

AVDASI-3: Sustainable Aviation & Ethics

Lecture-2: Policies / regulations / ethics for aviation sustainability

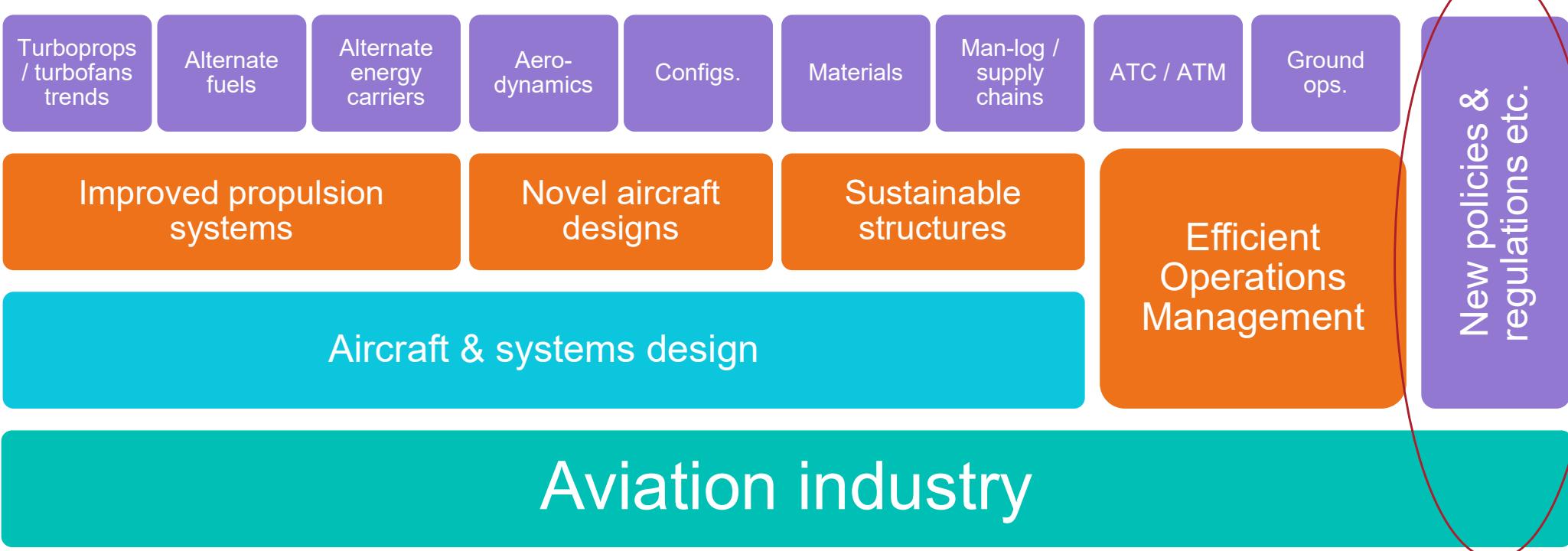
Samudra Dasgupta

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Building blocks for sustainable aviation



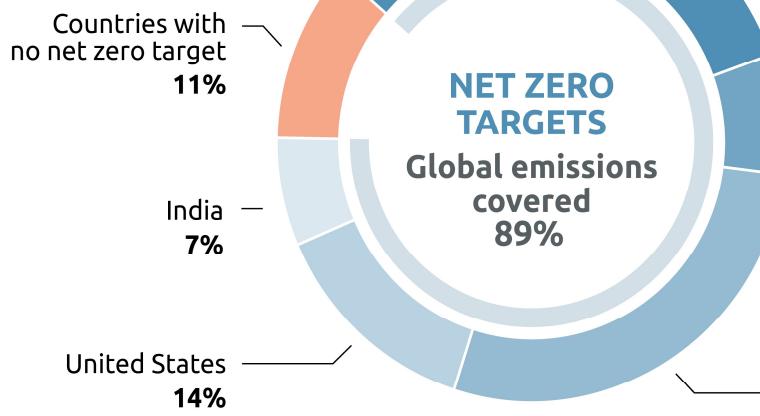
Net-zero climate action tracker

Net zero emissions target announcements

Agreed in law, as part of an initiative, or under discussion



Dec 2023
Update



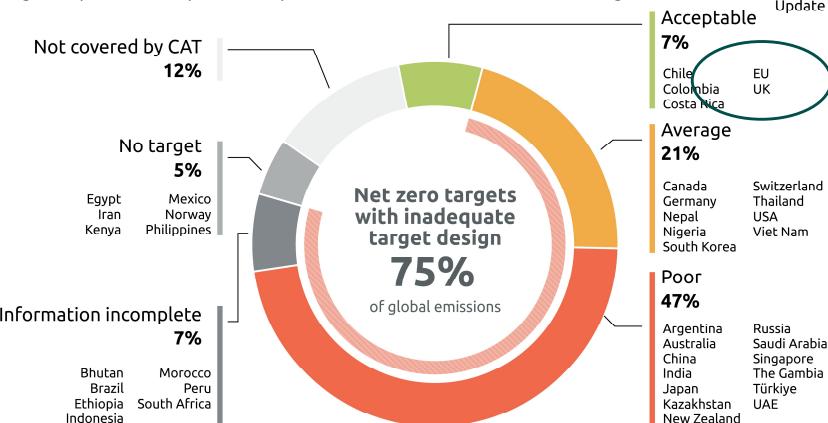
Net zero targets are key for reducing global CO₂ and other greenhouse gas emissions to net-zero around 2050 and 2070 resp. This is necessary to keep to the Paris Agreement's 1.5°C temp. limit.

