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# A sustainable future for aviation

## Pioneering the power that matters

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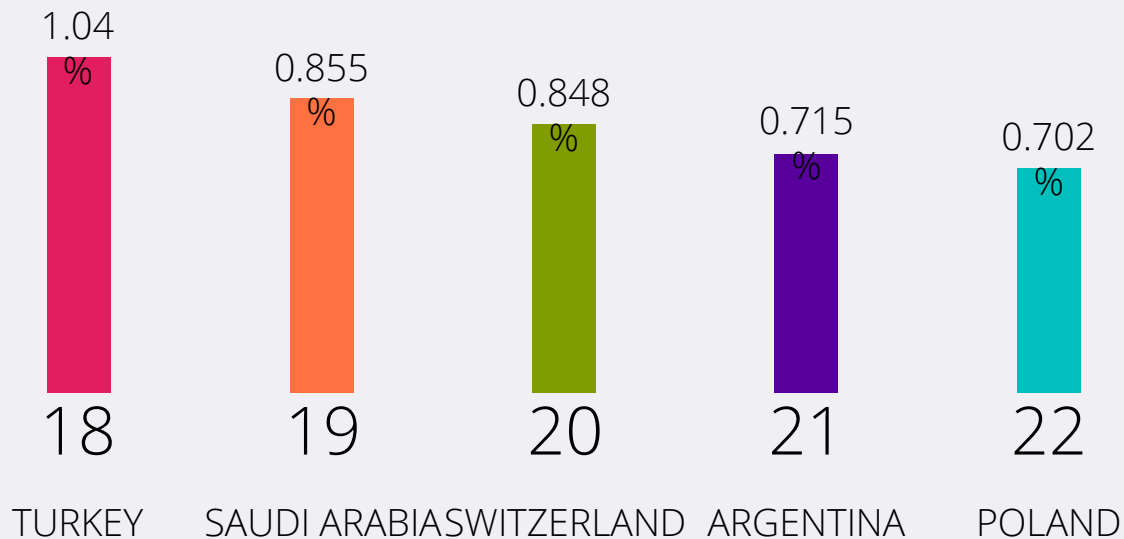


## The economic factor

Generates ~\$2.7 trillion globally

Transports 35% of world trade

Supports >65m jobs worldwide



**If aviation were a country, it would rank 20<sup>th</sup> in size by GDP**



## The human factor

Helping cultures understand each other

Giving people life-enhancing moments and memories

New opportunities to live and work in different places

Also vital for healthcare and humanitarian aid





## The challenge of growth

Demand for air travel will increase by >4% each year

>37,000 new passenger aircraft will be required over the next 20 years

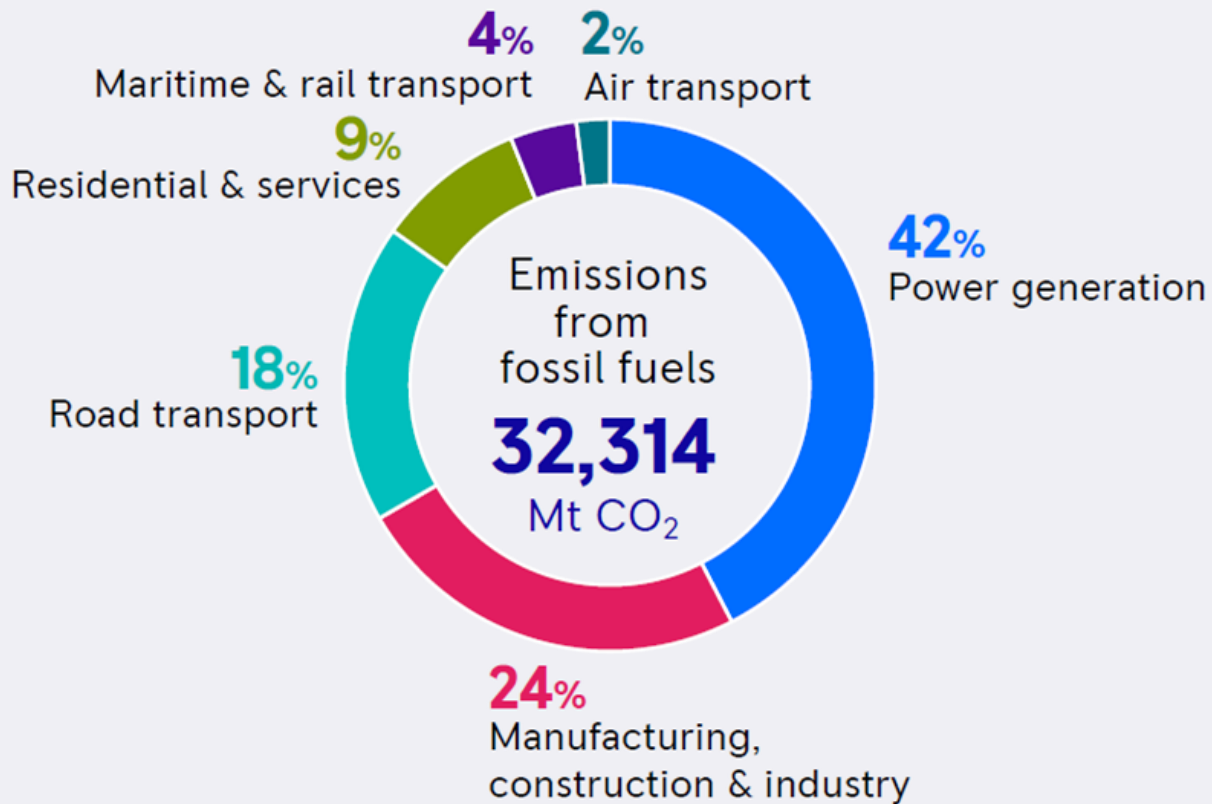
We have a responsibility to cater for that growing demand in a sustainable way

