Aviation Sustainability
and Aerospace's Response

Building Sustainable Supply Chains for the 21st Century

Thursday 15 April 2021

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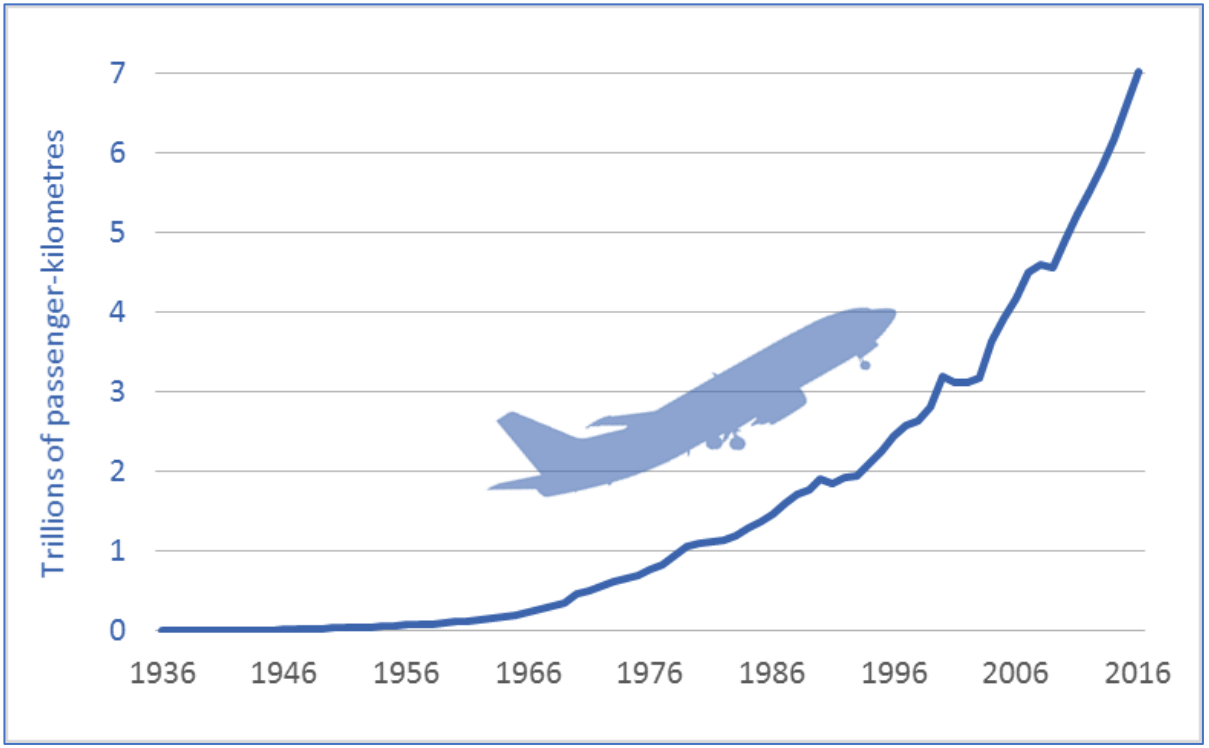
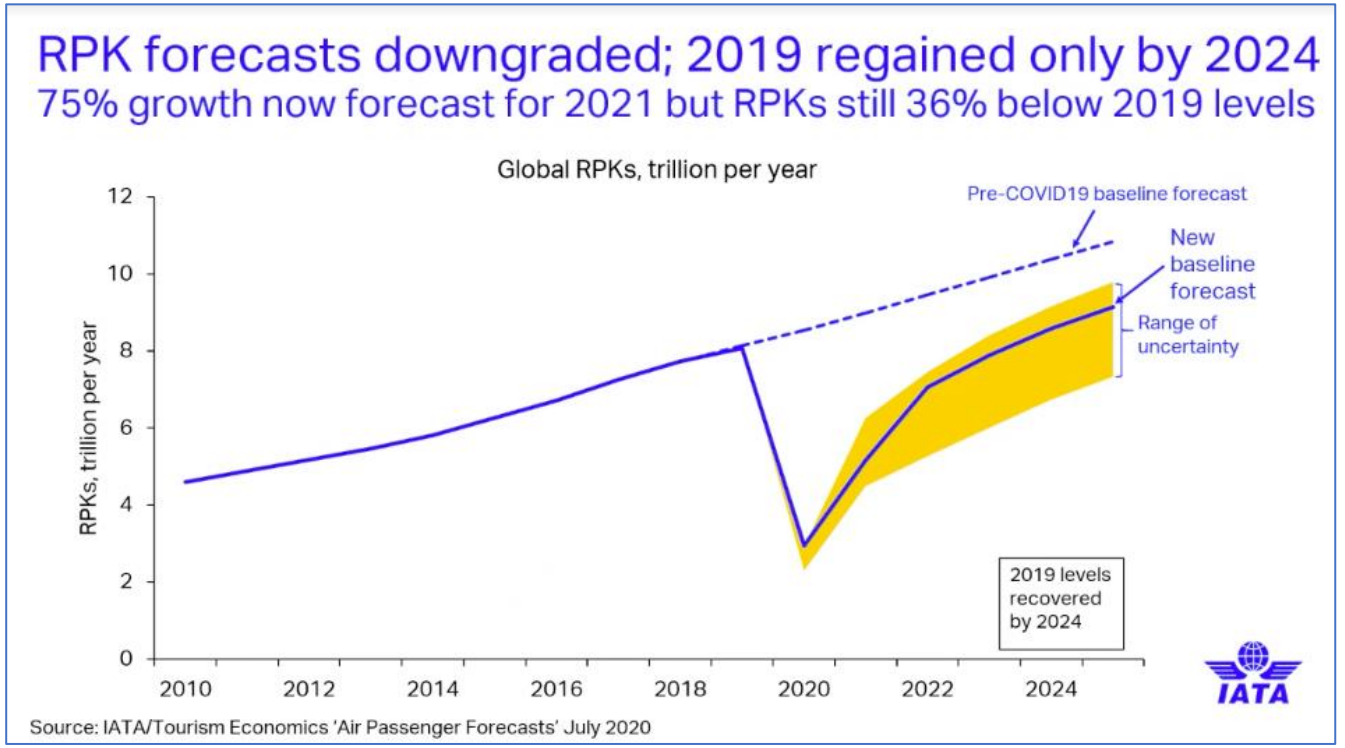
Background to the current civil aviation market