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Net zero target design - mostly inadequate to date

Quality of net zero targets by percentage of global emissions evaluated using the CAT's design blueprint for transparent, comprehensive and robust national net zero targets

Climate Action Tracker
Dec 2023 Update



Chile
Colombia
Costa Rica
EU
UK

Canada
Germany
Nepal
Nigeria
South Korea

Switzerland
Thailand
USA
Viet Nam

Russia
Saudi Arabia
Singapore
The Gambia
Turkiye
UAE

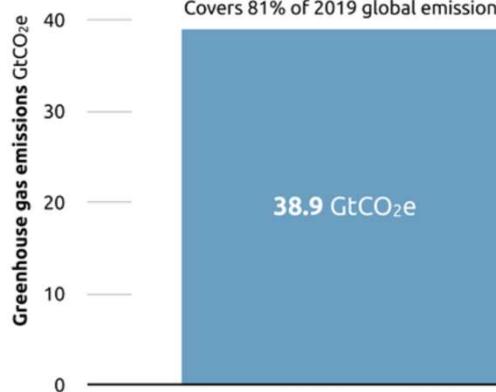
Argentina
Australia
China
India
Japan
Kazakhstan
New Zealand

Egypt
Iran
Kenya
Mexico
Norway
Philippines
Bhutan
Brazil
Ethiopia
Indonesia
Morocco
Peru
South Africa



Estimating the residual emissions for when countries reach net zero
Governments either don't have complete coverage of all their emissions in their net zero plans and/or are relying on carbon dioxide removal to meet their goals

Total emissions of 28 of the 34 countries with net zero targets
Covers 81% of 2019 global emissions



Volume of residual emissions when countries reach net zero

Conservative estimate of land use / technological CDR volumes and excluded emissions for the 28 countries

Equal to
16–20%
of 2019 emissions

6.3–7.6 GtCO₂e

Jet, set, go...

Rating the comprehensiveness of national net zero target design

Climate Action Tracker Dec 2023 Update

Country **Rating**

		Target year	Emissions coverage	Net zero target design elements									
				1	2	3	4	5	6	7	8	9	10
European Union	ACCEPTABLE	2050	✓	⊖	✓	✓	✗	✓	✓	✓	✓	✓	✗
United Kingdom	ACCEPTABLE	2050	✓	✓	⊖	✓	✗	✓	✓	✓	✓	⊖	⊖
United States	AVERAGE	2050	✓	✗	✗	⊖	✗	✗	✗	⊖	✓	⊖	✗

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- Effects on industry
- Effects on academia

Jet-zero UK!



- **What?**

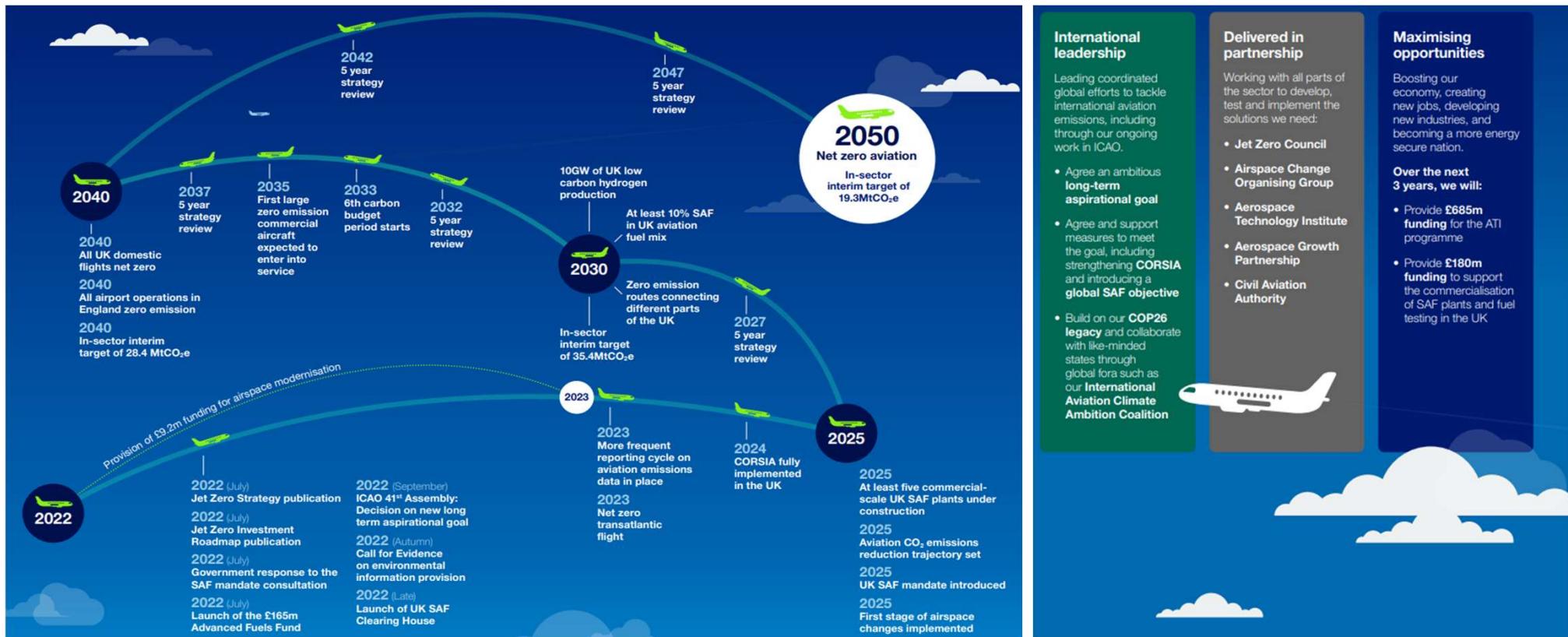
- Net-zero target for 2050 (~50% in-sector reduction + 19.5 MtCO₂ carbon offset)
- Net-zero in domestic flights by 2040
- 10% SAF in fuel mix by 2030
- Net-zero in airport operations by 2040
- Implement CORSIA by 2024

