CLIMATE REVIEW 2022

CONTENTS

THIS REVIEW SETS OUT DETAILS OF OUR STRATEGIC RESPONSE TO CLIMATE CHANGE, INCLUDING OUR ASSESSMENT OF CLIMATE-RELATED RISK AND A REVIEW OF PROGRESS MADE AGAINST OUR DECARBONISATION STRATEGY.

It is intended to supplement the information reported in our Annual Report 2022. It also details our disclosures in line with the Taskforce on Climate-related Financial Disclosures (TCFD) requirements and includes our preliminary transition plan.

ALIGNMENT WITH TCFD DISCLOSURES

Mitigating our impact on climate change and decarbonising our product portfolio are intrinsically linked to our purpose and business strategy; we believe there is significant commercial opportunity to come from this. At the same time, climate change poses a potentially significant risk to our business and we are working to ensure we have the appropriate governance, risk management and strategic resilience to respond, and the right metrics to monitor our performance.

Since joining the Race to Zero and making our commitment to reach net zero carbon by 2050, we have made considerable progress in the development and execution of our decarbonisation strategy.

PROGRESS SINCE JOINING UN RACE TO ZERO

2020

JUNE 2020
Launched net zero value chain commitment, joining UN Race to Zero and pledging to set science-based targets

2021

JUNE 2021
Published net zero report, including decarbonisation pathway and short-term climate targets linked to executive remuneration

NOV 2021
Set world speed record for all electric flight with ACCEL 'Spirit of Innovation'

NOV 2021
Announced UK Government funding, backed by private investors, to deliver our innovative SMR solution

2022

MAY 2022
Announced release of our two most popular reciprocating *mtu* engines for 100% sustainable fuels

JULY 2022
Submitted proposed science-based targets to the SBTi for validation

NOV 2022
Completed first gaseous hydrogen test on aviation engine

2023

END OF 2023
Targeting all in-production engines proven compatible with 100% SAF

2027

END OF 2027
Targeting 50% of our suppliers to have set science-based targets*

2030

END OF 2030
Targeting 50% reduction in scope 1 + 2 and net zero facility emissions*

END OF 2030
Targeting 55% reduction in scope 3 use of sold product emissions, normalised by OE revenues*

2050
Targeting net zero value chain emissions

* Proposed targets awaiting verification from SBTi

STATEMENT ON TCFD DISCLOSURES

THROUGH OUR ONGOING CLIMATE PROGRAMME AND WIDER ACTIVITIES DURING 2022 WE HAVE WORKED TO BUILD ON AND IMPROVE OUR STRATEGIC RESPONSE TO CLIMATE CHANGE AND IN TURN OUR DISCLOSURES AGAINST THE TASKFORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES (TCFD) FRAMEWORK.

In our 2021 Annual Report, we stated that our climate disclosures were in line with nine of the 11 TCFD recommendations. The two areas we felt our disclosures were inconsistent were strategy part C, related to the assessment of organisational resilience in the face of climate change; and, metrics and targets, part B, related to the disclosure of scope 3 emissions. A key focus of our climate programme, climate steering committee and Safety, Ethics & Sustainability Committee throughout the year has been in strengthening these two areas. As a result, we have made considerable progress on the integration of climate within our routine strategic and financial planning activities, and in the calculation of scope 3, category 11 use of sold products emissions in line with the Greenhouse Gas Protocol.

Against the latter, we have disclosed the impact of our scope 3, category 11 use of sold products, calculated in accordance with the Greenhouse Gas Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard. As our category 11 emissions are most material, comprising >90% of our total emissions footprint, we have concluded this disclosure meets the TCFD recommendation to calculate and disclose appropriate scope 3 emissions sources. Targets for reducing these emissions have been developed and submitted for validation by the Science-based Targets initiative.

Against strategy part C, we have sought to build on the work undertaken in 2021 where we had completed a preliminary, largely qualitative assessment of the impact of climate-related risk under climate scenarios. For 2022, we have substantiated the two climate scenarios we use for strategic planning, one of which explores an accelerated transition pathway linked to global temperature rise of 1.5°C by 2100, the other accelerated physical risk linked to global temperature rise of 3.6°C by 2100, with further quantitative and qualitative inputs. These inputs, on variables such as anticipated carbon prices ($/t) and global GDP, which have been taken from external sources, including Oxford Economics and the International Energy Agency, are used to model Company-specific assumptions such as demand for aviation and maritime transport. Each business has modelled these variables in detail to understand the extent to which each scenario manifests as a risk, and if so how material.

In these assessments, eight key risks and two key opportunities relating to climate change have been considered. Each business has modelled the potential impact of each risk and/or opportunity against their strategic and financial plans under each scenario, and reviewed the existing strategic response and controls in place to mitigate each risk and/or realise each opportunity. The outputs of which have then been consolidated and assessed at the Group level for disclosure. This has included consideration of the impact of climate in the preparation of the Going Concern and Viability Statements, as well as in the preparation of our consolidated financial statements, as disclosed in our 2022 Annual Report. It is our assessment that we have met the principles of the TCFD recommendations through these activities.

However, as set out in the 2022 Annual Report, at the start of 2023 we announced the commencement of a strategic review and wider transformation programme. This will include identifying and assessing strategic options, prioritising growth opportunities and assessing current portfolio attractiveness; much of which relates to the decarbonisation of our product portfolio and the wider opportunities the energy transition presents. The results of this review will include developing a new, granular strategic plan with clearly defined milestones and key performance indicators to enable the measurement of progress. This will be developed throughout the course of 2023. At this time therefore it would be unreasonable to conclude that we have fully considered the impact of climate change within our business strategy while that strategy is under review.

As a result, we believe our disclosures are consistent with nine of the 11 TCFD recommendations. The two areas where we consider that we are not fully aligned are: strategy, part B, relating to the consideration of the impact of climate in business strategy; and, strategy, part C, relating to the assessment of organisational resilience in the face of climate change.

DIRECTORS' RESPONSIBILITY STATEMENT

PLAYING A KEY ROLE IN THE ENERGY TRANSITION REMAINS A STRATEGIC PRIORITY. CLIMATE - THAT IS BOTH THE CONSIDERATION OF THE IMPACT OF CLIMATE ON OUR BUSINESS, INCLUDING STRATEGIC PLANNING, RISK MANAGEMENT, AND GOVERNANCE, AND CONSIDERATION OF THE IMPACT OF OUR STRATEGIC CHOICES ON THE CLIMATE, INCLUDING CARBON EMISSIONS - WILL BE A KEY CONSIDERATION THROUGHOUT THE STRATEGIC REVIEW THAT WE ANNOUNCED IN EARLY 2023.

2022 ANNUAL REPORT

GOVERNANCE

SUSTAINABILITY AND CLIMATE ARE EMBEDDED WITHIN OUR GLOBAL GOVERNANCE FRAMEWORK, RISK MANAGEMENT SYSTEM AND OPERATING MODEL.

The Board has oversight of climate-related risks and opportunities impacting the Group and all Board Committees have climate-related issues as part of their remit. In particular, the Safety, Ethics & Sustainability Committee is responsible for reviewing the principal risk relating to climate change.

The Executive Team is responsible for managing climate-related risks and opportunities on a day-to-day basis and for delivering the roadmaps to achieve our decarbonisation strategy.

COMMITTEE STRUCTURE

ROLLS-ROYCE HOLDINGS PLC

- NOMINATIONS & GOVERNANCE COMMITTEE
- AUDIT COMMITTEE
- REMUNERATION COMMITTEE
- SAFETY, ETHICS & SUSTAINABILITY COMMITTEE
- SCIENCE & TECHNOLOGY COMMITTEE

EXECUTIVE TEAM

- INVESTMENT REVIEW COMMITTEE
- ENVIRONMENT & SUSTAINABILITY COMMITTEE
- CLIMATE STEERING COMMITTEE

INDEPENDENT ENVIRONMENTAL ADVISORY COMMITTEE

BOARD OVERSIGHT

MANAGEMENT RESPONSIBILITY

GOVERNANCE

SUSTAINABILITY AND CLIMATE ARE EMBEDDED WITHIN OUR GLOBAL GOVERNANCE FRAMEWORK, RISK MANAGEMENT SYSTEM AND OPERATING MODEL.

During 2022, we have taken steps to strengthen this, with a particular focus on increasing management oversight of climate strategy and progress through the introduction of an executive-level climate steering committee.

COMMITTEE STRUCTURE

BOARD

THE BOARD HAS OVERSIGHT OF CLIMATE-RELATED RISKS AND OPPORTUNITIES IMPACTING THE GROUP

In turn, some elements of their responsibilities are delegated to Committees of the Board as set out below. All Board Committees have climate-related issues as part of their remit. Each Committee reports back to the Board formally on the matters considered following each Committee meeting. Directors received climate training during 2022, including an overview of climate science, risk management and Directors' duties.

The **Safety, Ethics & Sustainability Committee** reviews the Group's sustainability strategy, priorities and progress and has delegated responsibility to review the principal risk relating to climate change. It monitors our sustainability and climate-related performance and progress against our associated strategy and targets. It receives reports at each meeting from the head of sustainability who also reports on the discussions of the executive-level environment & sustainability committee on a regular basis, at least three times a year. During 2022, the Committee was particularly involved in the development of the Group's proposed science-based targets.

The **Science & Technology Committee** provides oversight of the Group's technology programmes and the approach to low carbon power. During 2022, the Committee reviewed the Group's net zero technology plan and progress against its roadmap.

The **Audit Committee** is responsible for reviewing and approving the content of our TCFD reporting and noted progress as preparations were being made for the disclosures in the 2022 Annual Report and within this review. The Committee also ensures that, where material, the impact of climate change is reflected in the financial statements and disclosed appropriately.

The **Remuneration Committee** determines our remuneration policy, which includes sustainability and climate metrics.

The **Nominations & Governance Committee** reviews the Board's skills and oversees membership of each of the Board's Committees and terms of reference therefore ensuring, as part of its overall remit, that the Board's governance and oversight of ESG matters, including climate, is appropriate.

DIRECTORS' RESPONSIBILITY STATEMENT ›

STATEMENT OF DIRECTORS' RESPONSIBILITIES IN RESPECT OF THE CLIMATE REVIEW

As the Directors of Rolls-Royce Holdings plc we confirm that we are solely responsible for the preparation of the Climate Review, including the reported metrics and this Directors' Statement.

The content and metrics disclosed within the Climate Review have been prepared in consideration of the recommendations of the Taskforce on Climate-related Financial Disclosures (TCFD) and in accordance with the Basis of Reporting documentation set out www.rolls-royce.com/sustainability.

SEE OUR BASIS OF REPORTING AT WWW.ROLLS-ROYCE.COM FOR FURTHER DETAIL

We confirm, to the best of our knowledge and belief, that we have:

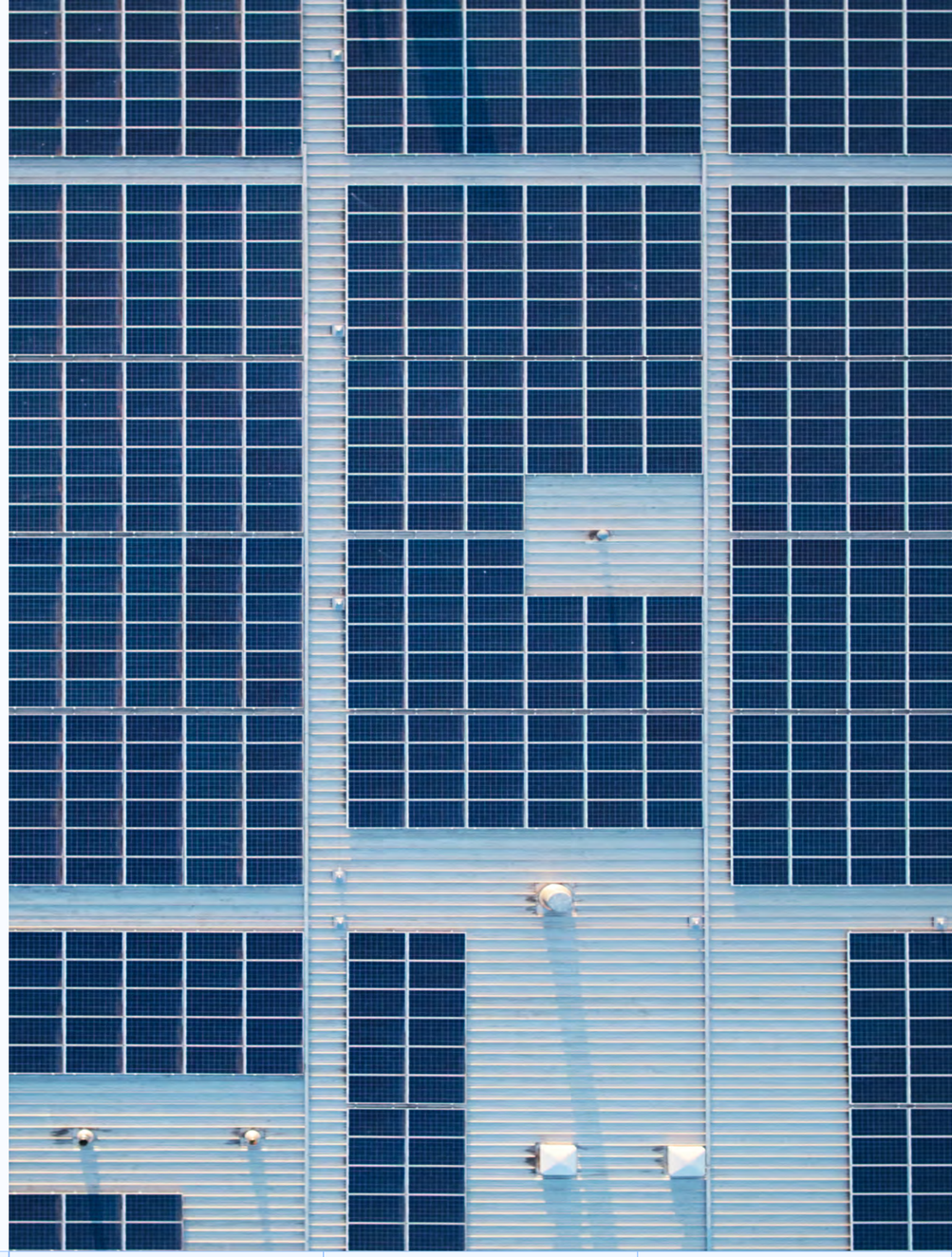
- Processes in place that we consider sufficient to collect, measure, evaluate and prepare metrics and information relevant to the Climate Review, and that this is free from material misstatement whether due to fraud or error;
- Established objective reporting criteria for preparing and presenting the metrics within the Climate Review, including clear definition of the entity's organisational boundaries, and applied them in accordance with our published Basis of Reporting;
- Presented information, including the reporting criteria, in a manner that provides relevant, complete, reliable, unbiased/neutral, comparable and understandable information;
- Reported the metrics, including the preparation of greenhouse gas emissions, within the Climate Review in accordance with the published Basis of Reporting.