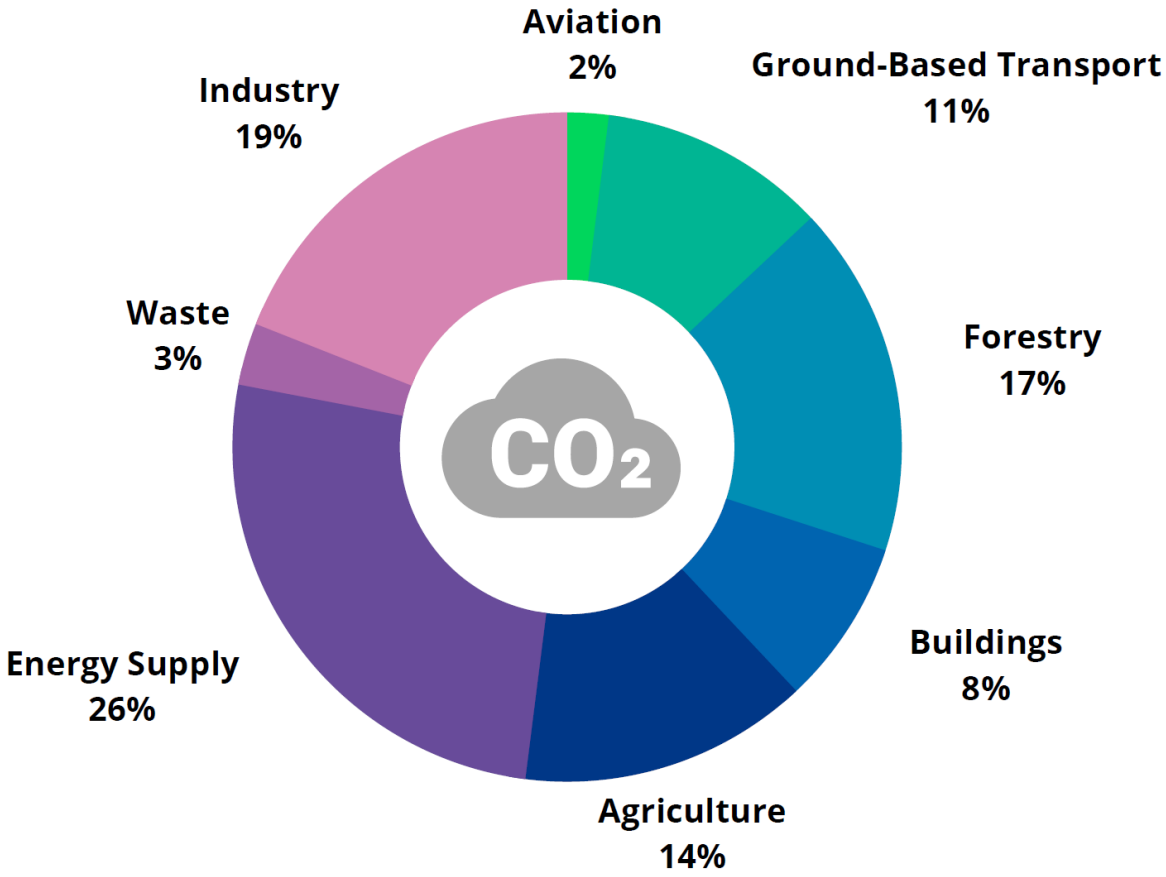


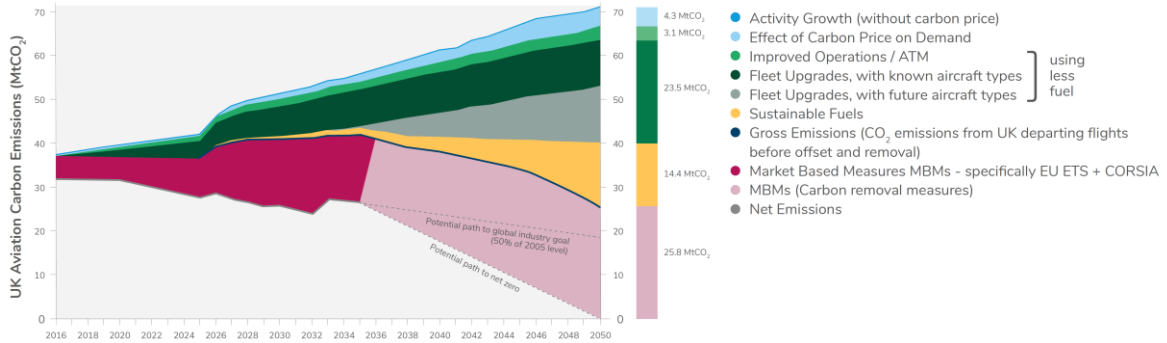
- Flying has continued to see strong growth over many decades.
- Driven by the socio-economic benefits of aviation, and accessibility.
- Resilient to shocks –recessions, Gulf wars, financial crises, 9/11…

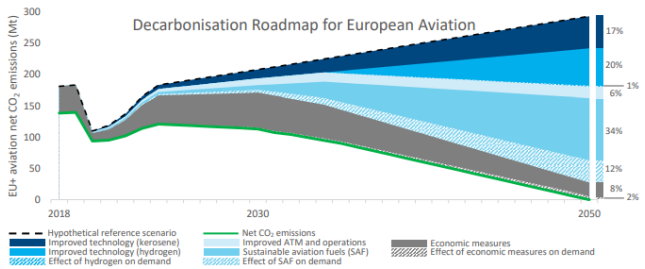
- COVID19 pandemic placed aviation in an induced coma
- Created a global economic downturn and impacted consumer confidence
- Resulted in widespread travel restrictions across the world