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- **How?**

- Leadership (annual monitoring & 5 yearly strategy updates) & partnerships
- Multi-faceted opportunities
 - Aircraft & system efficiencies
 - SAF (at least 5 SAF plants by 2025)
 - Zero emission flights
 - Markets & removals
 - Influencing consumers & their choice
 - Non-CO₂ mitigations

Jet-zero roadmap



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[jet-zero-strategy.pdf](#)

The policy measures



System efficiencies

Improving the efficiency of our existing aviation system: **our aircraft, airports and airspace.**

Our ambition is for **all airport operations in England to be zero emission by 2040.**

We are providing a further **£3.7m funding** in the years 2022/23 to support airports to complete stage 2 of their airspace change proposals.



Sustainable aviation fuels

SAF are a key lever to accelerate the transition to Jet Zero, and represent an industrial leadership opportunity for the UK.

We will be supporting the development of the UK SAF industry with **£180m of new funding.**

By 2025 we are committing to having at least **five UK SAF plants** under construction and a SAF mandate in place with a target of at least **10% SAF in the UK aviation fuel mix by 2030.**



Zero emission flight

There is the potential for new, zero emission aircraft to play a role in the decarbonisation of aviation.

Our aspiration is to have **zero emission routes connecting different parts of the United Kingdom by 2030.**

We are supporting industrial R&D through the **ATI Programme** (£685m funding over the next 3 years) and have **invested £3m in the ZEFI project.**



Markets and removals

The implementation of carbon markets and greenhouse gas removal technologies is vital to achieving Jet Zero.

We aim to have legislation for the **Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)** in force no later than 2024, and are working with the UK ETS Authority to **enhance the effectiveness of the UK Emissions Trading Scheme (UK ETS).**



Influencing consumers

We want to **preserve the ability for people to fly** whilst supporting consumers to make sustainable aviation travel choices.

We will publish a Call for Evidence on our proposal to **provide consumers with environmental information at the time of booking in autumn 2022**, working with the Civil Aviation Authority.



Addressing non-CO₂

Tackling the climate impact of aviation is not just about reducing CO₂ emissions, there are other non-CO₂ impacts that also affect the climate and local air quality.

Our focus is to **increase our understanding** of non-CO₂ impacts as the exact scale of their effect remains uncertain.

System efficiencies

The importance of system efficiencies:

Next generation aircraft, such as the **Airbus A320neo**, offer around **20%** efficiency gains on their predecessors¹⁸

CO₂ emissions per passenger in 2019 were **22% lower** than 1990 due to efficiency improvements



2/3 of major UK airports have **net zero targets** prior to **2040**¹⁹

Co-benefits of proposed efficiencies:

Moving to best-in-class aircraft, operations and airspace modernisation could deliver between **12-15%** of CO₂ savings **by 2050**²⁰



72,000 aerospace jobs on ultra-efficient aircraft by **2050**²¹

9.5% of annual CO₂ emissions from aviation avoided by ultra-efficient aircraft in **2050**²²

Great opportunities for Aerospace Engineers!

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 **90%** NOx reduction
65% reduced perceived noise per aircraft
by 2050 vs 2000 aircraft²³

Key actions:

All airport operations in England to be **zero emission by 2040**
£9.2m funding between **2020-2023** to deliver airspace modernisation in the UK



System efficiencies - Zero emission aircraft



Case Study: Airbus ZEROe Demonstrator

Airbus aim to bring a zero emission commercial aircraft to market by 2035 and in April 2022 announced the launch of a Zero Emission Flight Development Centre in Filton, Bristol.

In 2022, Airbus launched their ZEROe Demonstrator with the aim to test hydrogen combustion propulsion technology on an A380 multimodal platform. Three concept hybrid-hydrogen aircraft have been designed to enable the exploration of a variety of configurations and hydrogen technologies that will shape the development of future

zero emission aircraft. They are powered by hydrogen combustion through modified gas turbine engines, where liquid hydrogen is used as a fuel for combustion with oxygen. In addition, the onboard hydrogen fuel cells create electrical power that complements the gas turbine, resulting in a highly efficient hybrid-electric propulsion system.

Airbus ZEROe concept aircraft powered using liquid hydrogen.
Image courtesy of Airbus.

Great opportunities for Propulsion Engineers!

