



# The future is climate-neutral

PAVING THE WAY FOR EMISSIONS-FREE FLIGHT





**CARBON FOOTPRINT**

**60%**

lower CO<sub>2</sub> emissions by 2030 is MTU's target for on-site operations at its production sites worldwide



**LESS AIRCRAFT NOISE**

**75%**

The noise footprint of GTF engines is 75 percent smaller, which has significantly reduced the spread of aircraft noise around airports.



**RESEARCH PARTNERS**

**100**

MTU relies on a strong network of universities, companies and research institutions and participates in important aviation research programs.



**GREEN INVESTMENT**

**EUR 11.4 million**

is the amount that MTU spent on investments and ongoing expenses for environmental protection and climate action at all its fully consolidated production sites in 2022.



**GREEN ELECTRICITY**

**70**

four-person households consume roughly the same amount of electricity every year as MTU generates annually just with the first photovoltaic system at its Munich site.



**CO<sub>2</sub> SAVINGS OF**

**10 m metric tons**

Since their launch in early 2016, GTF engines have avoided more than 10 million metric tons of CO<sub>2</sub> emissions.

(Source: Pratt & Whitney, as of 01/2023)

# The future is climate-neutral

This is not wishful thinking, but a concrete vision: MTU intends to revolutionize aviation with innovative propulsion concepts and is committed to using more green energy and avoiding carbon emissions in production and maintenance.

## Acting for tomorrow, today.

Whether exploring faraway countries, discovering new cultures, meeting up with business partners or shipping commercial goods and humanitarian aid—flying brings people together. That said, as environmental awareness grows, aviation is becoming a major focus of the climate debate. The path to climate-neutral aviation will be the industry's key issue for the next 20 or 30 years. It is working hard to progressively improve the climate compatibility of its products and to deliver the kind of radical solutions that will improve aviation for the long term.

MTU Aero Engines is leading the way, playing a key role and assuming the responsibility that this entails. Drawing on its experience, expertise and innovative strength, the company aligns all its efforts toward that goal. As Germany's leading engine manufacturer, MTU is an expert in the development, manufacture and maintenance of commercial and military engines in all thrust and power categories as well as stationary industrial gas turbines. It offers full system capability in engine construction.

For MTU, one thing is clear: in light of the Paris Agreement, any developments designed to deliver climate-neutral flight will need to be market-ready well before 2050. In keeping with this goal, MTU is working hard to minimize the climate impact and fuel consumption of aircraft engines over a number of stages. It has its sights set on the evolutionary refinement of the gas turbine as well as on the development of new, revolutionary propulsion concepts, collaborating with its partners from industry, science and research. MTU delivers answers to the challenges of the future so as to make the vision of emissions-free flight a reality.

The company successfully implements measures at its production and maintenance facilities, such as reducing its carbon footprint by using more green energy. Its corporate climate action initiative aims to make the company's production sites carbon neutral.





## Sustainable aircraft engines

Emissions-free flight is the vision of MTU Aero Engines and the overall goal of aviation. Both take the 1.5-degree target set out in the Paris Agreement as their focal point. In its Clean Air Engine technology agenda, MTU lays down the solutions that will deliver sustainable commercial aviation.

According to the Paris Agreement, global warming is to be kept below 1.5 degrees Celsius compared to preindustrial levels. In the past, aviation industry targets focused primarily on the reduction of CO<sub>2</sub> emissions. In the future, the climate impact of nitrogen oxide (NO<sub>x</sub>) emissions and contrails will be taken into account as well. Taken together, these effects constitute the climate impact of aviation.

This poses a great challenge for MTU and other players in the aviation industry. In order to reduce the climate impact of aviation, they need to make further improvements to existing aircraft and engines.

This can take the shape of, for example, increased efficiency and further weight reductions. Meanwhile, high-tech companies like MTU, in addition to researchers and scientists, are already working on new and revolutionary concepts that could drastically reduce the climate impact of aviation. New energy sources, such as sustainable aviation fuels and hydrogen, play a key role as well.

The aviation industry must take action now. When it comes to the development and production of aircraft, cycles are measured in decades rather than years. To shape the world of tomorrow, a number of key developments must be set in motion today. MTU is driving them forward.

### Claire: MTU's technology agenda

MTU is strongly committed to working with numerous partners on emissions-free flight solutions. To this end, it has realigned its Clean Air Engine (Claire) technology agenda. The concepts formulated in Claire boldly venture beyond the state of the art to provide solutions for a sustainable future.

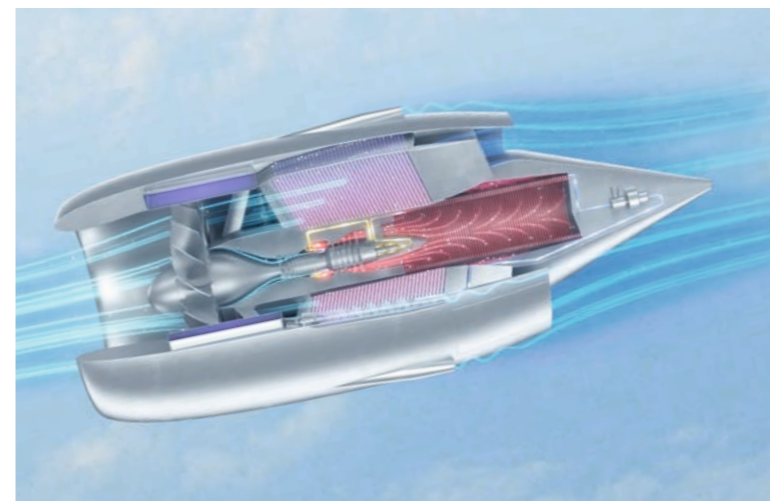
In addition to the evolutionary further development of the gas turbine engine based on the successful and highly efficient geared turbofan, MTU has anchored new, revolutionary propulsion concepts in Claire. The company is especially keen on advancing the water-enhanced turbofan (WET) which is powered by sustainable fuels or hydrogen. This engine massively cuts CO<sub>2</sub> and NO<sub>x</sub> emissions and significantly reduces the formation of contrails by recovering exhaust heat and injecting water into the combustor. It is suitable for short-, medium- and long-haul aircraft and thus covers the factors that are responsible for virtually the entire climate impact of aviation. MTU's revolutionary concepts also include an electric propulsion system: the Flying Fuel Cell™. This hydrogen-powered fuel cell has the potential to deliver virtually emissions-free flight. It is set to be deployed soon on short-haul routes in regional air traffic.