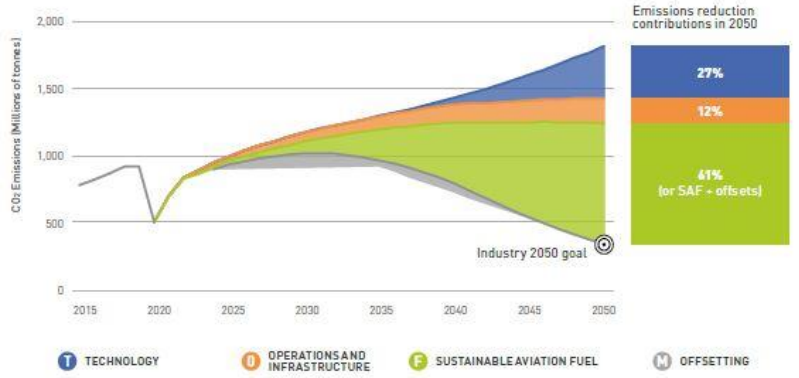
Opportunities in Aerospace

Aviation and Climate Change – the facts





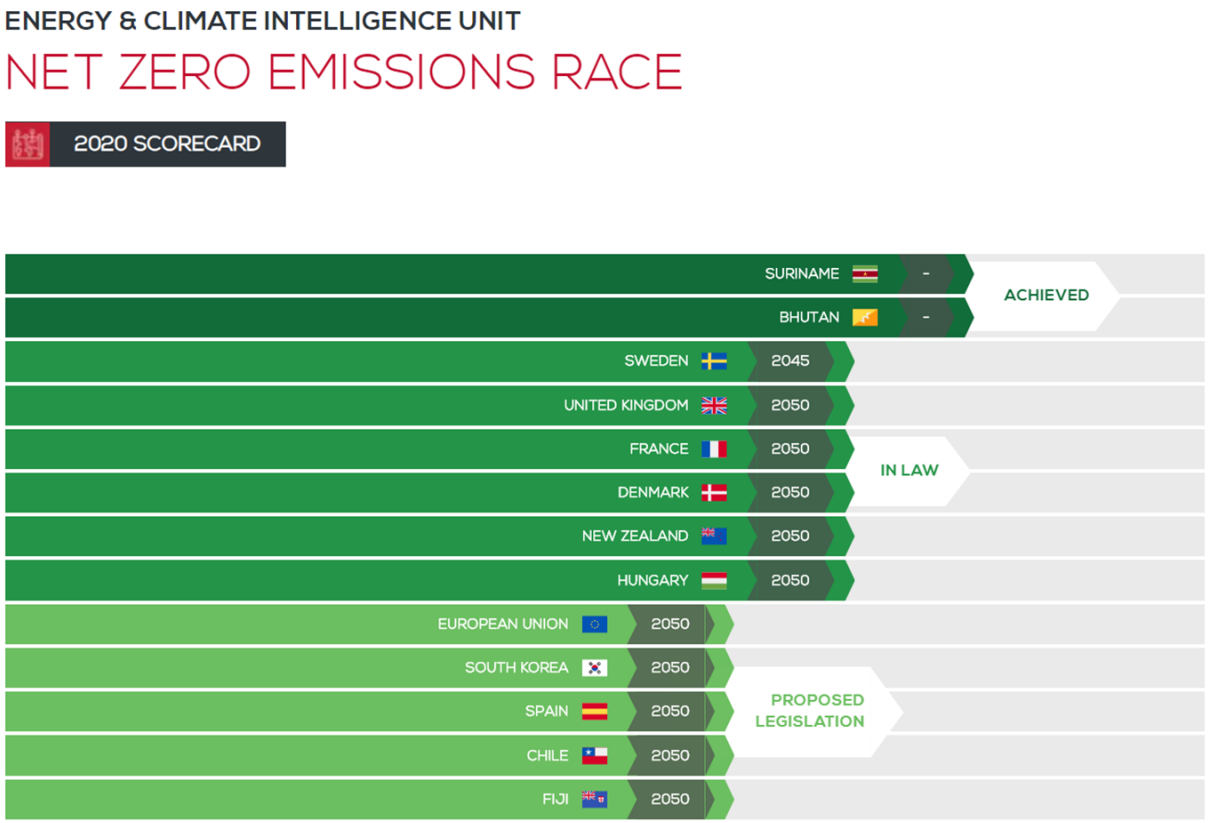




The different roadmaps have their nuances, they are all saying that we can achieve significant decarbonisation without inhibiting growth, through:

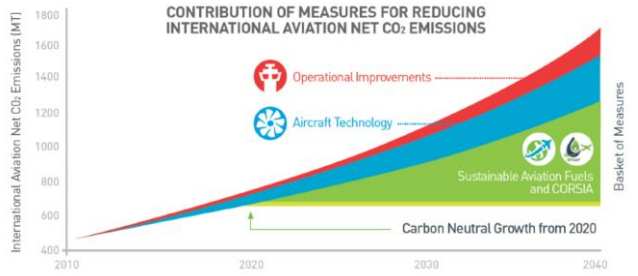
- **Aircraft Technology**
- **Sustainable Aviation Fuels**
- **Operations**
- **Market Based Measures**

Why sustainability is driving civil aviation



Recognition spreading that Sustainability delivers Triple Bottom Line (TBL) benefits to **Profit, People and Planet**

- China policy on net-zero emissions 2060
- US re-entering the Paris Climate Change Agreements



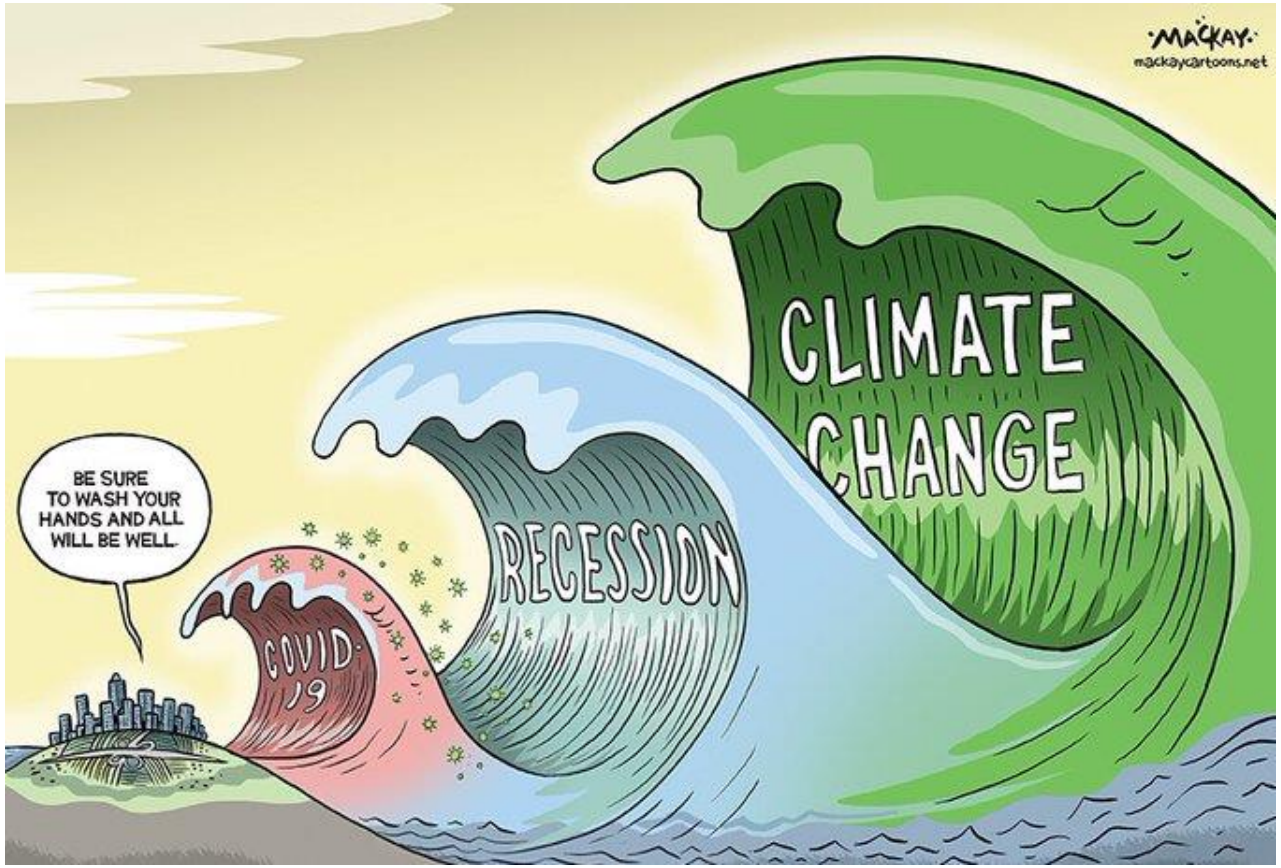
CORSIA kicks in, in 2021 – operators must offset emissions above 2019/2020 baseline