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Progress so far:

In 2021 Rolls Royce broke the world all-electric air speed record with their **Spirit of Innovation aircraft**³³

Airbus have announced plans to bring to market a **zero emission commercial aircraft by 2035**³⁴

In May 2022 Cranfield University **installed a hydrogen re-fuelling station** which can serve its co-located airport³⁵

Key Actions:

We will **double** our UK ambition for hydrogen production to up to **10GW by 2030**, with at least half of this from electrolytic hydrogen³⁶

In March 2022, £685m **government R&D funding** was granted to the ATI Programme over 2022-2025 to support the development of zero-carbon and ultra-low emission aircraft technology³⁷

Co-benefits of ZEF industry:

Rapid investment in hydrogen aviation could see the UK securing:

Up to **19%** global aerospace industry share, valued at **£178bn** per annum in 2050³⁸

60,000 aerospace jobs on zero-carbon emissions aircraft **by 2050**³⁹

Sustainable aviation fuel



Case study: Phillips 66 Limited

The Phillips 66 Limited Humber Refinery near Immingham is the first plant in the UK to produce SAF at scale. Phillips 66 Limited have leveraged the capabilities of their existing refinery to produce SAF from waste cooking oil and other waste derived oils. Currently the refinery has the capability of producing approximately 20,000 metric tonnes per year, with plans to increase to more than 53,000 metric tonnes per year by 2025. The SAF produced at the Humber Refinery has

already been supplied to several UK airports, including London Heathrow, via the existing pipeline structure. In March 2022, British Airways took its first delivery of SAF from the Humber Refinery as part of its multi-year supply agreement with Phillips 66 Limited.

Image courtesy of Phillips 66 Humber Refinery, South Killingholme, North Lincolnshire

Great opportunities for Chemical Engineers!

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The importance of SAF:

Aviation fuel usage reached

**12.4Mt
in 2019²⁸**



SAF are a 'drop in' option which can be used in existing aircraft without modification and are already available for commercial use²⁹

When fully replacing kerosene, SAF use achieves, on average, **over 70% GHG emissions savings** on a lifecycle basis

SAF will be essential to achieve **net zero aviation** for medium and long-haul flights, which account for around **80%** of the CO₂ emissions from aviation³⁰

Our "High Ambition" scenario projects approximately **5m tonnes of SAF are required by 2050** to meet our net zero target

Key actions:

We have committed to having **at least five commercial-scale UK plants under construction by 2025**

We will support the delivery of the first net zero transatlantic flight running on **100% SAF** with up to £1m of funding

Our previous advanced fuels competitions have supported the development and commercialisation of SAF pathways since 2014:

£25m Advanced Biofuels Demonstration Competition (ABDC) – launched in 2014

£22m Future Fuels for Flight and Freight Competition (F4C) – launched in 2017

£15m Green Fuels Green Skies Competition (GFGS) – launched in 2021

We will provide → **£180m new funding between 2022-2025**

to support the commercialisation of SAF plants and fuel testing in the UK

We will have a SAF mandate in place by 2025, reducing greenhouse gas emissions through the uptake of aviation fuel by the equivalent of at least

10% SAF use by 2030



The co-benefits of a UK SAF industry:

By 2035, the development of a SAF industry could generate up to

**£2.7bn GVA
for the UK from UK production and global exports**

By 2035, the development of a domestic industry for the production of sustainable aviation fuels is expected to support up to **5,200 UK jobs**³¹

Zero emission flights



Case study: NATS deployment of Free Route Airspace

In December 2021, NATS implemented the biggest airspace change ever undertaken in the UK, over Scotland and surrounding areas – a footprint twice the size of the UK and airspace that controls over 80% of transatlantic traffic. The introduction of Free Route Airspace (FRA) removes traditional air routes and allows airlines to flight plan and fly an optimal trajectory based on weather and wind speed between a defined entry and exit point.

It is estimated that the deployment of FRA in this area will enable a reduction of 500,000nm flown and up to 12,000 tonnes of CO₂ per year. Further benefits will be realised when FRA is extended across the rest of the UK in the coming years. FRA is also being implemented across Europe as part of a wider European plan to introduce cross-border FRA, which is estimated to result in a reduction in flying of one billion nautical miles and 20 million tonnes of CO₂.

**Great opportunities for
Sensors & AI market!**

Markets & removals

The importance of markets and removals

Carbon Offsetting Reduction Scheme for International Aviation (CORSIA):

CORSIA is the first worldwide offsetting scheme of its kind to address CO₂ emissions in any single sector

From 2023, a total of **114 States** have volunteered to participate in CORSIA, representing nearly 80% of international aviation activity⁴⁵

We are aiming to have all legislation for **CORSIA in place by 2024**, covering the majority of international flights departing the UK



Great opportunities for Chemical Engineers & Aerospace Consultants!