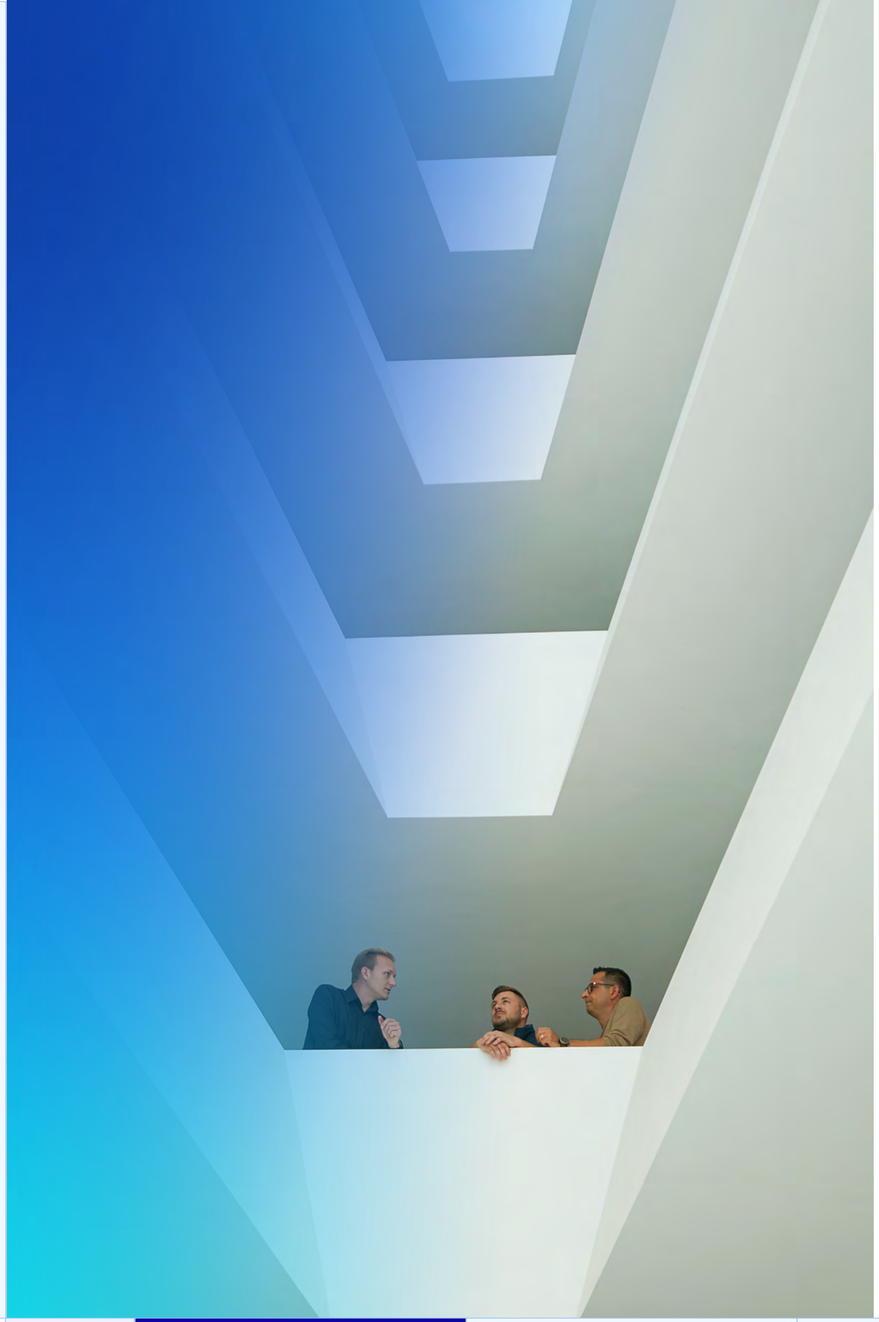
By order of the Board

Pamela Coles

Chief Governance Officer

23 February 2023





MANAGEMENT

The Executive Team is responsible for managing climate-related risks and opportunities on a day-to-day basis and for delivering the programmes and plans to achieve our decarbonisation strategy. The Chief Executive has specific ownership of the principal risk related to climate change.

The Executive Team received training on climate during the year, including an overview of the latest reports from the IPCC and climate scenario planning.

The **environment & sustainability committee** meets quarterly as a sub-committee of the Executive Team that is responsible for formulating and overseeing implementation of the Group's response to environmental and sustainability related matters, including strategy, policy, approach and key performance indicators related to climate change. The committee is chaired by the Chief Technology Officer and all members of the Executive Team are invited to participate alongside: the head of sustainability, chief governance officer; the director of external communications and brand; head of environmental technology; and the director of risk and internal audit. The committee receives regular updates from our independent environmental advisory committee, and itself reports regularly to the Safety, Ethics & Sustainability Committee as well the Science & Technology Committee as required.

This committee is supported by a **climate steering committee** which specifically oversees progress against our climate programme and decarbonisation strategy. Established during 2022 and comprising the Chief Financial Officer, Chief Technology Officer and General Counsel, alongside the head of strategic planning, head of sustainability, head of environmental technology, head of risk, and group financial controller, the committee meets on a bi-monthly basis. This ensures regular oversight of progress made against our decarbonisation strategy and climate programme.

The **investment review committee** (IRC) is an executive-level committee that reviews all investments, acquisitions and divestment proposals against a set of balanced criteria relevant to the Group's strategy, including the Group's core capability to deliver the transition to net zero. ESG and carbon impact are two elements of the Group's capital allocation framework.

Internal expertise is complemented by an **independent environmental advisory committee** which comprises external experts and academics who are leaders in relevant fields, including climate science, materials science and environmental policy. One member is a lead author of the Intergovernmental Panel on Climate Change (IPCC). The committee provides input and independent critique of our sustainability and environment policy and strategy, and is commissioned to undertake or review scientific research on behalf of the Group. A focus of the advisory committee during 2022 was on the potential impacts of the most recent IPCC research on Rolls-Royce, including for example the impact of global surface temperature rise on product operability.

STRATEGY

OUR STRATEGIC RESPONSE TO CLIMATE CHANGE ENSURES THAT WE ARE ABLE TO SIMULTANEOUSLY MITIGATE RISKS AND REALISE OPPORTUNITIES ASSOCIATED WITH CLIMATE CHANGE.

Our decarbonisation strategy will ensure that Rolls-Royce is aligned with a net zero carbon future and is playing an active role in the energy transition.

Our decarbonisation strategy has three interconnected pillars. It starts with the emissions in our own operations, extends to our value chain, and ultimately focuses on the contribution we can make to the global energy transition and the landscape that must be in place for this to come to fruition.

STRATEGY RELATING TO CLIMATE CHANGE

Our strategic response to climate change ensures that we are able to simultaneously mitigate risks and realise opportunities associated with climate change. Our decarbonisation strategy will ensure that Rolls-Royce is aligned with a net zero carbon future and is playing an active role in the energy transition.

OUR DECARBONISATION STRATEGY

Our decarbonisation strategy starts with the emissions in our own operations, extends to our value chain and ultimately focuses on the contribution we can make to the global transition.

Since joining the Race to Zero and making our commitment to reach net zero carbon emissions by 2050, we have made considerable progress in the development and execution of our decarbonisation strategy.

Our decarbonisation strategy has three interconnected pillars:

01

MAKING OUR OPERATIONS NET ZERO CARBON

02

DECARBONISING COMPLEX, CRITICAL SYSTEMS AT THE HEART OF GLOBAL SOCIETY, BY

a. enabling our products to be used in a way that is compatible with net zero

b. pioneering new breakthrough technologies that can accelerate the global energy transition

03

CREATING THE NECESSARY ENABLING ENVIRONMENT, WITH PUBLIC AND POLICY SUPPORT TO ACHIEVE THIS AMBITION

MAKING OUR OPERATIONS NET ZERO CARBON

Emissions associated with our office, manufacturing and production activities are a small but important part of our overall climate impact; ensuring these are mitigated is an important step in our decarbonisation journey. This will also ensure our facilities are more resilient.

BY 2030, OUR GOAL IS TO ACHIEVE NET ZERO GREENHOUSE GAS EMISSIONS FROM ALL ENERGY PURCHASED AND CONSUMED IN THE OPERATION OF OUR BUILDINGS, FACILITIES AND MANUFACTURING PROCESSES (EXCLUDING EMISSIONS FROM PRODUCT TESTING ACTIVITIES).

This target is well aligned with the ambition and emissions reduction trajectory required to curb global temperature rise to 1.5°C. We will achieve this through continued focus on onsite renewable energy installations; the procurement of renewable energy; and continued investment in energy efficiency improvements to reduce our overall energy demands and operating costs. During the year we have made further investments in upgrading lighting systems and heating, ventilation and air conditioning (HVAC) systems.

There is ongoing work at multiple sites in the UK and elsewhere in the world to develop detailed net zero roadmaps for buildings and manufacturing processes. These have already provided clarity on the programme of change that is required over the coming years and the commencement of feasibility studies into large scale solar deployments, battery storage and renewable heat networks. These activities have helped inform our wider transition plan.

Emissions associated with our operations totalled 175 kt CO2e in 2022. This is a 61% reduction since 2014 and a 1% reduction year-on-year from 2021.

METRICS AND TARGETS ›

EMISSIONS FROM PRODUCT TEST ACTIVITIES

WE UNDERTAKE RIGOROUS PROGRAMMES OF PRODUCT TESTING AS PART OF OUR TECHNOLOGY DEVELOPMENT PROGRAMMES, AS WELL AS TO SUPPORT CUSTOMER DELIVERIES, MEET REGULATORY REQUIREMENTS AND CERTIFICATION; THIS IS A CRITICAL PART OF OUR PRODUCT SAFETY ASSURANCE ACTIVITIES.

Typically, regulation requires us to undertake physical testing, whether on the ground through test benches, rigs or in platform application such in the air on our flying test bed, using the fuel source that the product is most likely to be operated on when it enters service. As a result, today, the majority of our testing activities, particularly pass-off tests, are carried out using fossil fuels, such as Jet-A for our Civil Aerospace fleet.

The amount of emissions generated by test activities is roughly proportional to production volumes, but also fluctuates with R&D cycles. Emissions associated with product test activities totalled 142 kt CO_2 in 2022. This is broadly equivalent to the total emissions associated with our manufacturing, production and office facilities, representing around 45% of our total scope 1 + 2 emissions for the year.

SEE METRICS AND TARGETS ›

Mitigating these emissions will rely on a combination of measures, including: increased use of sustainable fuels; reduced demand for physical testing during product development through the use of computer modelling; further standardisation and automation of production testing; and continued efficiency improvements in our gas turbine and reciprocating technologies, alongside the development of hybrid and fully electric technologies. Energy and heat capture from testing facilities will also play a role in the future as energy is repurposed and we may consider the use of credible offsets as an interim solution.

Over the past eighteen months we have been conducting a series of tests using 100% sustainable fuels as part of our goal to demonstrate that all our products can be compatible with net zero operation.

This includes the use of sustainable aviation fuel (SAF) in our Civil Aerospace and Defence portfolio and second generation biofuels in Power Systems.

Throughout 2022, and in collaboration with industry partners, we have conducted a series of one-off tests across our portfolio of in-production and in-development engines to demonstrate their readiness for 100% sustainable fuels. This includes the Trent XWB-84 and Trent 900 in Civil Aerospace, the Pearl 700 and the BR725 for business aviation and a successful in-flight test of the Trent 700 powered Royal Air Force Voyager aircraft in Defence.

In November 2022, we announced the successful completion of the first ground test of a modern aero engine on green hydrogen.

In addition to these one-off tests, we are now using a blend of 10% SAF across our UK and Europe testing activities at assembly sites in our Civil Aerospace and Defence businesses. This is significantly higher than the ~1% average SAF uptake across global aviation today and a key part of our work to advocate for increased uptake of sustainable fuels.

Emissions from product test activities have historically been excluded from our externally published climate target setting due to concerns about potentially stifling innovation, potentially impacting our ability to develop more efficient products and technologies that could realise greater emissions savings at scale, as well as concerns about disrupting customer delivery and regulatory compliance. As we transition to science-based targets we will introduce targets to reduce our overall scope 1 + 2 emissions, bringing product test emissions into our target boundary.

To support this during 2023 we will develop a roadmap for further reducing test emissions over the longer term for integration with our wider transition plan; this will be critical to ensuring we continue to meet a 1.5°C pathway beyond 2030.

BRISTOL SITE ACHIEVES NET ZERO STATUS

Our Defence site in Bristol, UK is the first Rolls-Royce production facility to achieve net zero carbon status on operational emissions (excluding product test emissions). Completion of a secondary ground source heat pump installation, in addition to the existing onsite solar and heat pump, combined with the procurement of renewable electricity and gas, granted the site with net zero carbon status for all energy consumed onsite from October 2022...

VIEW CASE STUDY

TWO SOLAR PARKS PRODUCE ELECTRICITY EXCLUSIVELY FOR POWER SYSTEMS SITE

Procuring clean energy is a key element of our journey towards net zero operations and facilities. To increase the feed-in of electricity from renewable sources into the grid supplying our plants, we are working even more closely with local partners. We have signed offtake agreements for the supply of electricity from two solar parks near the Power Systems...

VIEW CASE STUDY

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A small quantity (<10% of baseline emissions) of independently verified carbon offsets were utilised where there was no immediately viable alternative to eliminating hydrofluorocarbon (HFC) emissions from chillers and diesel use associated with some on-site transport and the testing of emergency generators. In total 220 verified carbon units were retired to Verra CCB Gold standard, representing 220 t CO_2e, against a REDD+ reforestation project under the Voluntary Carbon Standard.

BACK TO CASE STUDIES

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NEXT CASE STUDIES

GOVERNANCE | DECARBONISATION STRATEGY | ASSESSING STRATEGIC RESILIENCE | RISKS AND OPPORTUNITIES | METRICS AND TARGETS | TRANSITION PLAN | GLOSSARY

TWO SOLAR PARKS PRODUCE ELECTRICITY EXCLUSIVELY FOR POWER SYSTEMS

Procuring clean energy is a key element of our journey towards net zero operations and facilities. To increase the feed-in of electricity from renewable sources into the grid supplying our plants, we are working even more closely with local partners. We have signed offtake agreements for the supply of electricity from two solar parks near the Power Systems headquarters in Friedrichshafen, Germany. These were commissioned in June and September 2022, and are now supplying the site exclusively with renewable energy.

Together, both plants provide us with 5.5 million kilowatt hours of electricity, which accounts for about a third of the externally sourced energy for the Friedrichshafen site, and will deliver around 2,400 t CO_2 savings each year.

BACK TO CASE STUDIES

CASE STUDIES 2/2

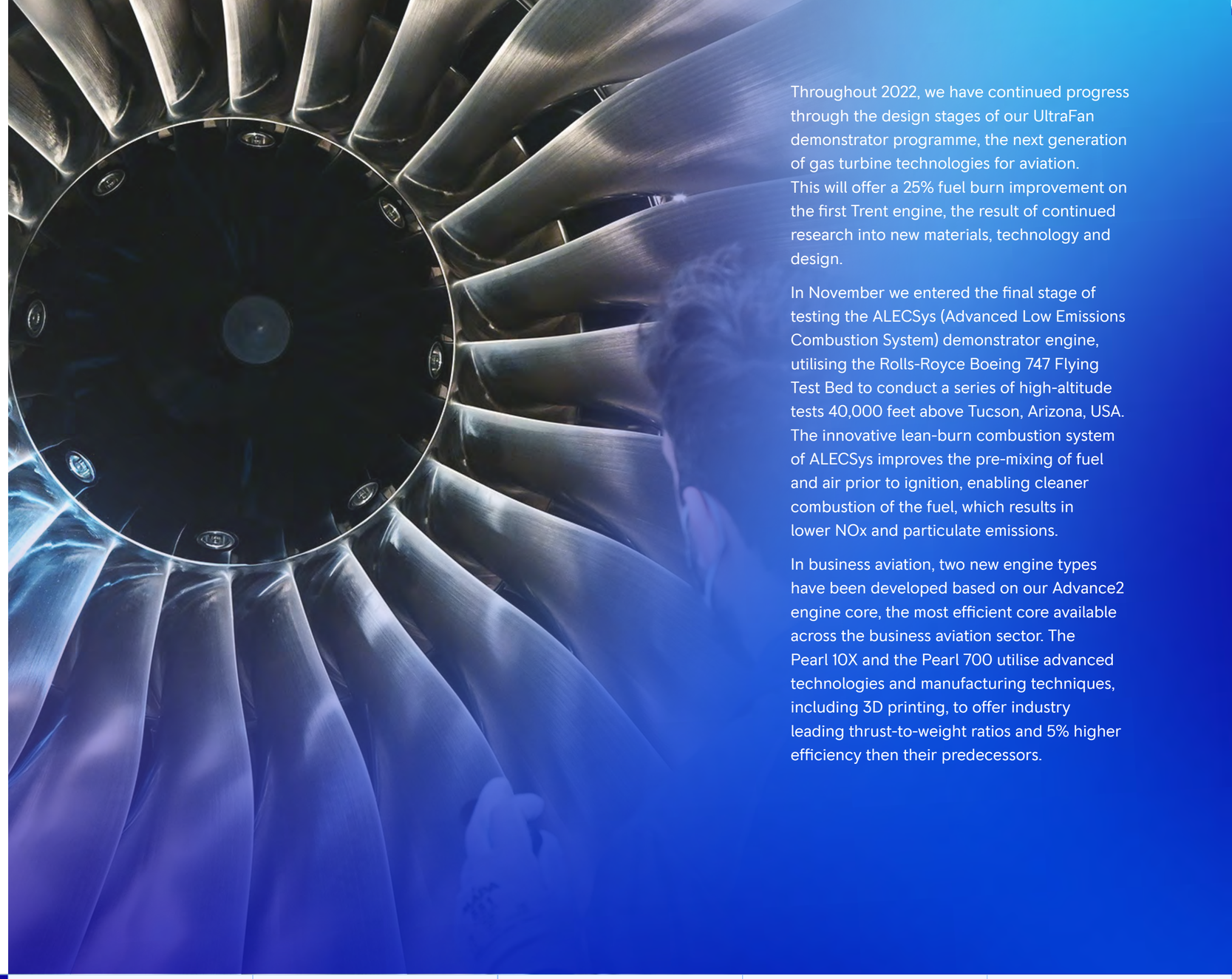
GOVERNANCE | DECARBONISATION STRATEGY | ASSESSING STRATEGIC RESILIENCE | RISKS AND OPPORTUNITIES | METRICS AND TARGETS | TRANSITION PLAN | GLOSSARY

ENABLING OUR PRODUCTS TO BE COMPATIBLE WITH NET ZERO

To be consistent with global climate goals and a 1.5°C aligned emissions reduction trajectory, we must ensure that all of our products are compatible with net zero carbon operation by 2050 at the latest. This will mitigate the most material category of our emissions footprint - scope 3, use of sold products emissions.