"Aviation is likely to be the largest emitting sector in the UK by 2050"

"There is a certain irony that aviation - the sector perhaps most responsible for the speed with which coronavirus spread across the world - has been one of the most badly hit

"One per cent of the world's population accounts for 50 per cent of emissions from aviation."

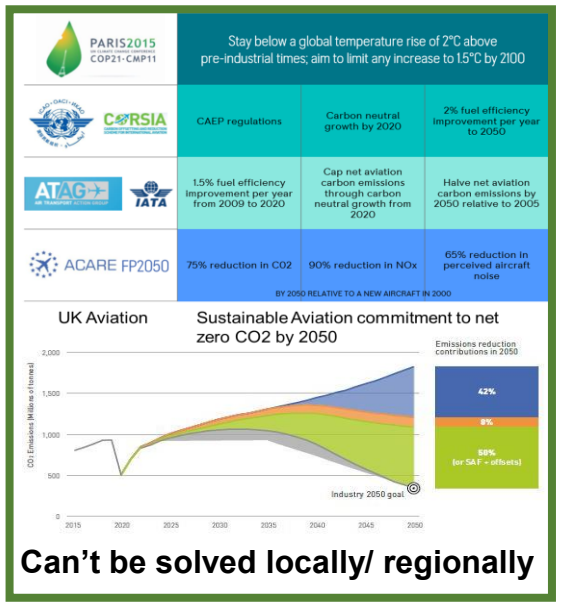
2020s: The decade for action



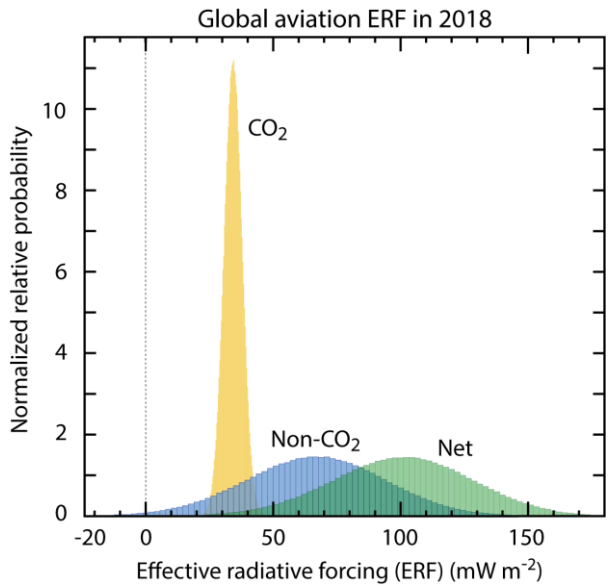
- Delivering on aviation's Climate Change goals is a driving force behind the Aviation industry's post COVID recovery plans.
- Although incremental improvements have delivered significant emissions reductions, this will not be good enough to deliver 'net zero'.
- Achieving net zero will involve solving a multitude of complexities - Policy and Strategy, Technology, Stakeholders…
- UK is taking a leadership position:
  - UK net zero emissions in law
  - UK Aviation commitment to net zero
  - Jet Zero Council established
- **It is time to align action with ambition**

Complexities may make this a “Wicked Problem”

