alongside in-house expertise to reduce power system emissions.



Next-generation grid balancing engine solution:

Wartsilä launched a [next-generation grid balancing engine solution](#), the Wartsilä 315G Balancer, which is designed to provide flexible grid capacity even in adverse weather conditions. It enables renewables to be utilised as the lowest-cost, most resilient power source.

Building a Power-to-X-to-Power hydrogen system in Finland:

Wartsilä joined the City of Vaasa and energy companies EPV Energy and Vaasan Sähkö to build a [Power-to-X-to-Power](#) system. Green hydrogen created with wind power will be used to balance electricity generation and to provide district heating.

Green hydrogen blending project in Portugal:

Wartsilä announced a collaboration with the Portuguese energy solutions provider and independent power producer Capwatt in the [testing of a green hydrogen and natural gas blend fuel](#) for the Capwatt power plant located in Maia, Portugal. The project aims at testing blends of up to 10 vol.% green hydrogen. The combined heat and power plant, which provides energy for Sonae Campus and the national grid, currently operates with a Wartsilä 345G engine running on natural gas. This will be one of the first cases where green hydrogen is used to lessen the carbon footprint of an existing gas fueled Wartsilä power plant.

ENVIRONMENTAL MANAGEMENT AND TARGETING CARBON NEUTRALITY IN OUR OWN OPERATIONS

Striving for continual improvement

The continual improvement in environmental performance is based on consistently working in a systematic way. This work is guided by our strategy and environmental targets, our Code of Conduct, as well as policies relating to Quality, Environment, Health and Safety, coordinated and monitored by the cross-business Wartsilä EHS (Environment, Health, Safety and Security) team. In developing our operations, processes and products, we endeavour to utilise the latest technologies available for improving efficiency in areas such as material and energy consumption, as well as for reducing and managing emissions and waste throughout the lifecycle of our products and services.

Operations and products are continuously developed and improved with the help of certified environmental management systems. The principle means is to apply certified Environmental, Health and Safety (EHS) management systems based on ISO 14001 / ISO 45001 in all Group companies, excluding those companies focusing purely on sales. Our EHS management systems cover all operations carried out by our subsidiaries. This promotes environmental protection and allows the reduction of adverse impacts to be carried out on a wide front.

Our EHS management system emphasises compliance with legal requirements, identifying and reducing environmental impacts and risks, training personnel and clearly defining their responsibilities, the full documentation of activities and procedures, actions to be taken in emergencies, and the continuous improvement of environmental performance. Our subsidiaries and business units set their own targets for covering the significant environmental aspects of their operations, and for monitoring the overall performance of their management systems. At the end of 2022, 58 Wartsilä companies operated with a certified environmental management system. These certified environmental management systems cover roughly 92% of our total workforce.

Sustainability achievements at Wartsilä's Central Distribution Centre (CDC)

Wartsilä's Central Distribution Centre (CDC) is located in Kampen, the Netherlands. It delivers spare parts to our customers worldwide as well as to Wartsilä's 160 service locations around the globe. Several actions have been taken in CDC Kampen in recent years to improve sustainability in our operations.

Since 2019, the reuse of crates has been monitored at CDC. Before reusing, we check if the crates meet our requirements regarding quality, markings, and that they are not damaged. If the requirements are met, the crates are stored nearby the packing desks, ready to be used for the next suitable shipment. Since the start of the project, the reuse of crates has increased considerably. 2022 was a record year with an average of 12 reused crates being used per day. This equates to about 3,000 per year (based on 250 working days per year), thus saving both costs and the environment. The improvement has been enabled by good cooperation between various departments in the CDC and the improved quality of the crates received from suppliers.

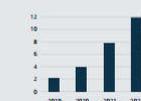
Another focus areas for CDC Kampen has been the reduction of the use of plastic in packaging. Compared to 2021, our permanent changes made in 2022 contributed to an annual plastic reduction of 3.5 tons through the following actions (replaced material and quantity):

- Introduction of paper labels (156,000 plastic labels, 375 kg)
- Paper tape used as standard (451 km of plastic tape, 846 kg)
- Paper bubble foil roll out (5 km of plastic bubble foil, 193 kg)
- Rope ty wraps in serial use (50,000 plastic ty wraps, 83 kg)
- Paper shipping bags (220,000 plastic shipping bags, 1,100 kg)
- Paper address labels (90,000 plastic A4 document pouches, 900 kg)

Additional plastic elimination actions are being tested, the aim being to roll these out during 2023.