### Alternative sustainable fuels

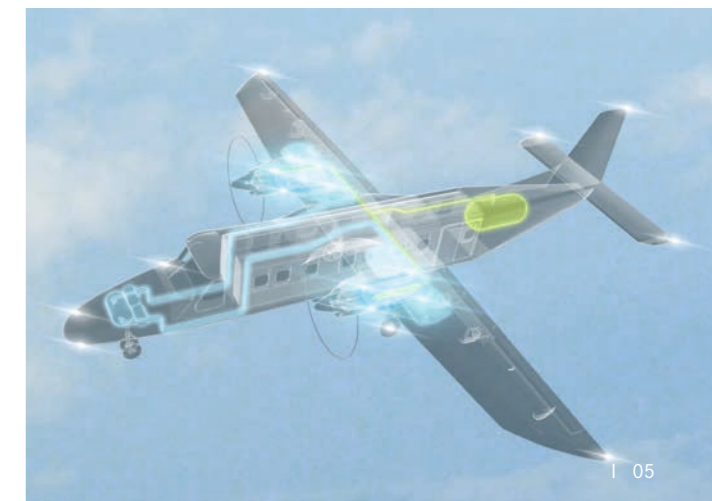
In the short term, the use of alternative sustainable fuels will substantially reduce aviation's climate impact. Known as sustainable aviation fuels (SAFs), they can be produced from biomass or from renewable energy via, for example, a power-to-liquid (PtL) process.

They are already being used for current aircraft fleets in admixtures of up to 50 percent as a "drop-in" fuel—i.e., without the need to adapt the aircraft or engine. Though not a fuel manufacturer itself, MTU is pressing hard for the use of SAFs. For example, it is supporting a number of projects to set up PtL production facilities. Furthermore, MTU Maintenance is the world's first maintenance company to perform acceptance runs with SAFs on the test stand.

The WET concept slashes nitrogen oxide emissions. It also substantially reduces energy consumption, CO<sub>2</sub> emissions and the formation of contrails.



The Flying Fuel Cell™ converts liquid hydrogen into electricity—and thus achieves a virtually emissions-free solution.



# Clean production and maintenance

For MTU Aero Engines, a clean engine implies clean production and maintenance operations. Therefore, MTU aims to be efficient in its use of energy and resources, limit its emissions and avoid environmental risks at all its sites. Over the long term, the company aims to achieve carbon-neutral production at all its locations.

As well as providing products and services that are safe, reliable and of the highest quality, MTU is constantly striving to manufacture them in ever more resource-efficient and ecologically sustainable ways in order to meet its environmental commitments. Environmental protection and climate action are enshrined in the Code of Conduct that applies to all employees. Moreover, MTU pursues an integrated strategy that involves incorporating environmental protection into its business decisions and acts in accordance with the principle of avoid-reduce-offset.

## Environmental management

MTU has established corporate environmental management at all its production sites. The environmental criteria apply to all divisions and processes and are laid down in documented process flows and special company standards. In addition, MTU implements local environmental programs at its sites, primarily to reduce energy consumption and emissions.

MTU uses its photovoltaic systems to generate green electricity.



Additive processes can be used to produce complex components with less material and fewer tools.



## MTU Green Global

In 2021, MTU launched its ecoRoadmap for its headquarters in Munich and completed the rollout at all its European and North American production sites in 2023. Called Green Global, the goal of the ecoRoadmap is to reduce MTU's carbon footprint by 60 percent by 2030—with the help of sustainable energy efficiency measures and an increase in the company's use of green energy. This way, MTU plays its part in achieving the goals of the Paris Agreement at its sites as well.

## More green energy

In the interests of clean production and maintenance, MTU intends to permanently reduce its use of fossil fuels and emissions of greenhouse gases. More green energy and avoidance of carbon emissions are important components of its climate strategy. Photovoltaic systems are already in operation in Munich and Rzeszów. Further systems are at the planning stage.

## Conservation of resources

MTU is dependent upon raw materials for production and maintenance at its facilities. In addition to the use of renewable and non-renewable energy, there is also the use of water as a natural resource and the consumption of various materials. It is the job of MTU's environmental management system to control the company's demand for raw materials in production and maintenance with the aim of obtaining high levels of efficiency while keeping resource consumption as low as possible.

## Focus on the entire lifecycle

MTU's circular economy approach takes into account the entire lifecycle of an engine—from development and production to operation, maintenance and decommissioning. It focuses on the responsible use of primary resources, improved material efficiency and the use of secondary materials without impairing the quality or safety of our products. Responsible waste management and recycling are also part of the MTU approach. In addition, MTU is working on extending the service life of its products. Developed inhouse, its innovative and high-tech repairs avoid the use of new parts and thus conserve valuable resources.



MTU Aero Engines AG  
Dachauer Strasse 665  
80995 Munich | Germany  
Phone +49 89 1489-0  
Fax +49 89 1489-5500  
info@mtu.de  
www.mtu.de