This will be achieved by further advancing the efficiency of our engine portfolio through continued improvements and next generation technologies, and ensuring our products can be run on sustainable fuels.

IN TODAY'S PRODUCT PORTFOLIO, WHICH IS HIGHLY DEPENDENT ON HYDROCARBON COMBUSTION THROUGH THE USE OF FOSSIL FUELS, CARBON EMISSIONS ARE INTRINSICALLY LINKED TO FUEL BURN. BY DEVELOPING AND IMPLEMENTING TECHNOLOGIES TO IMPROVE EFFICIENCY AND THEREFORE REDUCE FUEL BURN, WE CAN SUBSTANTIALLY REDUCE THE CO_2 IMPACT OF OUR PRODUCTS IN OPERATION.



Throughout 2022, we have continued progress through the design stages of our UltraFan demonstrator programme, the next generation of gas turbine technologies for aviation. This will offer a 25% fuel burn improvement on the first Trent engine, the result of continued research into new materials, technology and design.

In November we entered the final stage of testing the ALECSys (Advanced Low Emissions Combustion System) demonstrator engine, utilising the Rolls-Royce Boeing 747 Flying Test Bed to conduct a series of high-altitude tests 40,000 feet above Tucson, Arizona, USA. The innovative lean-burn combustion system of ALECSys improves the pre-mixing of fuel and air prior to ignition, enabling cleaner combustion of the fuel, which results in lower NOx and particulate emissions.

In business aviation, two new engine types have been developed based on our Advance2 engine core, the most efficient core available across the business aviation sector. The Pearl 10X and the Pearl 700 utilise advanced technologies and manufacturing techniques, including 3D printing, to offer industry leading thrust-to-weight ratios and 5% higher efficiency then their predecessors.

SUSTAINABLE FUELS

The scale up of sustainable fuels will play a crucial role in reaching net zero carbon. To accelerate this, we are working to demonstrate that all the commercial aero engines we produce, and our most popular reciprocating engines, representing 80% of the portfolio, are compatible with sustainable fuels by the end of 2023 and working with our armed forces customers to achieve the same goals for the Rolls-Royce engines they use. Throughout 2022 we have been testing a number of our in-production engines, such as the *mtu* Series 4000 and Series 1600 engines for power generation, and in-development engines, such as the Pearl 10X, on 100% sustainable fuels.

SEE TEST EMISSIONS

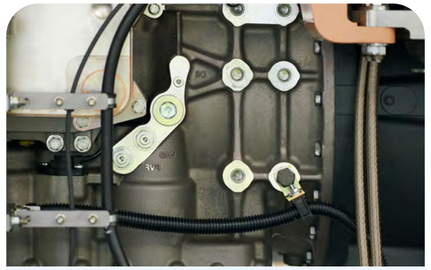
Today's sustainable fuels can deliver a 70-90% reduction in lifecycle CO_2 emissions compared to conventional fossil-based fuels, and provide a readily deployable solution to mitigating emissions associated with hard to abate sectors, particularly aviation and maritime transport, and can be compatible with existing technology and in-service fleets.

However, currently only around 2% of global fuel demand is met with sustainable fuels. We are working in partnership with fuels manufacturers to encourage the ramp-up of sustainable fuels production and with policy makers to create the necessary environment to support this.

SEE CREATING AN ENABLING ENVIRONMENT

We have already committed that by 2030, all new products entering service will be compatible with net zero operation.

CASE STUDIES



MTU SERIES 4000 ENGINE RELEASE FOR SUSTAINABLE FUELS

In May 2022, we announced the release of our *mtu* Series 4000 and Series 1600 diesel engines for use with a range of EN15940-certified synthetic diesel fuels in power generation applications...

VIEW CASE STUDY

VOYAGER SAF FLIGHT

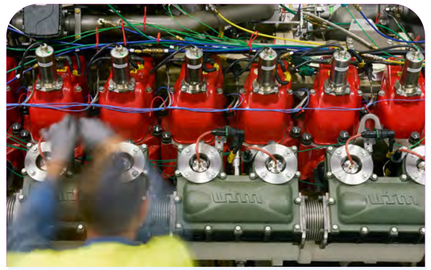
In November 2022, a UK Royal Air Force (RAF) Voyager aircraft was successfully operated on 100% unblended SAF; a key milestone in the UK Ministry of Defence's decarbonisation plan. The flight, powered by Rolls-Royce Trent 700 engines, demonstrated the ability for SAF to be utilised without the need for any technology change or change in military aircraft operation...

VIEW CASE STUDY

SAFINITY

At the start of 2022 we launched a new service offering to our business aviation customers. SAFinity enables them to operate flights in a carbon neutral way through the combination of independently verified offset projects and direct investment in Sustainable Aviation Fuels (SAF) production. This first-of-its-kind service has been made available to all business aircraft, regardless of manufacturer...

VIEW CASE STUDY



100% HYDROGEN TESTS WITH *MTU* GAS ENGINES

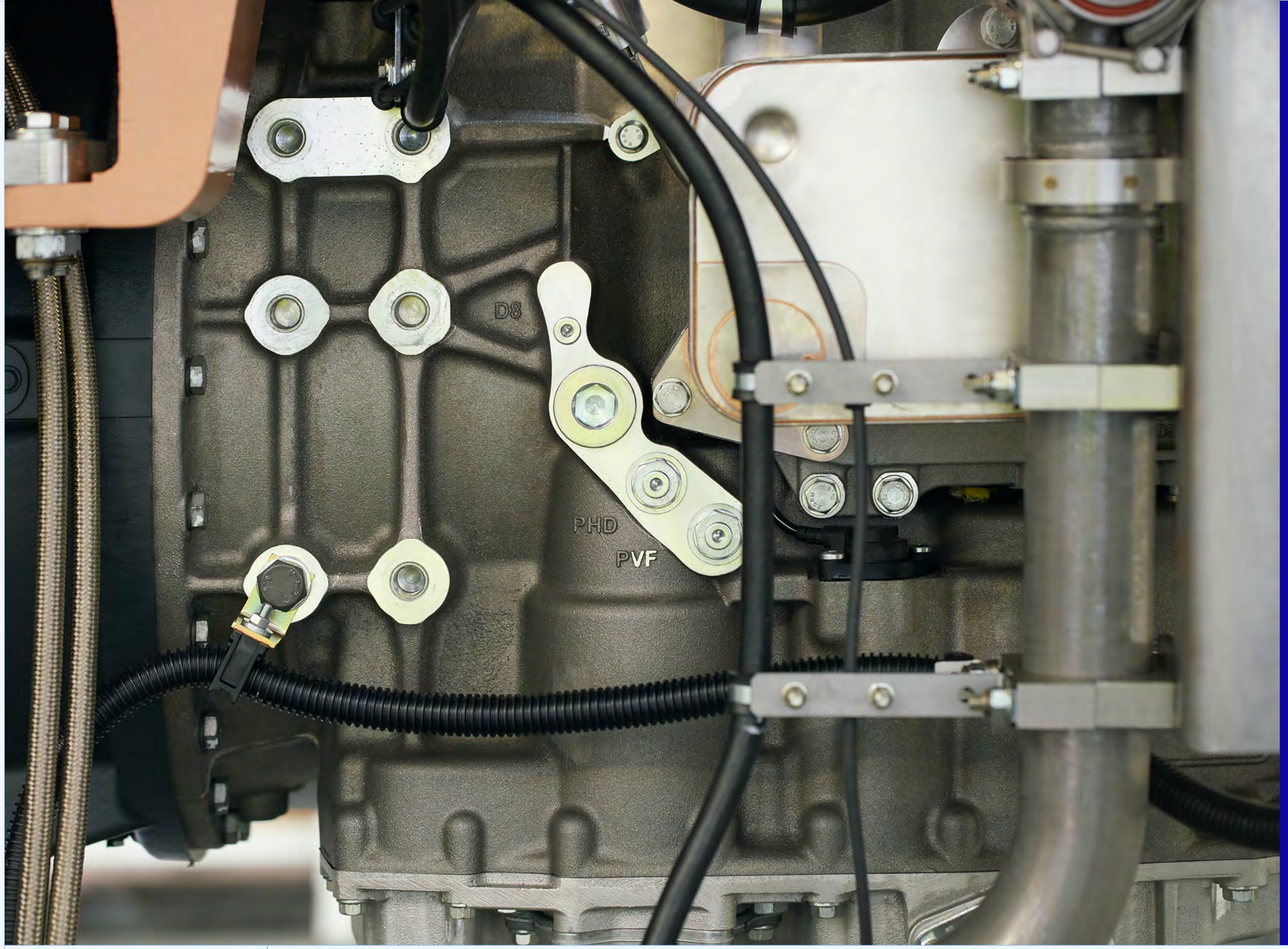
The decarbonisation of power generation requires reliable, flexible, but also climate-neutral, power plants to supplement the fluctuating generation from wind and sun. We assume that natural gas will initially be the primary fuel in the development of the hydrogen ecosystem, but we see hydrogen as technically and economically possible...

VIEW CASE STUDY

ULTRAFAN

In December 2022, we announced the completed build and test preparation for our UltraFan technology demonstrator. The first test of the demonstrator is expected to take place early 2023 and will be operated using 100% Sustainable Aviation Fuel...

VIEW CASE STUDY



MTU SERIES 4000 ENGINE RELEASE FOR SUSTAINABLE FUELS

In May 2022, we announced the release of our *mtu* Series 4000 and Series 1600 diesel engines for use with a range of EN15940-certified synthetic diesel fuels in power generation applications. Following successful testing, including in the field, both types of engines can use a range of sustainable fuels including Biomass to Liquid (BtL), Hydrotreated Vegetable Oil (HVO) and Power to Liquid (PtL) fuels such as e-diesel. They can all be used to replace conventional diesel fuel.

The tests conducted concluded that, alongside the immediate lifecycle CO_2 savings offered by the use of sustainable fuels, additional operational benefits included a decrease in NOx emissions and particulate matter.

In 2023, we expect to release the most important *mtu* diesel engines for application in rail, marine, industry and agriculture for sustainable fuels.

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VOYAGER SAF FLIGHT

In November 2022, a UK Royal Air Force (RAF) Voyager aircraft was successfully operated on 100% unblended SAF; a key milestone in the UK Ministry of Defence's decarbonisation plan. The flight, powered by Rolls-Royce Trent 700 engines, demonstrated the ability for SAF to be utilised without the need for any technology change or change in military aircraft operation. Both engines ran on 100% SAF for the entire 90-minute duration; a world first achievement using a military aircraft of its size, and the first of any aircraft type in the UK.

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SAFINITY

At the start of 2022, we launched a new service offering to our business aviation customers. SAFinity enables them to operate flights in a carbon neutral way through the combination of independently verified offset projects and direct investment in Sustainable Aviation Fuels (SAF) production. This first-of-its-kind service has been made available to all business aircraft, regardless of manufacturer, with the aim of accelerating the availability and uptake of sustainable fuels in the aviation industry.

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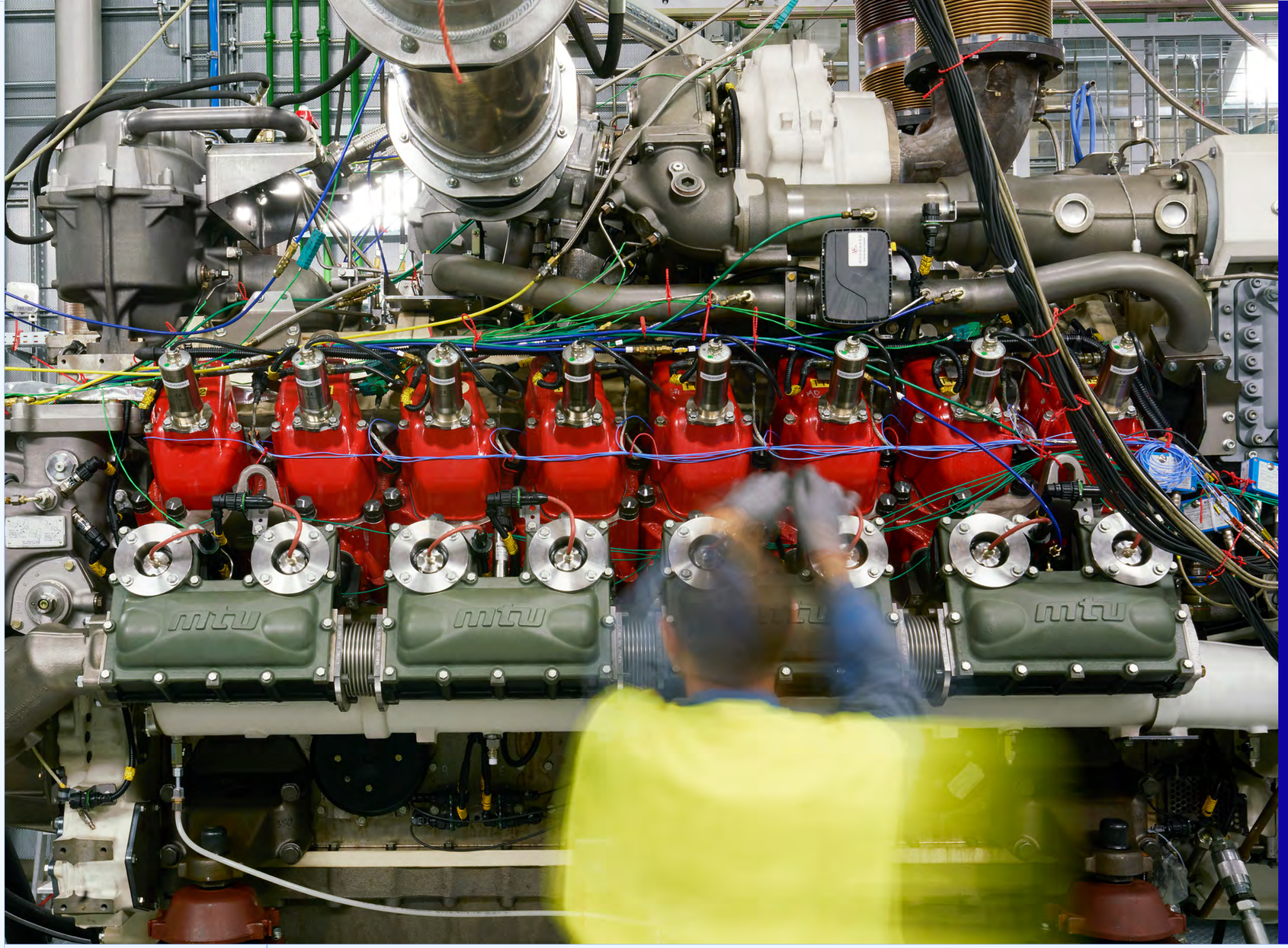

100% HYDROGEN TESTS WITH *MTU* GAS ENGINES

The decarbonisation of power generation requires reliable, flexible, but also climate-neutral, power plants to supplement the fluctuating generation from wind and sun. We expect natural gas power generation will initially continue to play an important role in the energy transition. This will be increasingly replaced by hydrogen, from green sources, in the future energy system. That is why we continue to develop our *mtu* gas engines for use with green hydrogen - whether as a 10% or 20% admixture or for 100% hydrogen.