UK Emissions Trading Scheme (UK ETS):

The UK ETS promotes cost-effective decarbonisation, allowing businesses to cut carbon where it is cheapest to do so



UK ETS-covered flights made **44%** of all commercial flights to and from UK airports based on 2019 emissions⁴⁶



Approximately, **27%** of emissions from UK departing flights were covered by the UK ETS based on 2019 emissions⁴⁷

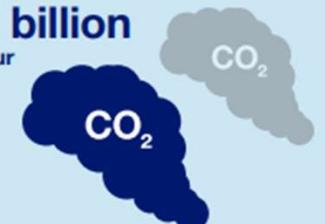
We have consulted on amending the UK ETS cap to align with net zero, and to seek views on the future of free allowances, SAF uptake and non-CO₂ impacts

Greenhouse gas removals (GGRs):

We are providing **£100m** in research and innovation funding for Direct Air Capture and other GGRs



We have committed to **£1 billion** in investment to develop four Carbon Capture, Usage and Storage clusters aiming to capture and store between **20-30 MtCO₂** a year by 2030⁴⁸



We are exploring the potential of UK ETS as a long term market for both nature-based and engineered GGRs, and the preferred business models to incentivise investment in engineered GGRs

Carbon market – Trade emission permits

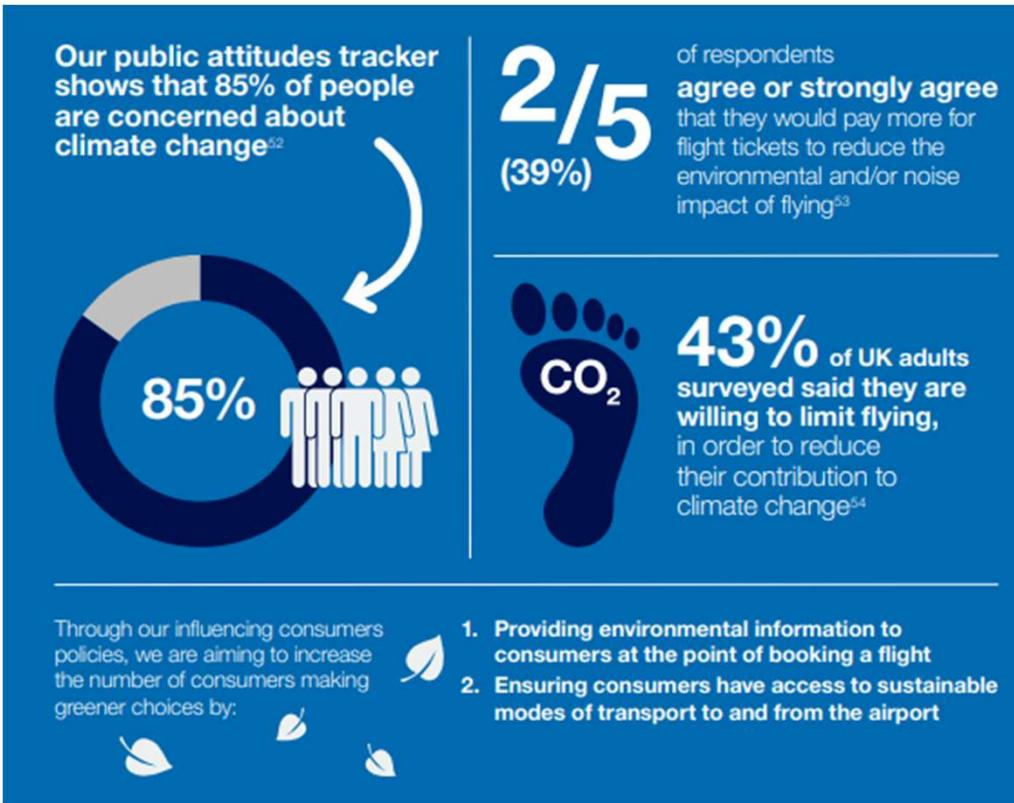
- Carbon Market Trading – UK emission trading scheme (ETS)
 - Marketplace for buying & selling permits to emit CO₂ / other greenhouse gases
 - Goal is to limit the total amount of emissions to help fight climate change
 - Methods
 - Cap and Trade: Governments set a "cap" on the total amount of emissions allowed. Companies get permits (allowances) for a certain amount of emissions. If they emit less than their allowance, they can sell their extra permits to other companies that need them
 - Carbon Credits: These are credits for reducing or avoiding emissions. Companies can buy these credits if they need to offset their own emissions
 - It creates a financial incentive for companies to reduce their emissions because they can sell any extra allowances they don't use

Carbon market – Carbon reduction

▪ Atmospheric carbon reduction

- Process of taking CO₂ out of the atmosphere and storing it so it doesn't contribute to global warming
- Even if we reduce emissions, we still need to remove some CO₂ that's already in the atmosphere to meet climate goals
- Methods
 - Natural Methods: Planting trees , protecting forests and enhancing soil health etc.
 - Technological Methods: Using machines or processes to capture CO₂ from the air and store it underground or use it in products
- These methods help reduce the overall concentration of CO₂ in the atmosphere, complementing efforts to reduce emissions

Influencing customers



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The new rules will affect some short-haul flights on routes that can be travelled by direct train



Guardian graphic. Note: the times shown are the fastest possible train times from a Paris terminal.