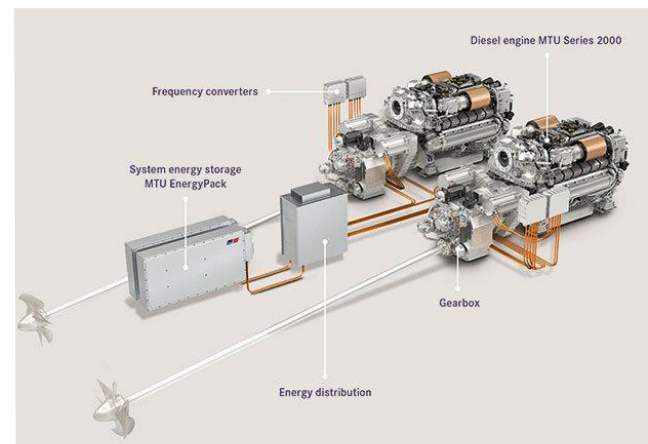
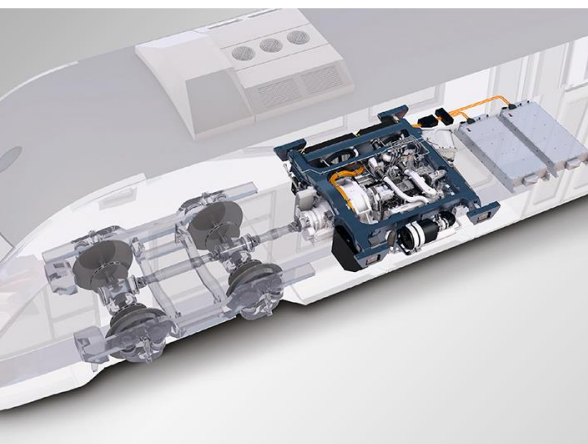
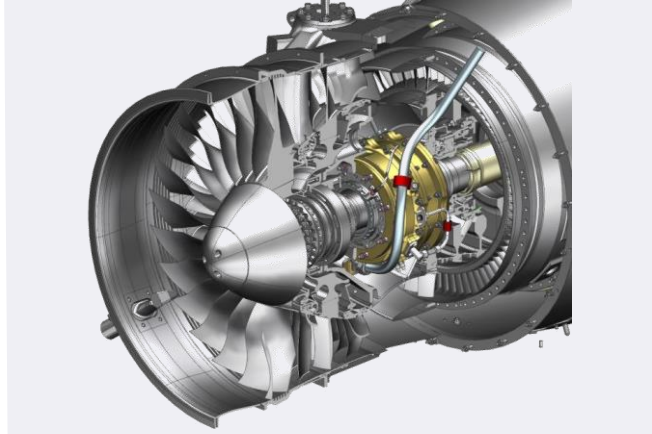