Reused crates per day



Carbon neutrality

Wärtsilä's roadmap to decarbonise our own operations is divided into three phases, with the emission reduction measures and targets for the first phase (2022-2024) having been confirmed in 2022. Based on a thorough assessment, we identified the main greenhouse gas (GHG) reduction measures for 2023 and outlined our ambition levels in terms of annual GHG reductions. In 2023, the target is to reduce CO₂e emissions by 20,000 tons (approx. 20%) compared to our base year 2021.

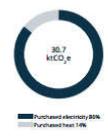
To understand the full potential of CO₂e emissions reduction opportunities at the site level, country-specific assessments were kicked off in 2022. These assessments included analysing, for example, the opportunities to purchase green electricity and utilise solar power at our sites, and the feasibility of using electric heat pumps for heating purposes instead of using natural gas in boilers. In 2022, Wärtsilä Finland began purchasing green electricity, which led to reductions of around 6,000 tCO₂e.

When looking at our carbon footprint, R&D and factory engine testing are responsible for a significant amount of our GHG emissions. To identify how CO₂e emissions related to engine testing can be reduced, a workshop was held in August 2022. This resulted in several improvement ideas being identified, such as reducing engine running times during factory and R&D engine testing. Some of the improvement ideas, however, need a longer-term perspective, for example switching to cleaner fuels in our engine testing.

Scope 1 emissions



Scope 2 emissions



The main emission reduction categories in our decarbonisation pathway are:

- Energy efficiency and energy savings
- Switching to low emission company vehicles
- Utilisation of self-generated energy and the purchase of green electricity
- Reducing the time needed for R&D and factory engine testing
- Utilisation of heat pumps in heating
- Replacing fossil fuels with alternative fuels in factory and R&D engine testing
- Utilisation of various technologies to reduce the greenhouse gas (GHG) emissions in our engine testing.

Wärtsilä joins ABB's Energy Efficiency Movement

In November 2022, Wärtsilä joined ABB's [Energy Efficiency Movement](#) with its commitment to carbon neutrality by 2030 and providing a product portfolio ready for zero carbon fuels by 2030. ABB's Energy Efficiency Movement, launched in March 2021, aims to mitigate climate change by increasing awareness and encouraging actions to reduce energy use and carbon emissions. Companies around the world are invited to join the movement and make a public pledge as a way to inspire others to take action.

Internal energy saving campaign

In November 2022, we launched an internal energy saving campaign. One way for Wärtsiläns and Wärtsilä companies to contribute is to focus on heating and cooling. Heating accounts for approximately 15-20% of Wärtsilä's total energy consumption.

Wärtsilä sites have already taken several actions to reduce energy consumption. Almost 40% of our facilities have installed smart controls and meters for electricity use, temperature, and/or ventilation. This is significant because it saves both energy and money.

Examples of energy saving actions on a local level:

- Wärtsilä's Central Distribution Centre in Kampen, the Netherlands, lowered the indoor temperature by 2°C and limited the draft from opening doors to keep the heat inside.
- Wärtsilä locations in Finland, including the Wärtsilä Helsinki Campus headquarters, committed to a nationwide campaign 'Astetta alemmas' to reduce the temperature by a minimum of one degree.
- In the USA and Canada, programmable thermostats have been installed to heat the facilities only during office hours.
- In the Singapore main office, the air conditioning has been replaced with a Variable Refrigerant Volume (VRV) system, which is more energy efficient.
- In Chennai, India, the air conditioners are never set below 28°C and they use combinations of ceiling fans and ACs to increase the heat dissipation, which creates a cooling effect with lower power consumption.

Find more: [Information and figures about our operational performance in the Environment Data section.](#)