**Great opportunities for
Data Scientists!**

Educating customers

- Travalyst (NPO) – shared framework for flight emission data
- Coalition between Skyscanner, Google, Booking.com, Trip.com, Tripavdisor, Expedia & VISA
- Collect & display flight emission data (& independent of booking platform)
- Factors considered
 - Origin & destination
 - Aircraft type
 - Cabin class & seat configuration
 - CO₂ emissions for different flight segments & contrails

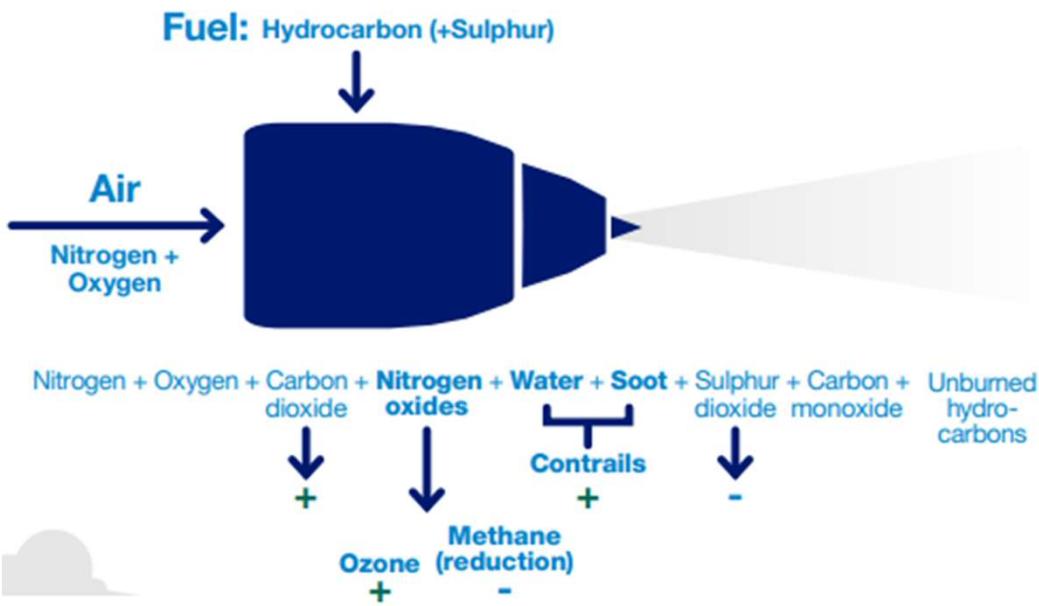
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Added cost on ticket with UN offsetting scheme (CORSIA)



Addressing non-CO₂



What are non-CO₂ impacts?

CO₂ is the principal greenhouse gas emitted by aviation but important non-CO₂ effects can cause additional warming

Major forcings from aviation come from contrail cirrus clouds, CO₂ and the 'net NOx' effect, with minor contributions from water vapour, soot and sulphur aerosol-radiation interactions



What effect do non-CO₂ impacts have?

Non-CO₂ impacts currently represent around **66%** of the net effective radiative forcing (ERF): this is not a fixed number and is scenario dependent. Cumulative CO₂ emissions currently represent around **34%** of the net ERF⁶⁴

Non-CO₂ effects contributed **8X more than CO₂** to the uncertainties of net global aviation warming in 2018⁶⁵

Non-CO₂ emissions can have both warming cooling effects &

What can we do to tackle non-CO₂ impacts?

Research indicates SAF can produce **50%–70% fewer** soot particles, which could reduce the overall warming effect of contrails⁶⁶

We will carefully consider any need for **additional research and development activity on non-CO₂ effects**, including working with UK Research and Innovation (UKRI)



Aviation specific carbon / energy reporting schemes

- Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)
 - By International Civil Aviation Organization (ICAO) to address CO₂ emissions from international aviation.
 - Aiming to cap CO₂ emissions from the aviation sector at 2020 levels, airlines are required to monitor, report and verify their CO₂ emissions
 - From 2021 onwards, airlines must offset emissions that exceed the 2020 baseline by purchasing carbon credits from approved projects
- European Union Emissions Trading System (EU ETS) – Aviation
 - EU ETS was extended to cover aviation in 2012, applying to flights within EEA
 - Airlines operating within EEA must monitor and report their CO₂ emissions, surrender allowances corresponding to their emissions or face penalties

Other such reporting schemes

- UK Emissions Trading Scheme (UK ETS) – Aviation
 - Following Brexit, the UK established its own emissions trading scheme, which includes aviation, for flights departing from UK airports to domestic or European destinations.
 - Airlines must monitor and report their CO₂ emissions and surrender eqv. allowances
- Aviation Environmental Reporting (AER)
 - Reporting tool developed by ICAO to monitor environmental data related to aviation.
- International Air Transport Association (IATA) Carbon Offset Program
 - Voluntary program to offer carbon offsetting options to passengers and report the same
- Airport Carbon Accreditation (ACA)
 - Specifically for airports to help airports reduce their carbon footprint
 - Airports are accredited at one of four levels (Mapping, Reduction, Optimization, and Neutrality) based on their efforts to manage and reduce carbon emissions.

Misreporting & abuse

- Selective / under reporting
 - Reporting only favourable data (only report emissions reductions from specific projects & ignoring other areas where emissions have increased)
 - Misleading picture of the company's overall environmental sustainability
- Greenwashing
 - Marketing company as sustainable based on misleading or exaggerated claims, using minor or symbolic environmental actions to distract from overall footprint
 - Mislead consumers, investors, and regulators potentially attracting investment or customers under false pretences
- Manipulating emission baseline year
 - Manipulate the baseline year by choosing a year with unusually high emissions
 - Distorts to meet targets more easily without real / substantive changes etc.

Misreporting & abuse (contd.)