In July 2022 we commissioned a first hydrogen engine testbench at our site in Augsburg, Germany and in November 2022 we successfully tested our *mtu* Series 4000 gas engine with 100% hydrogen.

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ULTRAFAN

In December 2022, we announced the completed build and test preparation for our UltraFan technology demonstrator. The first test of the demonstrator is expected to take place early 2023 and will be operated using 100% Sustainable Aviation Fuel.

Combining a brand new engine design with a suite of technologies to support sustainable air travel for decades to come, the UltraFan demonstrator has a fan diameter of 140 inches and offers a 25% fuel efficiency improvement compared with the first generation of Trent engine.

UltraFan offers a variety of sustainability solutions that will support the journey to net zero aviation. In the nearer term, there are options to transfer technologies from the UltraFan development programme to current Trent engines to deliver enhanced fuel efficiency and reductions in emissions. In the longer term, UltraFan's scalable technology from ~25,000-110,000lb thrust delivers the potential to further improve fuel efficiency of both narrowbody and widebody aircraft by up to 10%.

The UltraFan technology demonstrator programme has been supported by the UK's Aerospace Technology Institute and Innovate UK, the EU's Clean Sky programmes, plus LuFo and the State of Brandenburg in Germany.

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PIONEERING NEW BREAKTHROUGH TECHNOLOGIES

BEYOND MITIGATING THE EMISSIONS ASSOCIATED WITH THE USE OF TODAY'S PRODUCTS, WE BELIEVE ROLLS-ROYCE HAS A CRITICAL ROLE TO PLAY IN ACCELERATING THE GLOBAL ENERGY TRANSITION THROUGH THE DEVELOPMENT OF NEW BREAKTHROUGH TECHNOLOGIES.

This includes the development of new low or zero emission products and solutions; including fuel cells and microgrids for energy supply; hybrid-electric and all-electric technologies for urban and commuter aviation; and small modular nuclear reactors for large scale power generation, all of which operate in markets or market segments we are not present in today.

In aviation, there are great opportunities for novel technologies, such as electrical and hydrogen-based power systems, to simultaneously decarbonise urban, commuter and regional transport and create new levels of interconnectivity and mobility.

In Power Systems, we are developing hydrogen fuel cells for applications in back-up and emergency power, for example in hospitals and data centres. In Friedrichshafen, Germany a 250-kilowatt fuel cell demonstrator has been installed to demonstrate future CO_2-free energy systems to customers.

We continued to progress through the design stages for our small modular nuclear reactor (SMR) concept, in line with our goal for the first SMR to be on grid in the UK by the early 2030s.

Beyond the provision of low and net zero emissions technologies, pathways to curb global temperature rise to 1.5°C rely on carbon dioxide removals, or negative emissions (see IPCC Working Group III Climate Change 2022: Mitigation of Climate Change, report). Rolls-Royce is exploring the potential of direct air capture (DAC) in a partnership with the Commonwealth Scientific and Industrial Research Organisation (CSIRO) based in Australia.

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SMALL MODULAR NUCLEAR REACTORS (SMRs)

Our goal is to deploy a fleet of Rolls-Royce SMRs which produce affordable, low carbon electricity – helping meet future energy demands and global net zero targets.

Utilising the most common reactor technology operated in the world, the Pressurised Water Reactor...

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H3PS HYBRID-ELECTRIC DEMONSTRATOR

In February 2022, we announced that the first successful in-flight testing of our hybrid-electric demonstrator, H3PS (High Power High Scalability Aircraft Hybrid Powertrain), took place in late December 2021.

The project involved equipping a 4-seat Tecnam P2010 with a parallel-hybrid electric powertrain...

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PORT OF DUISBURG

Rolls-Royce is working in partnership with the German Federal Ministry for Economic Affairs and Energy to ensure that the world's largest inland port in Duisburg, Germany is carbon neutral.

A new container terminal, which will utilise a hydrogen-based supply network, is under construction and expected to begin commercial operation in 2023...

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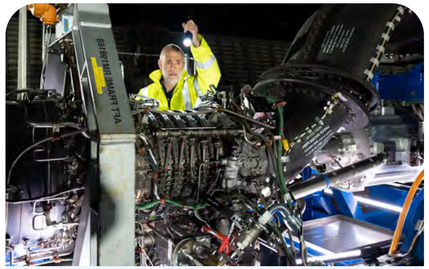

EASYJET HYDROGEN PARTNERSHIP

At Farnborough airshow in July 2022 we welcomed regional airline operator easyJet as a strategic partner supporting our work on the development of hydrogen combustion technology for aviation. The partnership is seeking to demonstrate that hydrogen has the potential to power a range of aircraft, including those in the narrowbody market...

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DIRECT AIR CAPTURE (DAC) PILOT

In July 2022, we announced a UK Government funded demonstrator project on net negative emissions technology, direct air capture. Climate science is clear that net negative emissions solutions, such as carbon capture, will play an important role in helping curb global temperature rise to 1.5°C...

VIEW CASE STUDY

SMALL MODULAR NUCLEAR REACTORS (SMRs)

Our goal is to deploy a fleet of Rolls-Royce SMRs which produce affordable, low carbon electricity – helping meet future energy demands and global net zero targets.

Utilising the most common reactor technology operated in the world, the Pressurised Water Reactor, and incorporating Rolls-Royce's 60+ years of experience in the design and manufacture of naval nuclear propulsion systems, the Rolls-Royce SMR can produce 470 MWe of low carbon power to support the decarbonisation of the whole energy system including power, heat, and transport.

The Rolls-Royce SMR is specifically designed to be factory fabricated and road transportable with >90% of the complete plant prefabricated, pre-tested then site assembled, under cover, within our site assembly factory.

Combining this manufacturing philosophy with our unique approach of supplying a turnkey solution under one managed contract allows us to provide the necessary cost reduction, schedule reduction and build certainty needed to fully realise the benefits of SMR technology and mitigates the deliverability risks associated with large scale nuclear.

Our SMR design draws upon well-established Pressurised Water Reactor (PWR) technology combined with novel factory-based manufacturing to mitigate the high infrastructure costs and delivery timescales typically associated with large scale nuclear.

A Rolls-Royce SMR power station will have the capacity to generate 470MW of low carbon energy, equivalent to more than 150 onshore wind turbines. It will provide consistent baseload generation for at least 60 years, helping to support the roll out of renewable generation and overcome intermittency issues.

During 2022, we entered the Generic Design Assessment process with UK regulators, the Office for Nuclear Regulation, the Environment Agency and Natural Resources Wales. With support from the Nuclear Decommissioning Authority, we have also successfully completed a siting sasessment review into the potential location options for the deployment of SMRs in the UK.

We believe there is significant potential for SMRs to support the clean energy transition of electricity grids of the national governments around the world, as well as supporting the decarbonisation of high carbon industries such as transportation and others. During 2022, we signed 9 MoU's and 3 further MoI's with national governments and private organisations; a clear demand signal for this technology.

H3PS HYBRID-ELECTRIC DEMONSTRATOR

In February 2022, we announced that the first successful in-flight testing of our hybrid-electric demonstrator, H3PS (High Power High Scalability Aircraft Hybrid Powertrain), took place in late December 2021.

The project involved equipping a 4-seat Tecnam P2010 with a parallel-hybrid electric powertrain – to help reduce fuel consumption by up to 20%, while maintaining and even extending aircraft range.

A 30 kW electric machine installed on the aircraft works as the starter-motor to start the combustion engine. During take-off and climb it is a thrust booster-motor adding extra torque to the propeller shaft. In the air, when the aircraft is cruising, it operates as a generator and converts the shaft movement into electric energy to re-charge the batteries.

The programme demonstrates our ability to design, manufacture and install a fully integrated system while also providing valuable data and experience in hybrid-electric flight.

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PORT OF DUISBURG

Rolls-Royce is working in partnership with the German Federal Ministry for Economic Affairs and Energy to ensure that the world's largest inland port in Duisburg, Germany is carbon neutral.

A new container terminal, which will utilise a hydrogen-based supply network, is under construction and expected to begin commercial operation in 2023. Rolls-Royce *mtu* fuel cell solutions will support electrical peak load coverage while two *mtu* hydrogen combined heat and power generation plants will supply the electricity and heat for the terminal. Excess energy will be fed into the local grid to support neighbouring infrastructure, including industry and local communities.

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EASYJET HYDROGEN PARTNERSHIP

At Farnborough airshow in July 2022 we welcomed regional airline operator easyJet as a strategic partner supporting our work on the development of hydrogen combustion technology for aviation. The partnership is seeking to demonstrate that hydrogen has the potential to power a range of aircraft, including those in the narrowbody market segment, from the mid-2030s onwards.

The first ground test of a Rolls-Royce AE2100 engine on hydrogen took place at UK MOD site Boscombe Down in November 2022, with the engine running on green hydrogen generated from wind and tidal energy.

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DIRECT AIR CAPTURE PILOT

In July 2022, we announced a UK Government funded demonstrator project on net negative emissions technology, direct air capture. Climate science is clear that net negative emissions solutions, such as carbon capture, will play an important role in helping curb global temperature rise to 1.5°C.

The initial demonstrator, being built in Derby, UK and expected to be operational during 2023, can remove 100 tonnes of CO_2 a year, while a full-scale version of the technology could remove one million tonnes a year once scaled. CO_2 removed from the atmosphere by such systems can be stored ensuring that it no longer contributes to global warming, or can be recycled to produce synthetic fuel for use in sectors such as aviation, enabling the more rapid phase out of fossil fuels.

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CREATING THE NECESSARY ENABLING ENVIRONMENT

Our ability to deliver on our decarbonisation strategy hinges on an external landscape that enables us to successfully transition to a net zero carbon future and support others to do the same.

Factors such as the provision and uptake of sustainable fuels or the acceptance of nuclear power in clean energy strategies, are outside of our immediate control.

In response to this we continue to actively engage with partners across our value chain, including policy makers, to advocate for the creation of that necessary enabling environment.

ENGAGING WITH POLICY MAKERS AND GOVERNMENTS

Governments and policy makers have a critical role to play in creating the necessary policy environment to incentivise and enact a global transition to net zero carbon. We believe we can play an important role as a technology partner to national governments and the EU, as well as supranational bodies such as the International Civil Aviation Organisation (ICAO) and work with them to shape and deliver their climate goals.

EXAMPLES OF ENGAGEMENT WITH GOVERNMENT AND POLICY MAKERS DURING 2022 INCLUDE:

- Active participation at the UNFCCC COP27 conference in Sharm el-Sheikh;
- Hosting a clean technology showcase in London for UK political stakeholders;
- Sponsorship of the Hydrogen Europe flagship event during the European clean hydrogen week held in Brussels;
- Briefing political stakeholders on our latest innovations in civil and defence aerospace at the Farnborough airshow, including UltraFan and our electrical portfolio;
- Role as chair of the board for energy and climate policy in the German Engineering Federation and Federation of German Industry.

INDUSTRY PARTNERSHIPS, ASSOCIATIONS AND INDUSTRY GROUPS

We are members of trade associations and industry groups relevant to our business activities and geographical locations. Doing so ensures that we can amplify and align our voice on policy and industry priorities; co-ordinate engagement activities to maximise outreach; and share intelligence on policy and legislative developments.

During 2022, we completed a review of the associations we are members of to better understand their positions with regards to climate change, including any stated decarbonisation targets. The organisations we are members of are taking positions in support of decarbonisation through their policy work and we will be engaging them on the evolution of their support for the energy transition and net zero.

ENGAGING OUR EXTERNAL SUPPLY CHAIN

Our supply chain, and the goods and services we procure through it, are an important part of our total emissions footprint as well as being critical to our ability to deliver our decarbonisation strategy.

As part of our science-based target setting, we have proposed a new target to work with external suppliers to ensure that 50% of suppliers by emissions have established science-based targets by 2027 (target subject to verification).

In 2022 we introduced sustainability assessments for our tier one and selected raw materials suppliers, suppliers with whom we have an immediate contractual relationship or with whom we engage through directed-buy contracts. As part of a broader assessment of social, environmental and ethical risk and performance, this includes specific criteria on climate approach and carbon impact. This is being rolled out on a risk-based approach, initially targeting our most significant suppliers in Civil Aerospace and Defence. To date, 60% of these suppliers have completed this assessment, the results of which will feed into our existing supplier management and scorecard processes going forward.

We see sustainability as a topic where the sharing of good practice is essential. During 2022, we have launched a working group to share sustainability challenges and practice; all suppliers are invited to participate on a voluntary basis and the group meets monthly. This enables the sharing of best practices between the suppliers themselves and also with Rolls-Royce. Climate-related topics discussed to date include addressing logistics emissions and common tools for scope 3 emissions calculations.

We recognise that the resilience of our supply chain is an important part of managing our own business continuity risk. A small number of selected suppliers were included in the physical climate impact assessments undertaken this year.

We have more work to do to better quantify scope 3 emissions associated with our purchased goods and services. This will be a key focus for 2023.

ENGAGING OUR PEOPLE

THE SKILLS AND CAPABILITIES OF OUR PEOPLE WILL BE CRITICAL TO ENSURING WE CAN DELIVER OUR DECARBONISATION STRATEGY. IT IS IMPORTANT THEREFORE THAT THEY ARE ENGAGED WITH AND EMPOWERED TO ACT IN OUR TRANSITION.

We have a detailed Group-wide communication and engagement campaign focused on sustainability and net zero, this features a range of formal and informal content across multiple channels, such as blogs, leader-led presentations and subject matter expert briefings. One campaign launched in 2022 is ‘sustainability & I’ an informal column-style format in which any employee, regardless of role, can offer to share their views on sustainability and climate across our global channels.

During the year we introduced voluntary learning courses on climate change as part of our digital learning platform, Leatro, as well as specific training for key parts of our employee population, such as training on our supplier sustainability ratings for procurement. Selected parts of the business have piloted more detailed climate and carbon specific training; in March 2022, Rolls-Royce & Partners Finance (RRPF) became the first aviation company to be certified Carbon Literate by the charity Carbon Literacy Project, after rolling out a new training programme.

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CIVIL OPERATIONS BIG IDEAS FORUM

This year our operations function in Civil Aerospace, including the manufacturing, procurement, quality & HSE teams, ran a competition to identify new ideas that could support the delivery of our sustainability and decarbonisation goals, including our 2030 net zero operations and facilities target...

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EU FIT FOR 55

Rolls-Royce strongly welcomes the Fit for 55 package proposed by the European Commission in July 2021. The legislative package sets out the framework that is needed to achieve Europe's climate goals, including targeting climate neutrality by 2050, and will play a critical role in supporting the decarbonisation of key sectors we operate in...

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GLOBAL SAF DECLARATION

During the Singapore airshow in February 2022 Rolls-Royce, Airbus, Safran and Singapore Airlines agreed a new commitment to promote the acceleration, development, production and consumption of Sustainable Aviation Fuels (SAF). They came together to sign a declaration to show that aviation must help to achieve ...

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ICAO LONG TERM ASPIRATION

We publicly welcomed the announcement of the long-term goal to reach net zero carbon from the International Civil Aviation Organisation (ICAO), the UN body that oversees global aviation. This level of aspiration is consistent with Rolls-Royce net zero commitments and we believe this is an important milestone...

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This year our operations function in Civil Aerospace, including the manufacturing, procurement, quality & HSE teams, ran a competition to identify new ideas that could support the delivery of our sustainability and decarbonisation goals, including our 2030 net zero operations and facilities target.