## Our role in the global picture

- Aviation
- Maritime & Railway
- Power Generation





## Experience in electrification and decarbonisation in other sectors



## Aviation – great progress so far

CO<sub>2</sub> down 80% since the first jet aircraft

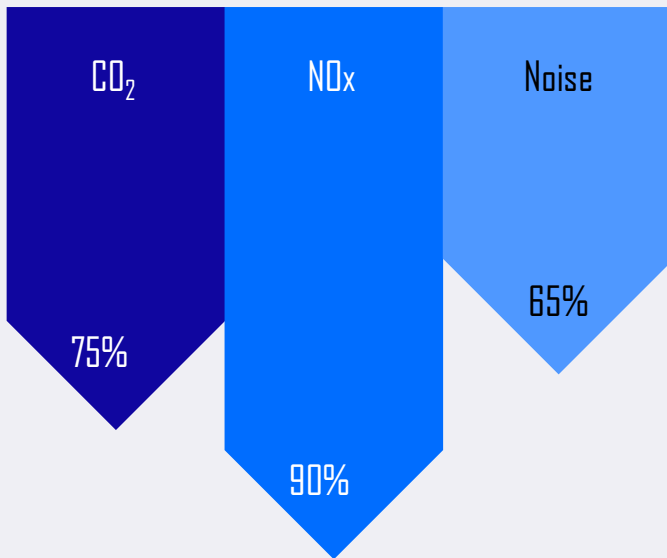
Aircraft are 50% quieter than 10 years ago

>10 billion tonnes of CO<sub>2</sub> avoided since 1990

With key contributions from a number of funding agencies



### ACARE Flightpath 2050 targets



### ATAG targets

Carbon neutral growth

by 2020

Halve carbon emissions

by 2050

But there is more to do if we are to reach our goals by 2050



## The Rolls-Royce forward strategy

Closely interconnected, being developed in parallel

All have a role to play in the decarbonisation of our industry



**Continue to evolve the gas turbine**



**Collaborate on Sustainable Aviation Fuels (SAF)**



**Explore radical alternatives such as Electrification**



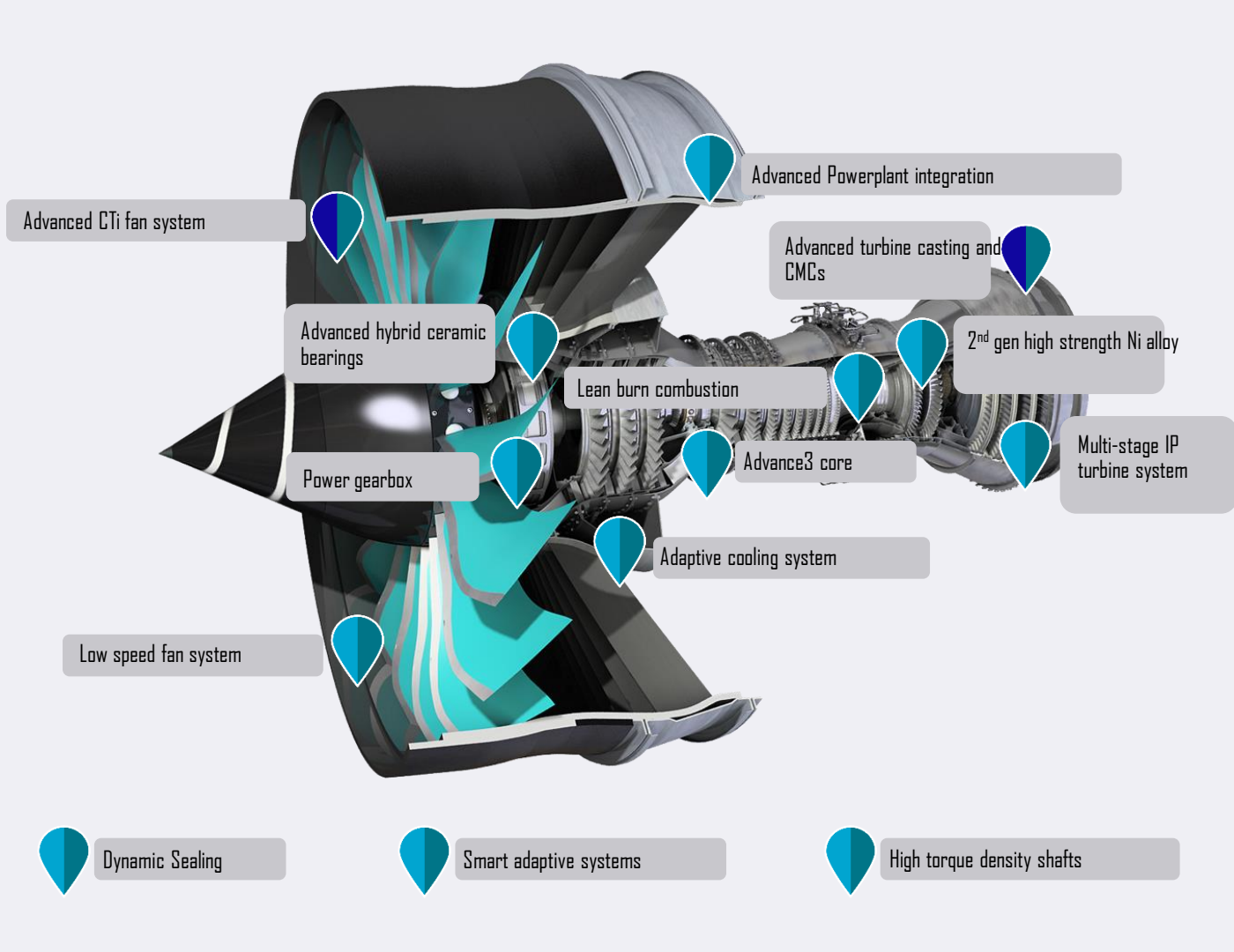


## Continuing to evolve the gas turbine

An enhanced IP turbine drives the fan via a power gearbox, allowing deletion of the LP turbine