- Creative accounting and offsetting
- Delayed Reporting and Inaccurate Measurement
- Non-Compliance with Verification Standards
- Lobbying for Loopholes
- Transfer of Emissions / carbon leakage to favourable countries

Examples of abuse

- Exxonmobil climate change research – 1970s
 - Intentional under reporting of climate change impacts
- BP's beyond petroleum campaign – early 2000s
 - Greenwashing
- Royal Dutch Shells overstatement of oil reserves – 2004
 - 25% inflated reserve reported to attract more investments
- Volkswagen emissions scandal (Dieselgate) – 2015
 - Software feature to reduce NOx emissions (by 40 times) during testing
- Carbon credit scams
 - Fake carbon credits for projects, several & ongoing issues

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Consequences of abuse

- Short term gain, long-term pain
- Fines, sanctions or legal action (VW paid \$30bn + vehicle buybacks etc.)
- Reputational damage and brand dilution (BP, especially after Deepwater Horizon oil spill in 2010)
- Loss of investor confidence (leading to resignation of Shell executives)

Aviation specific examples

- Ryanair greenwashing accusations - 2020
 - Misleading Ad campaign as ‘Europe’s lowest emission airlines’
 - Had to withdraw Ad, loss of credibility in market
- United airlines alleged misreporting of emissions - 2019
 - Under reporting Chicago airport GHG emission data
 - Focus on using updated models
- Allegations against B737Max– 2019 onwards
 - Fuel efficiency compromised while cutting corners
 - Major ongoing credibility crisis for Boeing

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Mitigations

- **Corporate ethics**

- Increasing transparency with more 3rd party verifications
- Standardized reporting methods
- Quality management systems with periodic audits

- **Technology**

- Use of digital tools like blockchain can help ensure data integrity
- Big DA for robust LCA tools

- **Others**

- Political goodwill
- Regulations (incentivised & punitive)
- Constructive activism

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Corporate ethics

For Engineers

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Order of Engineering - Oath

- I am an Engineer
 - In my profession, I take deep pride
 - To it, I owe solemn obligations
 - As an engineer, I pledge to practice integrity and fair dealing, tolerance and respect, and to uphold devotion to the standards and dignity of my profession
 - I will always be conscious that my skill carries with it the obligation to serve humanity by making the best use of the Earth's precious wealth
 - As an engineer, I shall participate in none but honest enterprises
 - When needed, my skill and knowledge shall be given, without reservation, for the public good
 - In the performance of duty, and in fidelity to my profession, I shall give my utmost.
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Many faces of ethics

▪ Engineering Council

- Honesty & integrity
- Respect for life, law, the environment and public good
- Accuracy and rigour
- Leadership and communication

▪ Types of ethics in aviation industry

- Deontology, or Moral Duty
- Consequentialism
 - Utilitarianism
 - Anticipatory Technology Ethics
 - [NAE Website - EES Perspective: Ethical Decision Making and the Aviation Industry](#)

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The screenshot shows the Engineering Council's website. At the top, there is a navigation bar with links to Glossary & FAQs, Publications, Shop, Contact Us, and Partner Portal. Below the navigation bar, there is a secondary navigation menu with links to About Us, Professional Registration, Standards & Guidance, Education & Skills, Professional Development, International Activity, and News. The main content area features a green banner with the title "Statement of Ethical Principles". Below the banner, there is a section titled "Information for:" with a list of categories: School leavers & advisors, Students, apprentices and graduates, Current registrants, Potential registrants, Journalists and media, Educators, developers and providers, and Employers. To the right of this list, there is a paragraph of text about the history of the statement and its purpose. At the bottom right, there is a logo for the Engineering Council and Royal Academy of Engineering, featuring two stylized trees.

[Engineering Council \(engc.org.uk\)](http://EngineeringCouncil.org.uk)

Honesty & integrity...

- act in a reliable and trustworthy manner
- be alert to the ways in which their work and behaviour might affect others and respect the privacy, rights and reputations of other parties and individuals
- respect confidentiality
- declare conflicts of interest
- avoid deception and take steps to prevent or report corrupt practices or professional misconduct
- reject bribery and improper influence

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Respect for life, law, the environment and public good...

- hold paramount the health and safety of others and draw attention to hazards
 - ensure their work is lawful and justified
 - recognise the importance of physical and cyber security and data protection
 - respect and protect personal information and intellectual property
- protect, and where possible improve, the quality of built and natural environments
 - maximise the public good and minimise both actual and potential adverse effects for their own and succeeding generations
- take due account of the limited availability of natural resources
 - uphold the reputation and standing of the profession

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Accuracy & rigour...

- always act with care
- perform services only in areas in which they are currently competent or under competent supervision
- keep their knowledge and skills up to date
- assist the development of engineering knowledge and skills in others
- present and review theory, evidence and interpretation honestly, accurately, objectively and without bias, while respecting reasoned alternative views
- identify, evaluate, quantify, mitigate and manage risks not knowingly mislead or allow others to be misled

Leadership & communication...