Over 100 ideas were submitted by teams and individuals from across the global operations footprint, with finalists invited to pitch their ideas to a panel of senior leaders from across the Civil Aerospace business and sustainability team. Four winning ideas were selected, and these will now receive executive sponsorship to proceed through formal business approval processes to implementation.

EU FIT FOR 55

Rolls-Royce strongly welcomes the Fit for 55 package proposed by the European Commission in July 2021. The legislative package sets out the framework that is needed to achieve Europe's climate goals, including targeting climate neutrality by 2050, and will play a critical role in supporting the decarbonisation of key sectors we operate in.

Throughout 2022, we have actively engaged stakeholders and policy makers across the Commission throughout the negotiation process, at both technical working and senior levels, to ensure that industry perspective is embedded within these policies. In particular we welcomed proposals for SAF mandates in aviation, consensus on emissions reductions pathways for maritime, more ambitious clean energy targets and a more ambitious emissions trading scheme (ETS), including the inclusion of maritime emissions for the first time.

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During the Singapore airshow in February 2022 Rolls-Royce, Airbus, Safran and Singapore Airlines agreed a new commitment to promote the acceleration, development, production and consumption of Sustainable Aviation Fuels (SAF). They came together to sign a declaration to show that aviation must help to achieve the Paris Agreement targets to limit global temperature rise to 1.5°C.

The purpose of this declaration is to act as a demand signal to incentivise SAF production in regions where the current policy landscape is less specific, including Singapore and the wider Asia Pacific region.

Turkish Airlines became the latest signatory to the Declaration at the Istanbul airshow in October 2022.

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In October 2022, we publicly welcomed the announcement of the long term goal to reach net zero carbon from the International Civil Aviation Organisation (ICAO), the UN body that oversees global aviation.

This level of aspiration is consistent with Rolls-Royce net zero commitments and we believe this is an important milestone in achieving climate consensus and ambition across the global aviation industry.

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ASSESSING STRATEGIC RESILIENCE

We assess our resilience over three time horizons:

- < 5 YEARS SHORT TERM
- 5-10 YEARS MEDIUM TERM
- 10-30 YEARS LONG TERM

CLIMATE SCENARIOS

We use climate scenarios to assess the viability of our business strategy, decarbonisation strategy and our approach to managing climate-related risk, including the impact on our financial performance.

Two climate scenarios have been developed, based on independent external climate scenarios and representative concentration pathways (RCPs), that present plausible levels of global temperature rise and associated policy responses.

These scenarios are designed by their very nature not to act as predictions or forecasts but as future possibilities which, in combination, enable us to explore the physical and transition risks and opportunities associated with climate change that may manifest over near, medium and longer-term horizons. Both climate scenarios act as bookends for our strategic planning, tested against our business planning baseline to assess not only potential risks and ways to mitigate them but also capture and realise opportunities from the energy transition. The outputs of these assessments help inform our wider business planning and decision making, including our technology portfolio and investment decisions, as well as our related engagement activities.

The climate scenarios we use are kept under review to ensure they remain viable, plausible and stretching. In early 2022, we commissioned research from our independent environmental advisory committee member Professor Piers Forster (Director of the Priestley International Centre for Climate and Professor of Climate Physics, University of Leeds UK) to review the role of the IPCC on climate policy and its potential implications for Rolls-Royce. This included concluding that the two climate scenarios we utilise in our strategic planning remain viable in line with latest climate science, including the IPCC 6th assessment report (published in August 2021) and the UNEP Emissions Gap report (published in October 2022).

In 2021, we completed a preliminary assessment of the potential impact of each scenario. This was primarily a qualitative exercise, although selected material risks were modelled for the purposes of assessment of their potential impact on our financial forecasting and results. During 2022, we substantiated the two climate scenarios with further qualitative and quantitative inputs to enable improved modelling to assess potential impacts.

Our scenario analysis exercise seeks to determine the extent to which climate scenarios manifest as risk or opportunity for the Group. This included assessment of potential impacts on market dynamics and demand, cost exposure (i.e. carbon pricing), and physical impact of climate change on operations, including site based impacts. Focal questions assessed under each scenario include:

- How does the scenario impact the life or risk exposure of assets?
- What additional production costs may occur under each scenario?
- How does the scenario impact future revenue projections?

The outputs of this exercise inform our climate-related risk management process.

	BASELINE	ACCELERATED TRANSITION SCENARIO (1.5°C BY 2100)*	ACCELERATED PHYSICAL SCENARIO (3.6°C BY 2100)*
DESCRIPTION			
	Recent global policy intervention on emissions bears some fruit, but society continues on largely as before. Existing policies are implemented, including moderate levels of carbon pricing. Geopolitical tensions rise as the physical impacts of climate change are felt.	The world shifts gradually, but pervasively, toward a more sustainable path, emphasising more inclusive development that respects perceived environmental boundaries. Resulting global temperature rise plateaus at 1.5°C. Educational and health investments accelerate the demographic transition, and the emphasis on economic growth shifts toward a broader emphasis on human wellbeing. Driven by an increasing commitment to achieving development goals, inequality is reduced both across and within countries. Consumption is oriented toward low material growth and lower resource and energy intensity.	Expanding fossil fuel demand and government failure to meet stated commitments leads to higher emissions. The expected expansion towards renewables is cut short causing global emissions to rise significantly. Global warming rises to 2.2°C by 2050, on track to hit 3.6°C of global temperature rise by 2100. This causes significant physical disruption and damage that accelerates as the scenario progresses. Fossil fuel supply is slower to adjust than demand as existing resources are strained and further exploration is needed. This causes spot prices to rise contributing to inflationary pressure in both energy and consumer sectors.
KEY DATA POINTS**			
2030	CO_2 price ($/ tonne) - Advanced economies $50/t - Developing economies $30/t GDP growth rate (global, five-year average) 2.5% Global emissions rise 37Gt CO_2 Global temperature rise 1.5°C	CO_2 price ($/ tonne) - Advanced economies $130/t - Developing economies $90/t GDP growth rate (global, five-year average) 2.3% Global emissions rise 20Gt CO_2 Global temperature rise 1.5°C	CO_2 price ($/ tonne) - Advanced economies NONE - Developing economies NONE GDP growth rate (global, five-year average) 2.4% Global emissions rise 52Gt CO_2 Global temperature rise 1.5°C
2050	CO_2 price ($/ tonne) - Advanced economies $90/t - Developing economies $55/t GDP growth rate (global, five-year average) 1.8% Global emissions rise 35Gt CO_2 Global temperature rise by 2050 2.0°C	CO_2 price ($/ tonne) - Advanced economies $250/t - Developing economies $200/t GDP growth rate (global, five-year average) 2.0% Global emissions rise NONE Global temperature rise 1.5°C	CO_2 price ($/ tonne) - Advanced economies NONE - Developing economies NONE GDP growth rate (global, five-year average) 1.4% Global emissions rise 66Gt CO_2 Global temperature rise 2.2°C

*Under each scenario our modelling considers both physical and transition-related elements. Our assessments conclude that under a 1.5°C scenario it is the transition risks that are more material to the Group, whereas in a 3.6°C scenario the physical risks are more material.

**Key data points are taken from external sources, including Oxford Economics, Global Climate Service and Databank (data extract March 2022) and the International Energy Agency, Net Zero by 2050 – A Roadmap for the Global Energy Sector, May 2021, and World Energy Outlook 2021, October 2021. These data points are then used to model company specific assumptions such as demand for aviation and maritime transport. We have modelled these scenarios over a medium (2030) and longer term (2050) time horizon, as is consistent with our strategic planning and decarbonisation targets.

RISKS AND OPPORTUNITIES

WE USE CLIMATE SCENARIOS TO QUANTIFY THE POTENTIAL IMPACT OF CLIMATE RELATED RISKS AND THEREBY ASSESS THE VIABILITY OF OUR BUSINESS STRATEGY, DECARBONISATION PLANS, OUR APPROACH TO MANAGING CLIMATE RELATED RISK AND THEIR POTENTIAL IMPACT ON OUR FINANCIAL RESULTS.

Two scenarios have been developed based on independent external climate scenarios and representative concentration pathways that present plausible levels of global temperature rise and associated policy responses. One scenario explores an accelerated transition pathway linked to global temperature rise of 1.5°C by 2100, the other accelerated physical risk linked to global temperature rise of 3.6°C by 2100.

KEY CLIMATE RISKS

CLIMATE SCENARIOS

ACCELERATED TRANSITION SCENARIO (1.5°C)

ACCELERATED PHYSICAL SCENARIO (3.6°C)

RISKS RELATING TO CLIMATE CHANGE

The assessment and management of climate-related risks and opportunities is an integral part of our enterprise risk management process.

Our enterprise risk management system looks to understand the risks to our objectives and sets common assessment criteria across the Group so that risks, including those arising from climate change, can be assessed and compared across the Group.

Our risk management system reflects ISO31000 and COSO principles and is designed to identify and manage, rather than eliminate, the risk of failure to achieve business objectives and to provide reasonable, but not absolute, assurance against material misstatement or loss.

Risks are identified by individuals across all businesses and functions and at many layers of the organisation by considering what could stop us achieving our strategic, operational or compliance objectives or impact the sustainability of our business model. Risk owners assess the risk's likelihood and impact, taking into account current mitigating control activities, identifying where additional activities may be needed to bring the risk within our risk appetite. Risk owners consider the effectiveness of current mitigating control activities in their assessment, supported by different assurance providers including internal audit. These considerations are recorded using a variety of systems and tools depending on the risk area.

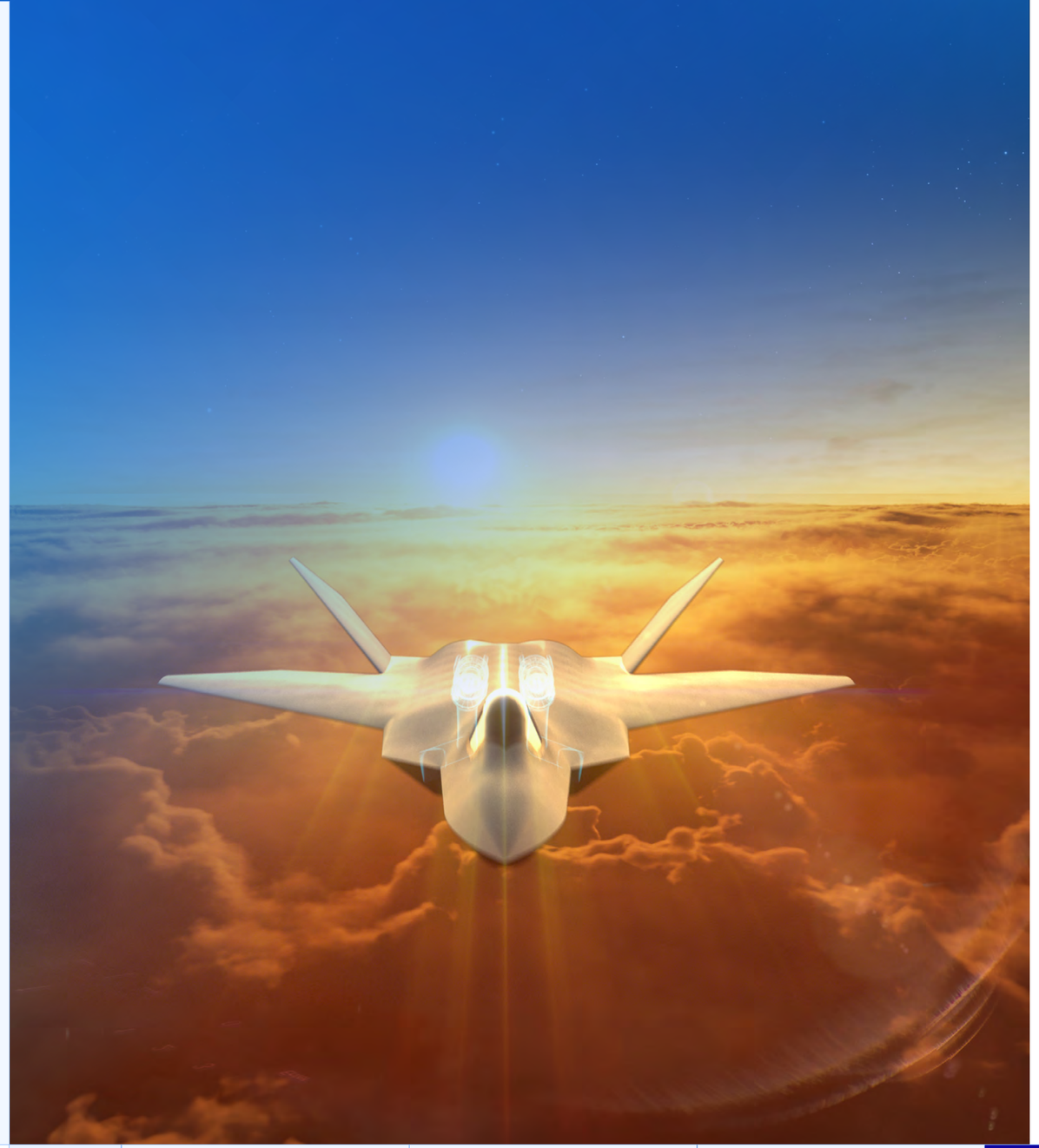
In managing the identified risks, judgement is necessary to evaluate the risks facing the Group in achieving its objectives, determine the risks that are considered acceptable, determine the likelihood of those risks materialising, assess the Group's ability to reduce the impact of risks that do materialise and ensure the costs of operating particular controls are proportionate to the benefit provided. Risk owners bring the results of their assessment, current risk status and action plans to business, function and other management review forums as often as is required depending on the nature of the risk, for support, challenge and oversight. These forums include the monthly Executive Team and regular Board and Committee meetings. At least once a year the Audit Committee, on behalf of the Board, conducts a review of the effectiveness of the risk management system, and where required, identifies areas for improvement.

SEE GOVERNANCE ›

In 2019, a principal risk related to climate change, specifically the potential risk to future revenue changes as a result of failure to transition to an inherently lower carbon product portfolio, was developed and added to our Group risk register. This principal risk was identified through a range of processes, including horizon scanning, the work undertaken on climate scenario development and inputs from subject matter experts (such as our environmental advisory committee) and other stakeholders.

As part of our emerging risk process we continually review emerging climate related risks with our recent assessment identifying the following risks: increasing focus on all environmental pollution; small particles and hazardous chemicals; increased stakeholder pressure to set targets and punishment of 'greenwashing'; increased regulatory and regulatory reporting requirements; fines/redress sought for legacy pollution; investment to remove carbon from atmosphere and; regulation leading to the cessation of use of fossil fuel to power our products. The Chief Executive is recognised as risk owner for the climate-related principal risk, and the Safety, Ethics & Sustainability Committee has oversight of the risk.

Broader climate-related risks and opportunities can manifest themselves beyond those described in our climate change principal risk. For example: extreme weather events leading to disruption in our supply chain (business continuity); carbon taxes reducing or enhancing the competitiveness of our products (competitive environment) and shifts in consumer preferences could reduce or increase the size of the accessible market (market shock).



KEY RISKS

We continually review emerging climate-related risks as part of our wider emerging risk management processes. Risks are identified across businesses and functions by considering what may prevent us achieving our strategic, operational or compliance objectives. They may be identified through a range of processes, including horizon scanning, subject matter expertise (such as that provided by our independent environmental advisory committee), stakeholder engagement, and through climate scenario modelling.

To concentrate the broad nature of climate-related risks and opportunities, and their potential impacts, we have consolidated a long list of potential climate risks we had identified into eight key risks. These represent the key hazards that could have a potentially material impact.

We have assessed the potential impact(s) of each of these key risks risk under our two climate scenarios to better understand: the trajectory and timeframe over which we expect the risk to occur; and, the existing strategic response and controls in place. The analysis undertaken shows that the actual impact of each risk is likely to be low or medium with the existing strategic controls in place.

Where relevant or material, potential impacts have then been considered in our financial planning, including in preparation of our 2022 consolidated financial statements.