Demo engine ground test on Bed 80 in 2021

- Environment
- Fuel burn
- Maintenance





## Electrification and Civil Aerospace

A number of demonstrator programmes underway

Timing and size of impact in each market is uncertain

Larger aircraft will benefit but this will take time

So we still need to do more

Personal Air Mobility (PAM)	Small Regional	Large Regional	Narrowbody & small/medium bizjets	Widebody & large bizjets
200nm	400nm	850nm	1,500nm	4,000nm

All electric

Hybrid electric

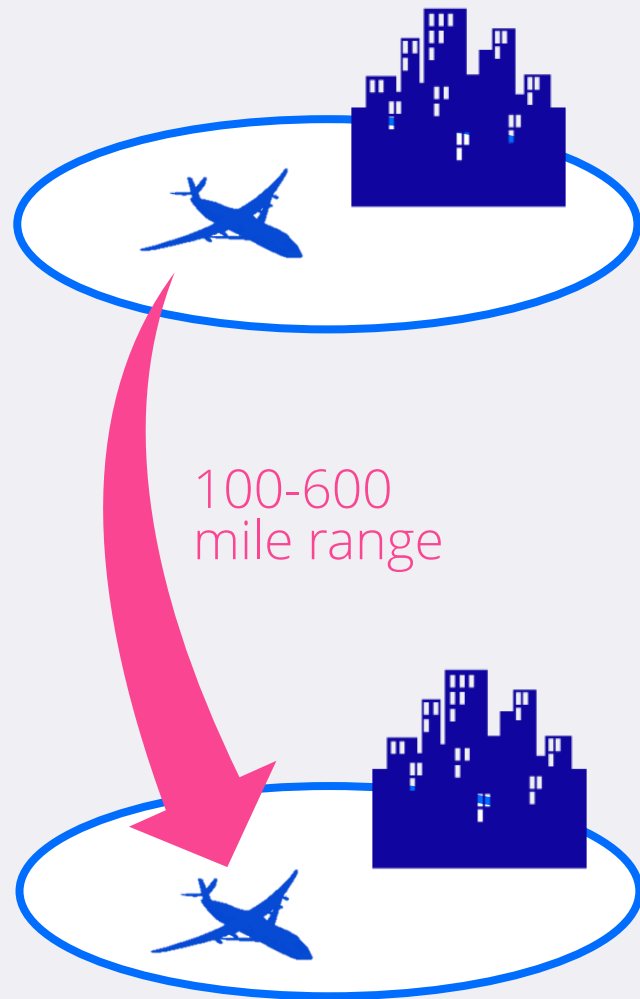
More electric





## A Revolution in Regional Hybrid Aviation

- Growth and new market opportunities
- Low-noise aircraft and short runways
- Transformational airport design and accessibility
- Faster and cheaper than rail, road, or hub airports





## Industry Commitment

The Chief Technology Officers of eight of the world's leading aviation manufacturers are now collaborating at an unprecedented level to ensure the industry meets its aggressive and necessary commitments.



**Continue to develop aircraft and engine technology in a relentless pursuit of fuel efficiency and reduced CO2 emissions.**

**Supporting the commercialization of sustainable, alternate aviation fuels. More than 175,000 flights have proven that today's aircraft are ready to use them.**

**Developing radically new aircraft and propulsion technology and accelerating technologies that will enable the 'third generation' of aviation.**



## Sustainable Aviation Fuels (SAF)

Vital in reducing the carbon emissions of our industry

Currently, only 0.1% of global flights are flown on SAF

### Suitability



Energy density  
Fuel specification

### Sustainability



CO<sub>2</sub> benefit  
Food / water

### Scalability



Global distribution

Already successfully completed ground and flight tests using blended SAF  
Latest Trent engines and business jet engines can already run on blended SAF  
Plan to test a 100% SAF in a Trent engine later this year - seeking partners

Working closely with fuel producers, operators, airports, environmental organisations and government agencies to bring these fuels into widespread aviation use by 2050



**It's about much more  
than the aircraft**