- be aware of the issues that engineering and technology raise for society, and listen to the aspirations and concerns of others
- promote equality, diversity and inclusion
- promote public awareness and understanding of the impact and benefits of engineering achievements
- be objective and truthful in any statement made in their professional capacity
- challenge statements or policies that cause them professional concern

Ethical dilemmas for aerospace engineers

Environmental effects Vs design choices

Will be covered in this course

Military concerns

WMD / carriers

Collateral damages

Safety Vs cost implications

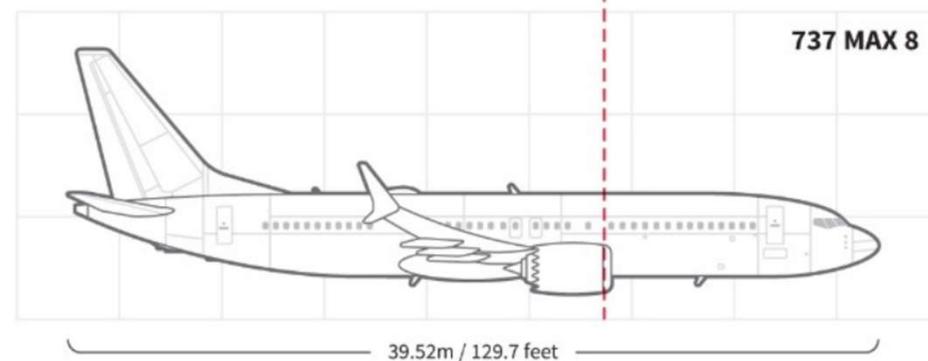
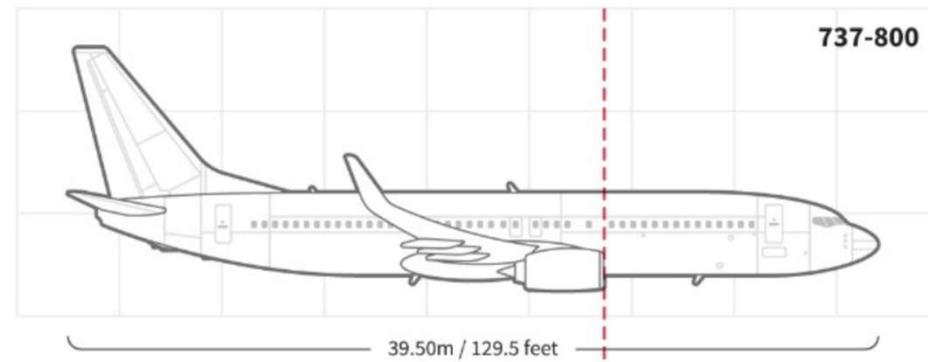
Relation with certifying agencies

Self-certification

Whistleblowing etc...

Boeing 737Max – fatal crash of aviation ethics

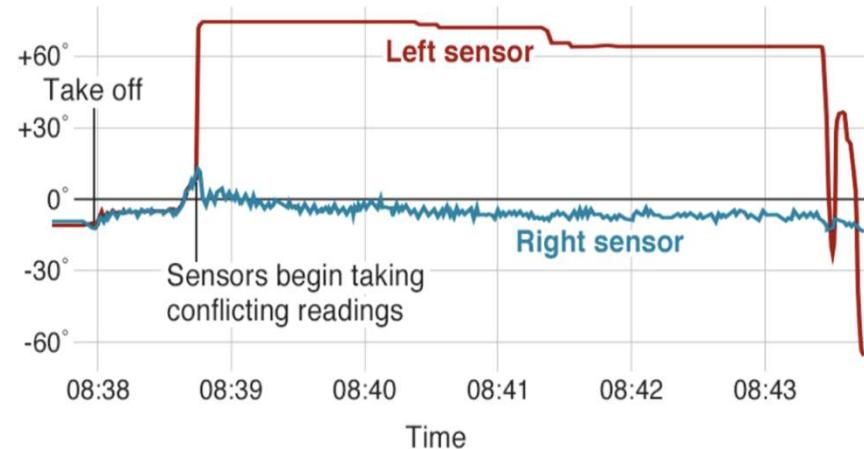
- 14% fuel saving over 737NG (similar to A320-NEO)
- FAA Certification based on 737NG on 8th March 2017
- Entry into Service on 22nd May 2017
- >5000 orders (Boeing's fastest selling aircraft)



& the tragedies...

- Fatal crashes
 - Lion Air (JT610) - 2018 (189 fatalities)
 - Ethiopian Airlines (ET302) - 2019 (157 fatalities)
- Identified causes
 - New MCAS to adjust nose down
 - AoA sensor malfunction
 - Lack of pilot awareness training (MCAS was not disclosed fully to save training/certification costs/time)
 - Prioritizing market capture over safety
 - Company culture towards certification
- Non-fatal major accident
 - Door plug blowout (Alaska Airlines)
 - QC owing to supply pressures (all bolts missing!)
 - No documentation?
 - Whistleblower harassments etc.

Angle of attack



ET302 – Manoeuvre Characteristics Augmentation System (MCAS)



Consequences

- **TRAGIC LOSS OF 300+ LIVES**
- Loss of confidence in 737Max (huge drop in sales)
- Loss of credibility (drop in sales across all models)
 - [Competition between Airbus and Boeing - Wikipedia](#)
- US parliamentary committee investigation
- Resignation of CEO
- Bad Press etc.
 - Boeing Co. directors, including current Chief Executive Officer David Calhoun, lied about the company's oversight of its 737 Max 8 airliner and participated in a misleading public-relations campaign following two fatal crashes involving the plane" - Bloomberg
 - The inaction amounts to an "epochal corporate governance catastrophe" - New York and Colorado investment fund

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The economic dilemma of aviation ethics

- Duopoly of Airbus & Boeing
 - Effective monopoly dictating terms?
- TOO BIG TO FAIL???
 - Too big to give a damn...?



"On the one hand, we'll burn in hell; on the other, that's a lot of money."

Thank you

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