EIGHT KEY RISKS RELATING TO CLIMATE CHANGE:

- Increased costs due to carbon pricing
- Reduced revenues due to changing customer demand
- Increased costs due to commodity price changes
- Regulatory changes on types of engines
- Product performance deteriorates in new physical climate
- Increased investment required in R&T/D
- Increased capital investment required due to changes in product mix and/or volume
- Changes to demand for low-carbon products in Defence

RISK IMPACT ASSESSMENT IN OUR ACCELERATED TRANSITION SCENARIO (1.5°C)

	RISK	IMPACT ASSESSMENT	CATEGORY	TIMEFRAME	TRAJECTORY	IMPACT	OUR RESPONSE / MITIGATING ACTIONS
1	**Increased costs due to carbon pricing**	Potential cost base increases both in our operations and passed on through upstream suppliers negatively impacting profits, particularly during the mid-term window for Civil Aerospace. Negative impacts will be partially offset by increased demand for more sustainable and transition products.	Market. Policy & Legal	Medium	Increasing	Medium	Preparation of our products to be sustainable fuels compliant. Seek pricing opportunities and potential cost pass-through in contracts with customers. Continue the work on developing new sustainable technologies and products (sustainable technologies in power, nuclear, electric flight) and increasing efficiency of gas turbines.
2	**Reduced revenues due to changing customer demand**	In Civil Aerospace we assume a slight decrease in demand due to interim GDP deviation and passenger 'behavioural' changes although this is principally in commuter and regional market where alternative modes of transport are available, long-haul aviation would be largely unimpacted. In Defence we expect decrease of engine flying hours/ product operation, while in Power Systems declining demand for conventional reciprocating engines would be offset by fuel cell and battery-based sustainable solutions and GHG beneficiary reciprocating base offerings.	Market	Medium	Stable	Low	Continue working to make the current fleet to be sustainable fuels compatible in short term. Market demand and dynamics are expected to be favourable even if demand is reduced. Continue the work on engine efficiency in Civil Aerospace, including UltraFan technology programme. Explore developing new low emission products and solutions in other business units to offset potential decline in today's 'core' fossil-fuel based markets.
3	**Increased costs due to commodity price changes**	Increased cost base if costs passed on from suppliers across all business units, especially prices for metal and energy, stresses profit. Partially mitigated through near term contractual protections.	Market	Short	Stable	Medium	Potential exposure in the short term. In mid-long term, a portion of the cost to flow through to customers through increase pricing. Power Systems looking to increase internal energy production to reduce dependency on energy market. Continue to explore ways to maximise potential for commodity reuse and recycle, such as revert and remanufacture programmes.

	RISK	IMPACT ASSESSMENT	CATEGORY	TIMEFRAME	TRAJECTORY	IMPACT	OUR RESPONSE / MITIGATING ACTIONS
4	**Regulatory changes on types of engines**	Regulatory changes could have a substantial impact, reduce revenue and stress the profit from existing products and services, if diesel or gas turbine engines are restricted, or demand is influenced through price signals. This could lead to a material revenue impact and stress the profit from existing products and services where alternative product lines are not yet mature. In Power Systems we observe shift from existing legacy and transition products to sustainable solutions increasing overall revenues.	Policy & Legal	Medium	Increasing	High	Continue monitoring changes in legislation to be introduced to mitigate impact on the functioning markets. Continue efforts to find solutions and new products that would help to reduce the environmental impact of current and next generation products.
5	**Product performance deteriorates in new physical climate**	No substantial effect assumed (all divisions) - negligible performance impact expected in this scenario.	Physical	Long	Stable	Low	Continue monitoring products performance during testing and in use. When designing new products take into account expected environmental change.
6	**Increased investment required in R&T/D**	The introduction of carbon pricing and/or emissions restrictions could accelerate new product introduction and raise the level of technology needed to deliver the required (higher) levels of performance and to maintain competitive position. Increased investments in current fleet (to increase fuel efficiency) and new more sustainable products and solutions while investing into maintenance of existing product range stresses the profitability.	Market	Short	Increasing	High	Addressing climate change will require shifting investment focus towards more sustainable products and solutions. Capital allocation strategy and investment approval process include assessment of investment's impact on energy transition.

	RISK	IMPACT ASSESSMENT	CATEGORY	TIMEFRAME	TRAJECTORY	IMPACT	OUR RESPONSE / MITIGATING ACTIONS
7	**Increased capital investment required due to changes in product mix and/or volume**	Increased investment required to meet new market conditions. Production facilities to be adapted / extended to ramp up or scale down the production of certain products which might affect negatively the bottom line profits and postpone in time launch of certain solutions.	Market	Medium	Increasing	Medium	Current facilities support expected demand. Leverage existing facilities as much as possible to reduce any potential investment needs. Increased demand for current generation products presents an opportunity.
8	**Changes to demand for low-carbon products in Defence**	Rolls-Royce's main Defence clients are currently building out net zero and carbon reduction strategies. The demand of these clients may shift towards low-carbon defence products in mid-long term, and we may risk losing market share if we are not able to meet these product needs.	Market, Policy and legal	Long	Increasing	Low	Rolls-Royce is developing new sustainable products and solutions to meet changing customer demand (i.e. SAF compatible engines, hybridisation, micro-grids, micro-reactors).

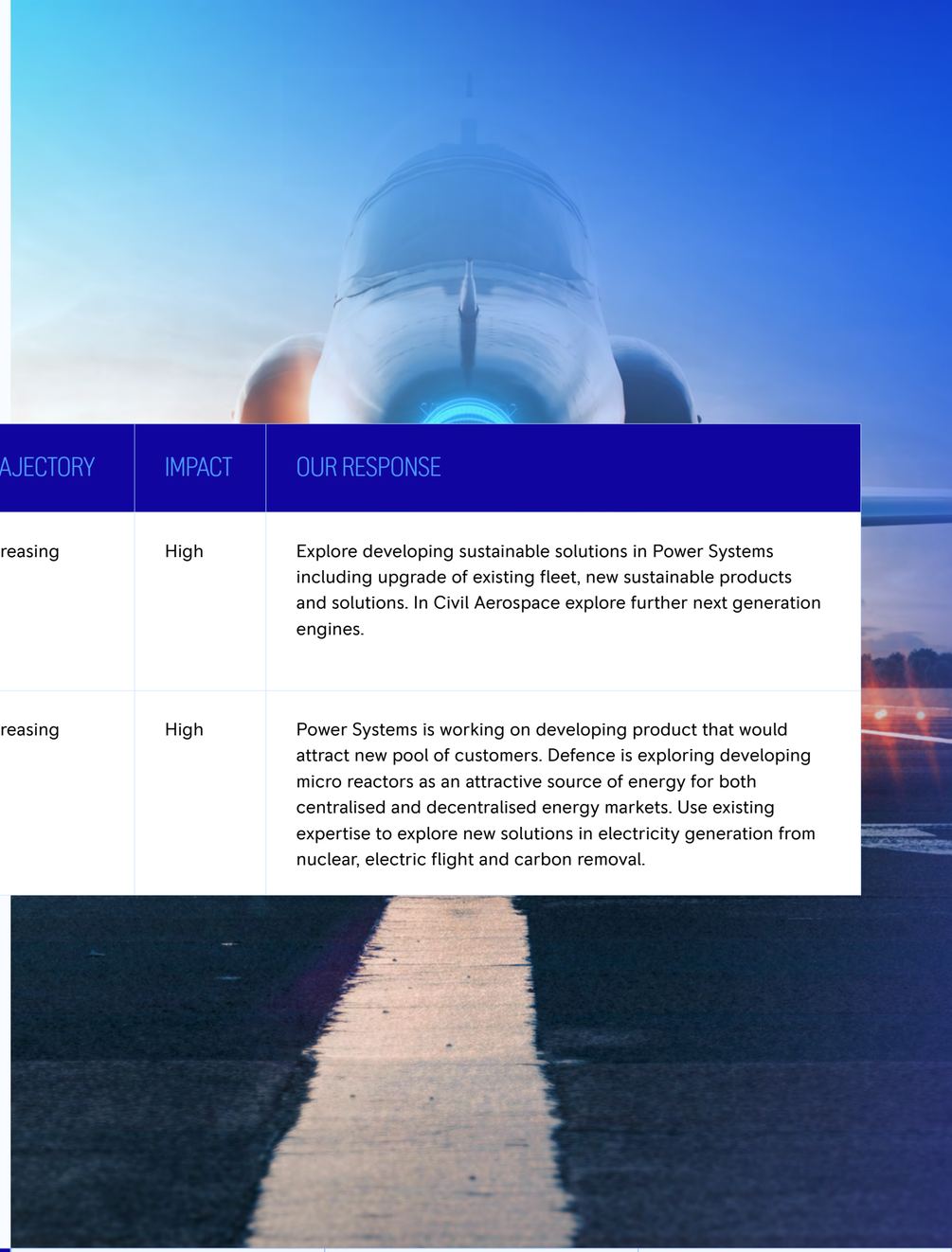
RISK IMPACT ASSESSMENT IN OUR ACCELERATED PHYSICAL SCENARIO (3.6°C)

	RISK	IMPACT ASSESSMENT	CATEGORY	TIMEFRAME	TRAJECTORY	IMPACT	OUR RESPONSE / MITIGATING ACTIONS
1	**Increased costs due to carbon pricing**	Potential inflationary pressures could cause the Rolls-Royce cost base to increase both in its operations and passed on through upstream suppliers negatively impacting profits but this is anticipated to be minimal in this scenario. Potential exposure in the short term, particularly in Civil Aerospace. In Power Systems we expect to see stronger demand for diesel–based and slower growth in sustainable products.	Market	Medium	Increasing	Low	Seek pricing opportunities and cost pass-through in contracts with customers in the longer term.
2	**Reduced revenues due to changing customer demand**	May lead to slower or lower adoption rate for sustainable products and solutions while sales of conventional products remain largely unchanged.	Market	Medium	Stable	Low	Continually monitor market requirements and adjust product portfolio where necessary.
3	**Increased costs due to commodity price changes**	Higher demand for oil & gas may and/or increased prices of metals and energy in target markets may result in higher prices and negatively impact cost base and profit margins.	Market	Medium	Stable	Medium	Seek pricing opportunities and cost pass-through in contracts with customers. In Power Systems to increase internal energy production to reduce dependency on the energy market Maximise potential for commodity reuse and recycle.
4	**Regulatory changes on types of engines**	Today's market dynamics status quo remains in play in this scenario. Scenario assumes no change from today's path with no significant impact on sales of existing products across all business units. Could lead to lower adoption rates for new sustainable products and solutions such as Advanced Air Mobility.	Policy & Legal	Medium	Increasing	Low	Continually monitor market requirements and adjust product strategy accordingly

	RISK	IMPACT ASSESSMENT	CATEGORY	TIMEFRAME	TRAJECTORY	IMPACT	OUR RESPONSE / MITIGATING ACTIONS
5	**Product performance deteriorates in new physical climate**	In Civil Aerospace average temperature increase leads to a time on wing reduction driving marginally higher number of shop visits. In Power Systems product already tested for operating in extreme climate conditions. In Rolls-Royce Electrical higher temperature may result in product deterioration and drive higher servicing costs. In Rolls-Royce SMR additional safety and security requirements on our plants.	Physical	Long	Stable	Low	Further analysis to be conducted in Civil Aerospace and in Power Systems, Rolls-Royce Electrical diligent product testing in development process. Rolls-Royce SMR continue following closely ONR requirements.
6	**Increased investment required in R&T/D**	In this scenario we may have a shift of investment focus between various technologies and solutions	Market	Medium	Stable	Low	Continually monitor market requirements and adjust product strategy and associated investment accordingly.
7	**Increased capital investment required due to changes in product mix and/or volume**	In Civil Aerospace higher average temperatures drive higher volume of shop visits - investment capital might be needed. While in Power Systems we would expect a reduction on near term investment need due to slower ramp-up of sustainable technologies.	Market	Long	Stable	Low	Continually monitor market requirements and adjust product strategy and associated investment accordingly. In Power Systems we would reduce investments in new sustainable product offerings to a level required to maintain optionality and offer a competitive product portfolio.
8	**Changes to demand for low-carbon products in Defence**	Demand for conventional products remains strong with limited customer shift to sustainable solutions.	Market, Policy & Legal	Long	Increasing	Low	In Defence we will continue the work on novel nuclear (e.g. microreactors) as we believe customer demand will be driven by numerous factors, not just decarbonisation policy. In Power Systems we would reduce investments in new sustainable product offerings to a level required to maintain optionality and offer a competitive product portfolio.

CLIMATE-RELATED OPPORTUNITIES

The table below shows the key opportunities identified as part of our risk and opportunities assessment activity and applied to both climate scenarios; the potential impact(s) of the opportunity; the timeframe over which we expect to experience it and how we plan to address it.



CLIMATE-RELATED OPPORTUNITIES ASSESSMENT IN OUR ACCELERATED TRANSITION SCENARIO (1.5°C)

OPPORTUNITY		CATEGORY	TIMEFRAME	TRAJECTORY	IMPACT	OUR RESPONSE
Develop new product for existing markets	Maintain Rolls-Royce existing market position, limit customer churn, acquire new customers in existing markets and increase level of product and services cross-sell by developing low emissions products and solutions driving reductions of carbon emissions.	Market, Product & Service	Medium	Increasing	High	Explore developing sustainable solutions in Power Systems including upgrade of existing fleet, new sustainable products and solutions. In Civil Aerospace explore further next generation engines.
Enter new markets by developing new low emissions products	Opportunity to tap on new addressable markets and also branching out to new geographies. Further diversification of revenue stream driven by new technologies, new customers and new geographies.	Market, Product & Service	Long	Increasing	High	Power Systems is working on developing product that would attract new pool of customers. Defence is exploring developing micro reactors as an attractive source of energy for both centralised and decentralised energy markets. Use existing expertise to explore new solutions in electricity generation from nuclear, electric flight and carbon removal.

CLIMATE-RELATED OPPORTUNITIES ASSESSMENT IN OUR ACCELERATED PHYSICAL SCENARIO (3.6°C)

OPPORTUNITY		CATEGORY	TIMEFRAME	TRAJECTORY	IMPACT	OUR RESPONSE
Increased demand for existing products	Higher demand for existing products across Civil Aerospace and Power Systems	Market, Product & service	Medium	Increasing	High	Continue to work on improving engine efficiency to remain competitive
	The increased risk of regional conflict, and weather-related humanitarian missions, increase flight hours for transport & patrol and combat aircraft	Market, Product & service	Long	Increasing	High	Continue work on maintaining and improving existing product portfolios
Develop new product for existing markets	Nuclear products still providing substantial revenue contribution thus potentially the growth lower than in baseline	Market, Product & service	Long	Increasing	High	Continue work on developing nuclear products

SITE BASED RISK ASSESSMENT

AS GLOBAL TEMPERATURES RISE WE EXPECT THE FREQUENCY AND SEVERITY OF EXTREME WEATHER EVENTS TO INCREASE. THIS IN TURN WILL RESULT IN A HIGHER LIKELIHOOD OF DISRUPTIONS TO OUR GLOBAL OPERATIONS. THESE IMPACTS WILL MANIFEST THEMSELVES DIFFERENTLY IN DIFFERENT LOCATIONS, DEPENDING ON LOCAL FACTORS AND LEVELS OF GLOBAL TEMPERATURE CHANGE.

Our analysis of physical climate risks is aligned with recognised climate scenarios, specifically the Intergovernmental Panel on Climate Change's (IPCC) Representative Concentration Pathway (RCP) scenarios which provide a uniform framework for exploring potential climate changes and related impacts. RCPs are used globally for climate modelling and give access to a wide range of peer-reviewed and accepted climate datasets, as well as allowing consistency across territories. Our assessment has focused on: river and surface water flooding; coastal inundation; high winds; soil subsidence; extreme heat; and the risk of forest fires. These hazards are considered as part of our business continuity risk in relation to climate change.

HAZARDS ASSESSED:

HAZARD	IMPACTS OF HAZARD
Coastal inundation	Sea water flooding due to high tides, wind, low air pressure and waves can damage coastal land and property
Extreme wind	Extreme windstorms can damage buildings and infrastructure
Forest fire	Flames and heat from burning vegetation can damage buildings and infrastructure
Riverine flooding	Riverine flooding can damage low-lying buildings or infrastructure
Soil subsidence	Soil contraction due to less rainfall causing subsidence damage to structures
Surface water flooding	Flash flooding can damage low-lying building or infrastructure
Extreme heat	Loss of use or failure of infrastructure, as well as human heat stress

KEY LOCATIONS ASSESSMENT

During 2022, we have conducted a physical risk impact assessment of key Rolls-Royce sites and selected supplier and joint venture locations. This builds on the work undertaken in 2021 to carry out a high-level assessment of key operating geographies at a country level. The sites selected for assessment include those of the most strategic significance, as well as those located in regions most vulnerable to climate impacts.

In total 50 physical locations were assessed as part of our physical climate impact assessment exercise this year. The majority of these are Rolls-Royce owned and operated production sites, while fifteen were selected supplier and joint venture locations primarily supporting our Civil Aerospace business. Sites were selected for assessment based on their strategic significance and therefore comprise the key production locations of each of our businesses.

The assessment utilised the latitude and longitude co-ordinates of the grid point for the centre of each site to understand potential likelihood of one or more of the hazards occurring. Probability has been assessed on a 1 in 500 year occurrence, 1 in 250 year occurrence and 1 in 100 year occurrence.

The findings of this identify that eight locations are vulnerable to potential surface water flooding on a 1 in 100 year occurrence. Two locations are vulnerable to potential storm risk, notably high winds, on a 1 in 100 year occurrence, with a further six sites vulnerable to a 1 in 250 year storm occurrence.

Our assessment suggest that these risks exist in all scenarios but become more likely with higher global temperature rise explored in the 3.6°C scenario.

Further work is needed to better determine total site exposure risk, rather than specific to the central grid point, particularly at locations with a greater than 1 in 250 year likelihood of an acute physical risk occurring. This will include work to better understand the risk event (i.e. depth of flood water) to inform further risk quantification and mitigation actions. This may include activities such as investing in adaptation and resilience capacity building (for example flood defences); duplicating production capability or sourcing in other locations less vulnerable to the identified hazard; and potentially holding additional safety stock to minimise supply chain and operational disruption.

SITES ASSESSED

Click on a location to see sites and more details

METRICS AND TARGETS

WE MONITOR SELECTED METRICS RELEVANT TO OUR STRATEGIC RESPONSE TO CLIMATE CHANGE, INCLUDING OUR GHG EMISSIONS.

Our climate strategy is supported by a suite of short and medium term targets intended to help measure and accelerate progress.

The backbone of our climate-related metrics and targets is our commitment to reach net zero value carbon across our value chain by 2050.

SCOPE 1 + 2, OPERATIONS AND FACILITIES AND PRODUCT TEST EMISSIONS

SCOPE 3, USE OF SOLD PRODUCT EMISSIONS

CLIMATE RELATED TARGETS

METRICS AND TARGETS

THE BACKBONE OF OUR CLIMATE-RELATED METRICS AND TARGETS IS OUR COMMITMENT TO REACH NET ZERO CARBON ACROSS OUR VALUE CHAIN EMISSIONS BY 2050, RATIFIED THROUGH OUR PARTICIPATION IN THE UN RACE TO ZERO.

To assess our progress against this commitment we have established a suite of climate-related metrics and targets, including decarbonisation targets.

We continue to focus on improving the rigour of our emissions calculations and reporting, particularly related to scope 3 emissions. For 2022, we have focused on preparing our scope 3, category 11 use of sold products emissions as the most material aspect of our total emissions footprint. We will focus on further scope 3 emissions categories, particularly category 1, purchased goods and services and category 2, capital goods, in 2023.

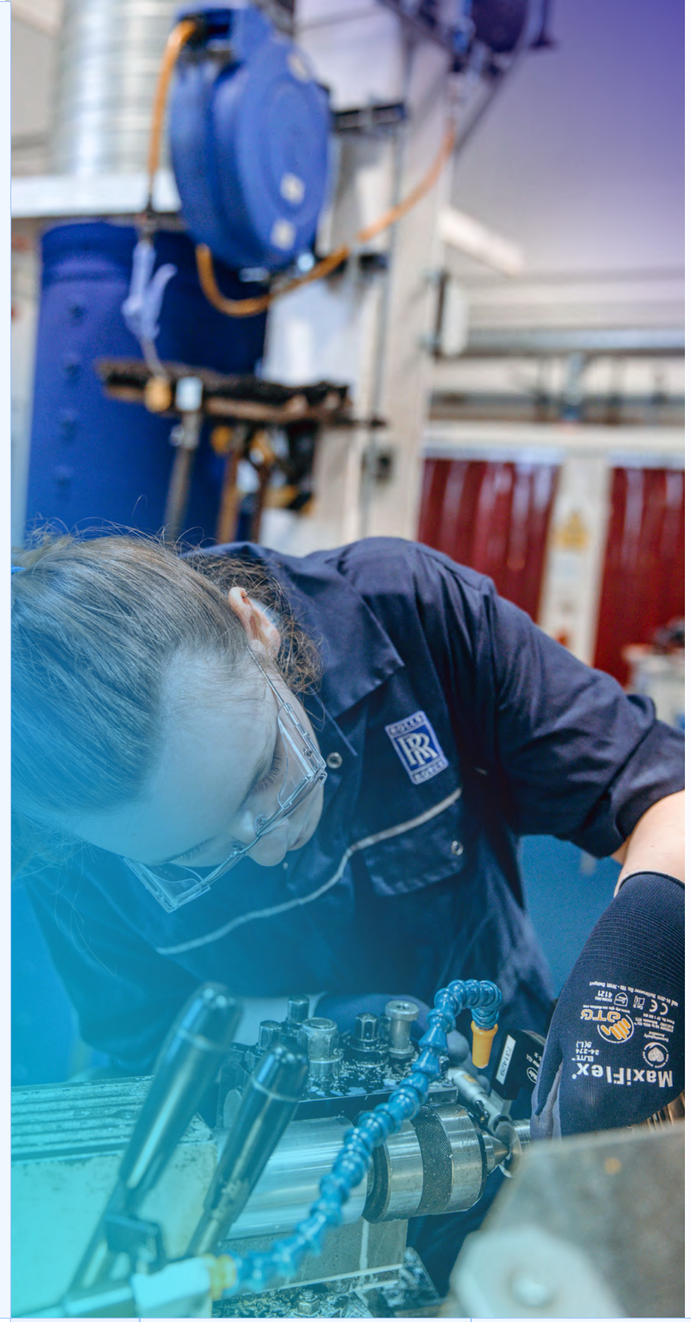
We have calculated our scope 1, 2 and 3 emissions in accordance with the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard and Corporate Value Chain (Scope 3) Accounting and Reporting Standard (GHG Protocol).

Scope 3 emissions in particular are a complex disclosure, and the calculation methodology requires us to make a number of informed estimates and assumptions, as outlined in our basis of reporting. Some of these may be subject to change over time as we continue to further refine and mature our emissions calculations. Any deviations from the GHG Protocol have also been documented within the basis of reporting.

SEE OUR BASIS OF REPORTING AT WWW.ROLLS-ROYCE.COM FOR FURTHER DETAIL

FURTHER DETAIL ON OUR GREENHOUSE GAS EMISSIONS, INCLUDING OUR STREAMLINED ENERGY AND CARBON REPORTING (SECR) STATEMENT, CAN BE FOUND IN OUR 2022 ANNUAL REPORT AND AT ROLLS-ROYCE.COM.

ANNUAL REPORT



SCOPE 1 + 2 EMISSIONS

Emissions associated with our facilities, and the energy required to heat and power them, is a small but important part of our overall emissions footprint.

For the purposes of transparency, we have disclosed emissions associated with product testing activities as a separate reporting line.

External assurance over scope 1 + 2 emissions data is provided by Bureau Veritas. See the 2022 Annual Report for their assurance statement.

EMISSION SOURCE	2019	2020	2021	2022
Scope 1: emissions from office, manufacturing and production facilities	110 kt CO_2e	109 kt CO_2e	85 kt CO_2e	92 kt CO_2e
Scope 1: emissions from product testing activities	135 kt CO_2e	126 kt CO_2e	132 kt CO_2e	142 kt CO_2e
Scope 2: emissions from the purchase of electricity, heat, steam and cooling for our facilities	144 kt CO_2e	91 kt CO_2e	93 kt CO_2e	86 kt CO_2e
Total scope 1 + 2 emissions	389 kt CO_2e	325 kt CO_2e	310 kt CO_2e	319 kt CO_2e
Total scope 1 + 2 emissions normalised by revenue (kt CO_2e/ £m)	0.0243 kt CO_2e/ £m revenue	0.0283 kt CO_2e/ £m revenue	0.0276 kt CO_2e/ £m revenue	0.0236 kt CO_2e/ £m revenue

SCOPE 3, CATEGORY 11 EMISSIONS (USE OF SOLD PRODUCTS)

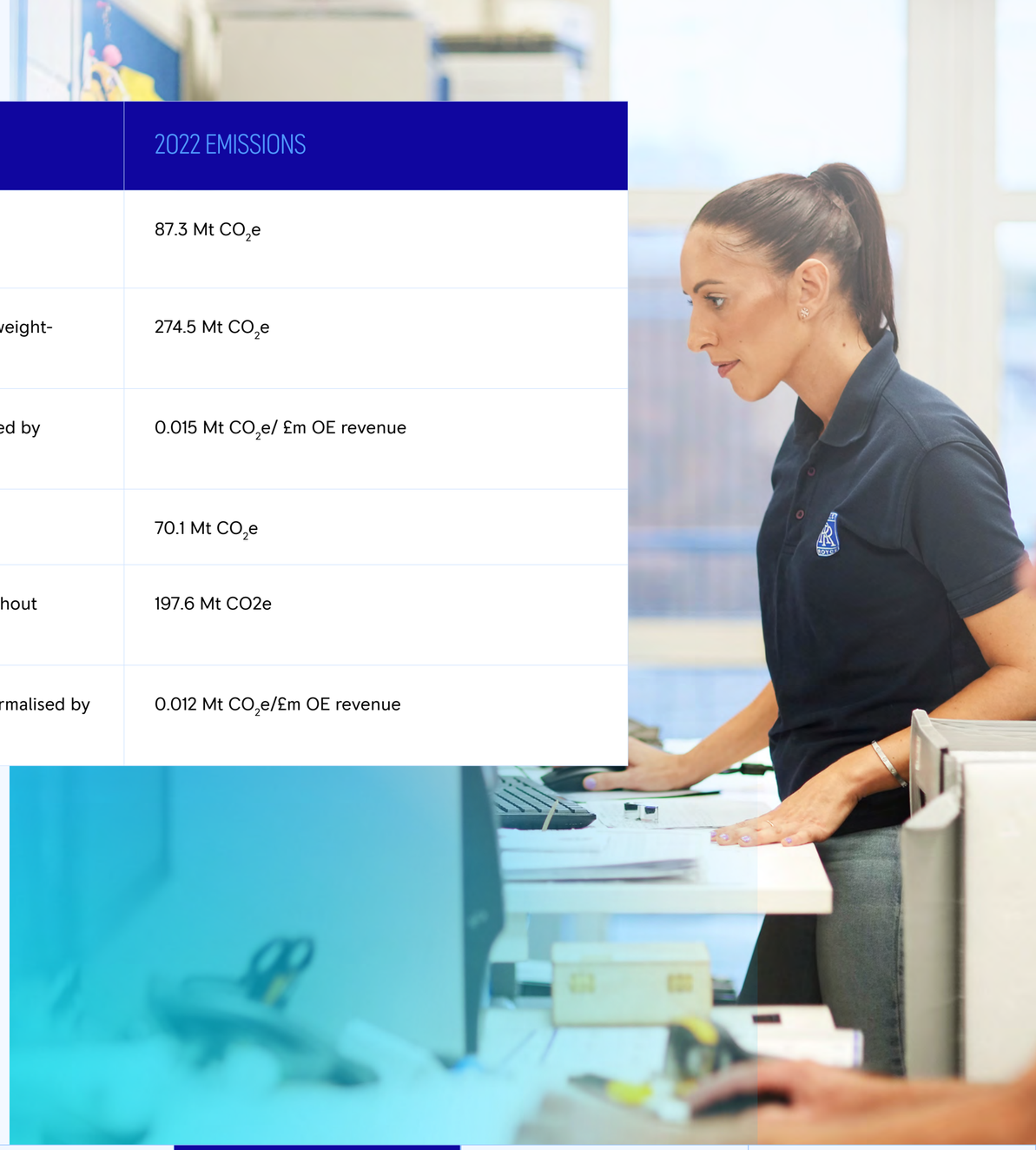
Emissions associated with the operation of our products by our customers comprises the majority of our emissions footprint. We completed an emissions inventory in 2019 that concluded scope 3, category 11 emissions were above 90% of our total footprint. We do not anticipate there has been any material change in this composition since then.

We have reported against two differing projections of sustainable fuels uptake, one of which aligns to a 1.5°C pathway, whilst the other assumes a 100% fossil fuel based pathway. Given the status of current and anticipated future policies, including sustainable fuels mandates, a 100% fossil fuel based pathway could be considered as a worst-case illustration.

In addition, we have disclosed a normalised metric to demonstrate the carbon intensity of our portfolio. This is calculated using original equipment revenues to align with the requirements of the GHG Protocol.

SEE EXPLAINER

USE OF SOLD PRODUCT EMISSIONS	2022 EMISSIONS
Use of sold products on a fossil fuel based pathway	87.3 Mt CO_2e
Use of sold products on a fossil fuel based pathway without weight-based adjustment	274.5 Mt CO_2e
Use of sold products on a fossil fuel based pathway normalised by original equipment revenues	0.015 Mt CO_2e/ £m OE revenue
Use of sold products on a sustainable fuel based pathway	70.1 Mt CO_2e
Use of sold products on a sustainable fuel based pathway without weight-based adjustment	197.6 Mt CO2e
Use of sold products on a sustainable fuel based pathway normalised by original equipment revenues	0.012 Mt CO_2e/£m OE revenue



USE OF SOLD PRODUCTS CALCULATION METHODOLOGY

Emissions associated with the use of sold products (scope 3, category 11) for 2022 have been calculated in accordance with the GHG Protocol.

In previous years we had calculated and disclosed an estimate of these emissions, most notably within our Net Zero report published June 2021. At the time this calculation was made based on an assessment of the emissions associated with the operation of the Rolls-Royce powered fleet within a given year, and was therefore not aligned with the GHG Protocol methodology.

Since 2021, we have refined our emissions data and calculation methodology to enable us to disclose in line with the GHG Protocol. Emissions data for 2019, the baseline of our proposed science-based targets, has been recalculated and is restated in the disclosure.

This methodology requires us to take a forward-looking projection of lifetime emissions associated with products sold in the reporting year. By its nature this requires us to make a number of estimates and assumptions, some of which may be subject to change over time as we continue to further refine and mature our emissions calculations.

The calculation methodology used can be summarised as:

This methodology requires us to make a number of assumptions including, but not limited to: usage intensity experienced by the product during different stages of its in-service life; expected performance of the product throughout its in-service life, and, anticipated choice of fuel, and the carbon intensity of that fuel throughout that in-service life. Given the long service life of the majority of our product portfolio, often around 30 years, there is a significant level of uncertainty associated with this methodology. As a result we have reported against two differing projections of sustainable fuels uptake, one of which aligns to a 1.5°C pathway, whilst the other assumes a 100% fossil fuel based pathway. Given the status of current and anticipated future policies, including sustainable fuels mandates, a 100% fossil fuel based pathway could be considered as a worst-case illustration.

The GHG Protocol classifies engines as intermediate rather than final products, especially in aerospace. This requires us to apply an adjustment factor to the emissions calculation for each product type, according to the proportion of the overall vehicle weight attributable to the Rolls-Royce product. This is calculated by individual product types, for example in our Civil Aerospace business a single Trent XWB-84 engine contributes approximately 3.8% of the total weight of the Airbus A350-900 it powers, therefore a weight-based allocation factor of 0.038 is applied. The weight-based approach also requires us to include CO_2 emissions associated with non-fuel-burning products which account for a proportion of vehicle weight. For example, we have included a weight-based proportion of CO_2 emissions from naval ships fitted with our propellers.

At present this weight-based adjustment factor is applied solely to our Civil Aerospace and Defence products; we do not currently have the same level of data concerning the weight of the final platform in order to perform this calculation on the rest of the product range, nor would such an approach be meaningful in some applications, for example in stationary power-generation applications in Power Systems. We estimate that around 60% of products delivered by Power Systems in 2022 were destined for mobile applications, including rail, maritime and land-based transport applications, and therefore a weight-based adjustment could be considered applicable.

Given the high levels of uncertainty and assumptions associated with the GHG Protocol calculation of scope 3, category 11 emissions, and the cumulative nature of carbon in the atmosphere, it may be more appropriate to consider carbon emissions resulting from the operation of the Rolls-Royce powered fleet within the reporting year. For 2022, this would be 264.9 $MtCO_2e$ on a fossil fuel based pathway, and 262.0 $MtCO_2e$ on a sustainable fuel based pathway, with no weight-based adjustments made.

In previous years we had calculated and disclosed an estimate of these emissions, most notably within our Net Zero report published June 2021. At the time this calculation was made based on an assessment of the emissions associated with the operation of the Rolls-Royce powered fleet within a given year, and was therefore not aligned with the GHG Protocol methodology.

Since 2021, we have refined our emissions data and calculation methodology to enable us to disclose in line with the GHG Protocol. Emissions data for 2019, the baseline of our proposed science-based targets, has been recalculated and is restated as 131.2 Mt CO_2e on a fossil fuel based pathway, and 113.8 Mt CO_2e on a sustainable fuel based pathway with weight-based adjustments applied. 2019 has been selected as the baseline year as it is the most representative year of engine deliveries prior to the impact of COVID-19.

SEE OUR BASIS OF REPORTING AT
WWW.ROLLS-ROYCE.COM FOR FURTHER DETAIL

CLIMATE-RELATED TARGETS

OUR CLIMATE STRATEGY IS SUPPORTED BY A SUITE OF SHORT AND MEDIUM-TERM TARGETS INTENDED TO HELP MEASURE AND ACCELERATE PROGRESS. THIS INCLUDES TARGETS TO MITIGATE EMISSIONS, BUILD STRATEGIC RESILIENCE AND CAPABILITY DEVELOPMENT IN RELATION TO CLIMATE CHANGE.

During 2022, we developed and submitted science-based targets covering scope 1 + 2 and scope 3 category 11 (use of sold products) emissions, plus a supply chain engagement based target, in line with our commitment to the UN Race to Zero campaign. These were submitted to the Science-based Targets initiative (SBTi) for validation in July 2022; we anticipate being in a position to publish verified targets in the first half of 2023. Until the point of validation they are subject to change.

We recognise that we have more to do in defining further short term decarbonisation and transition related targets, as well as further development of our transition plan, these will be considered as part of the strategic review to be undertaken during 2023.

EMISSION	TARGET	2022 PERFORMANCE
Operations and facilities (scope 1 + 2)		
	Achieve net zero GHG emissions from operations and facilities by 2030 (excludes product test emissions)	Target on track - In 2022, the emissions associated with our operations and facilities target was 175 $ktCO_2e$, a 61% reduction since 2014
	Reduce total scope 1 + 2 emissions (includes product test emissions) by 50% by 2030, from a 2019 baseline *	New target for 2022
Product testing (scope 1)		
	Use SAF for 10% of Civil Aerospace and Defence UK product testing by end of 2023**	Target met - A blend of 10% SAF is now being used across our UK testing activities for Civil and Defence Aerospace
Product portfolio (scope 3)		
	Release *mtu* Series 2000 and 4000 series reciprocating engines to run on sustainable fuel by end of 2023**	Target on track - Engines released for use on 100% biodiesel and e-diesel in power generation applications
	Prove compatibility of all in-service Civil Aerospace engines and all major in-production Defence engines on 100% SAF by end of 2023**	Target on track - Successful engine tests conducted on 100% SAF, including the Trent XWB-84 and Trent 900 in large engines, Pearl 700 and B7R25 in business aviation, and Trent 700 in Defence
	Reduce CO_2 emissions associated with use of sold products by 55%, normalised by original equipment revenues, by 2030, from a 2019 baseline*	New target for 2022
	Reduce absolute CO_2 emissions from new products sold within Power Systems by 35% by 2030, from a 2019 baseline	Target on track - Milestones on releasing majority of engine portfolio to run on sustainable fuels have been met

*Proposed targets awaiting verification from SBTi

**2023 targets form part of the executive remuneration policy in the 2023 incentive plan

TRANSITION-RELATED METRICS

Maintaining competitive position in the key markets Rolls-Royce operates in requires developing more efficient products, services and operations that support the global energy transition.

In early 2022 we introduced categories to classify our R&D spend and track allocations to products and solutions that bring energy and emissions savings or wider resource efficiency to customers and our own operations. These definitions are based on external taxonomies, including the EU Green Taxonomy. These categories allow us to qualify various investments and measure our performance over time.

TOPIC	METRICS AND TARGETS	2022 PERFORMANCE
Supply chain engagement	Work with external suppliers to ensure that 50% of suppliers by CO_2 emissions have established science-based targets by 2027*	New target for 2022
R&D investment	Monitor % of net R&D expenditure allocated to Net Zero and Sustainable Transition products and solutions	74%

*Proposed targets awaiting verification from SBTi

NET ZERO

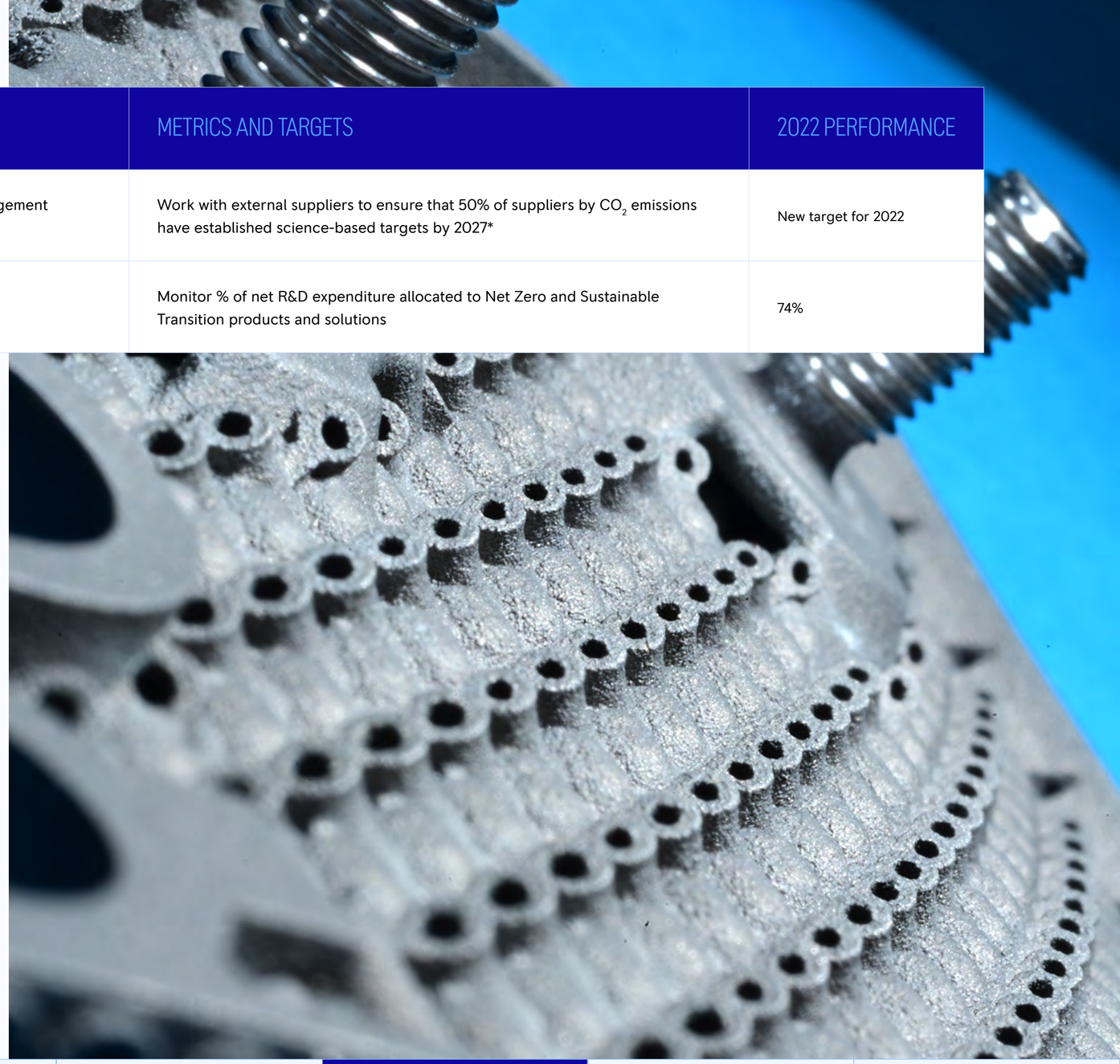
PRODUCTS THAT PRODUCE ZERO GHG EMISSIONS AT POINT OF USE, OR KNOWN TO OPERATE ON 100% SUSTAINABLE FUEL

SUSTAINABLE TRANSITION

PRODUCTS RECOGNISED AS SUPPORTING THE ENERGY TRANSITION, INCLUDINGTHOSE CAPABLE OF OPERATING ON SUSTAINABLE FUELS

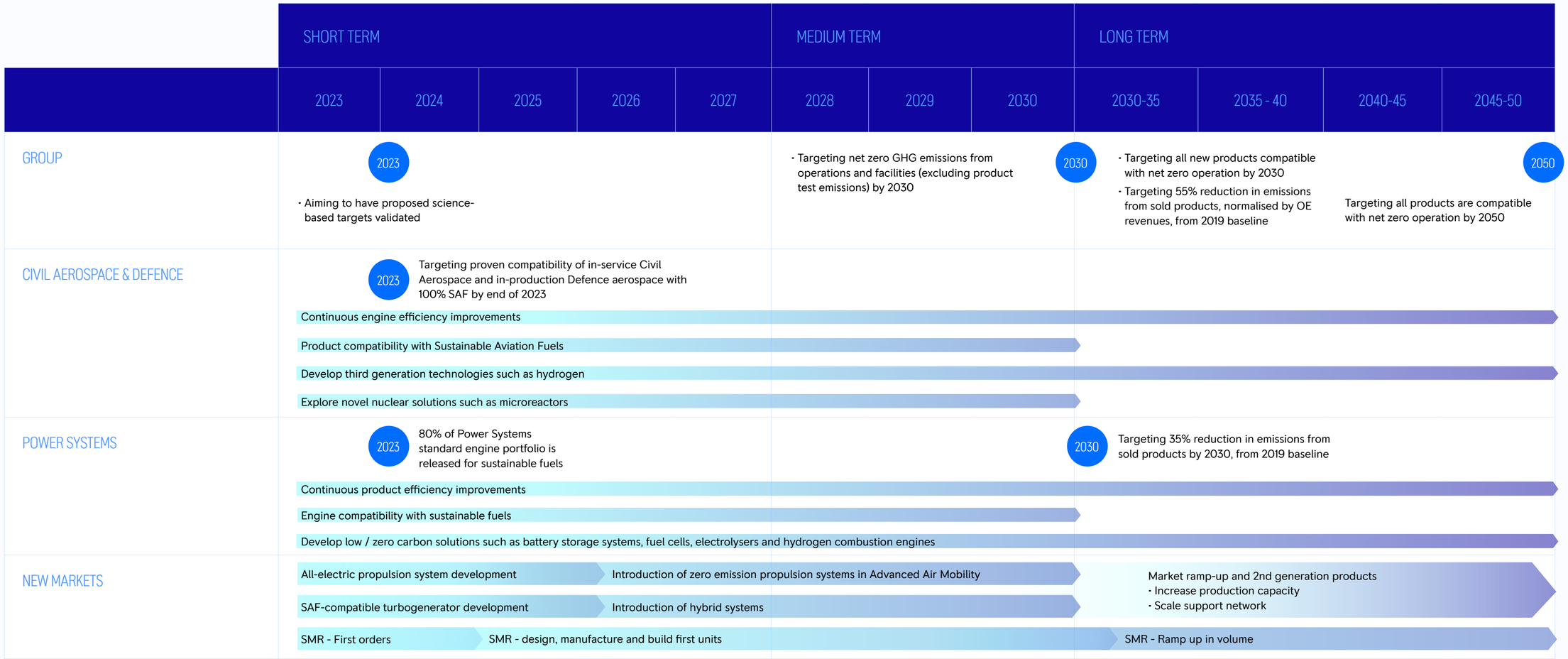
LEGACY & OTHER

BALANCE OF THE PORTFOLIO CAPABLE, INCLUDING THOSE OF OPERATING SOLELY ON FOSSIL-BASED FUELS



TRANSITION PLAN

For 2022 we have developed a preliminary, high level transition plan that summarises the key milestones and activities set out in this Climate Review. We recognise we have more to do to further define a transition plan, this will be considered as part of the strategic review throughout 2023.



GLOSSARY

1.5°C trajectory

A pathway of greenhouse gas emissions that provides a significant chance of limiting global warming to below 1.5°C or returning to 1.5°C by around 2100 following an overshoot.

Carbon offsetting

Reducing greenhouse gas emissions or intensity caused by one emissions source to compensate for emissions made elsewhere.

CO_2e

Carbon dioxide emissions equivalent. This is a proxy for measuring and summing the cumulative effect of GHGs.

Direct air capture (DAC)

The process of capturing carbon dioxide directly from the air and generating a concentrated stream of carbon dioxide for sequestration or other uses.

Greenhouse gas emissions (GHGs)

Gases that absorb heat to create a warming effect, including carbon dioxide (CO_2), methane, nitrous oxide (N_20) and water vapour.

Intergovernmental Panel on Climate Change (IPCC)

The United Nations body for assessing the science related to climate change, including assessing scientific, technical and socioeconomic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation.

Interim targets

Shorter term (between 5 to 10 years) decarbonisation targets, which apply before a longer-term net zero target.

Net zero carbon

Net zero carbon for a company refers to the systems level reduction of value chain greenhouse gas emissions, in line with a 1.5°C trajectory, and balancing the impact of any remaining greenhouse gas emissions with an appropriate amount of carbon removals.

Paris Climate Agreement

A multilateral agreement to hold the increase in global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C, recognising this would significantly reduce the risks and impacts of climate change. The agreement also aims to strengthen the resilience and adaptation capability of countries in the face of climate change. It was adopted by 196 Parties to the United Nations Framework Convention on Climate Change (UNFCCC) at COP21 in 2015 in Paris.

Science-Based Targets initiative (SBTi)

A NGO-led partnership that works with businesses to define and promote best practice in emissions reductions and net-zero targets in line with climate science.

Scope 1, 2 and 3 emissions

Categories of a company's greenhouse gas emissions footprint as defined by the GHG Reporting Protocol.

Small Modular Reactors (SMRs)

Nuclear reactors with a smaller output than conventional large scale power stations, designed with modular technology using module factory fabrication, pursuing economies of series production and short construction times.

Sustainable Aviation Fuels (SAFs)

Sustainable fuels specifically for application in aerospace. The negative carbon footprint of the feedstock offsets the emissions released upon combustion meaning that SAF has much lower lifecycle carbon emissions compared to the use of jet fuels in aviation engines.

Sustainable fuels

Collective term for non-fossil based fuels for application across multiple sectors, including transport and power generation. Typically, these fuels come from sources with a neutral or negative carbon footprint and can be produced using biological sources or created synthetically.

UN Race to Zero campaign

A UN-backed global campaign rallying non-state actors – including companies, cities, regions, financial and educational institutions – to take rigorous and immediate action to achieve net zero emissions by 2050.

Value chain

The set of activities and stakeholders involved throughout the lifecycle of the products and/or services that a business delivers.