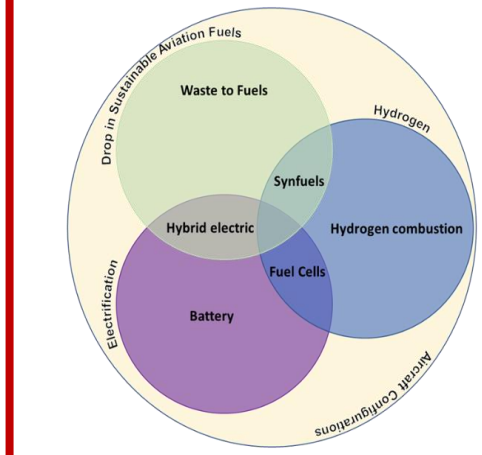
Growing public and investor pressure

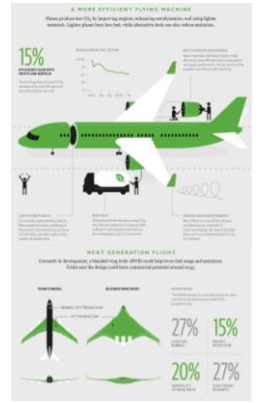


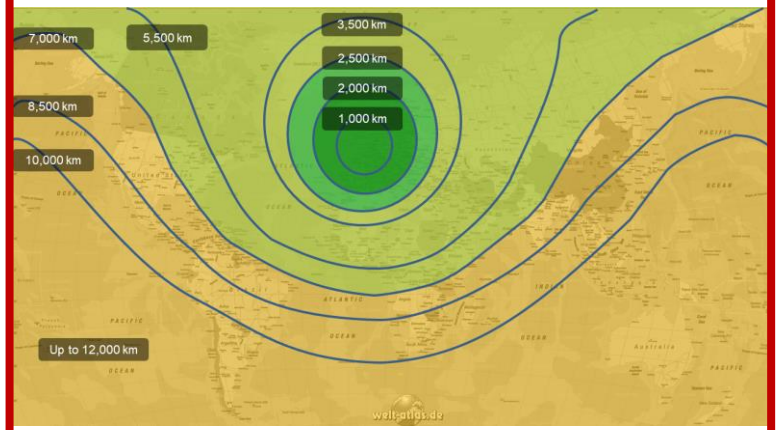
Can’t be solved locally/ regionally



Some of the Climate Science is still emerging – e.g. non-CO2

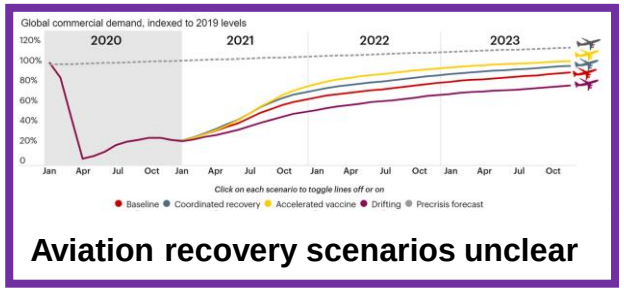




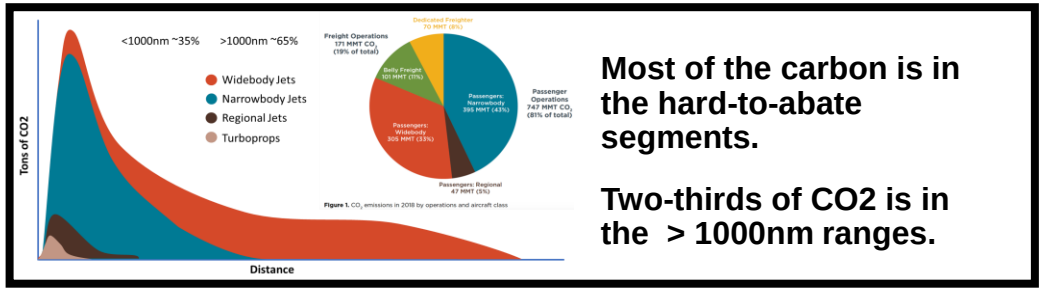


No “silver bullet” on technology

Much debate on solution-range-economics



Aviation recovery scenarios unclear



Most of the carbon is in the hard-to-abate segments.

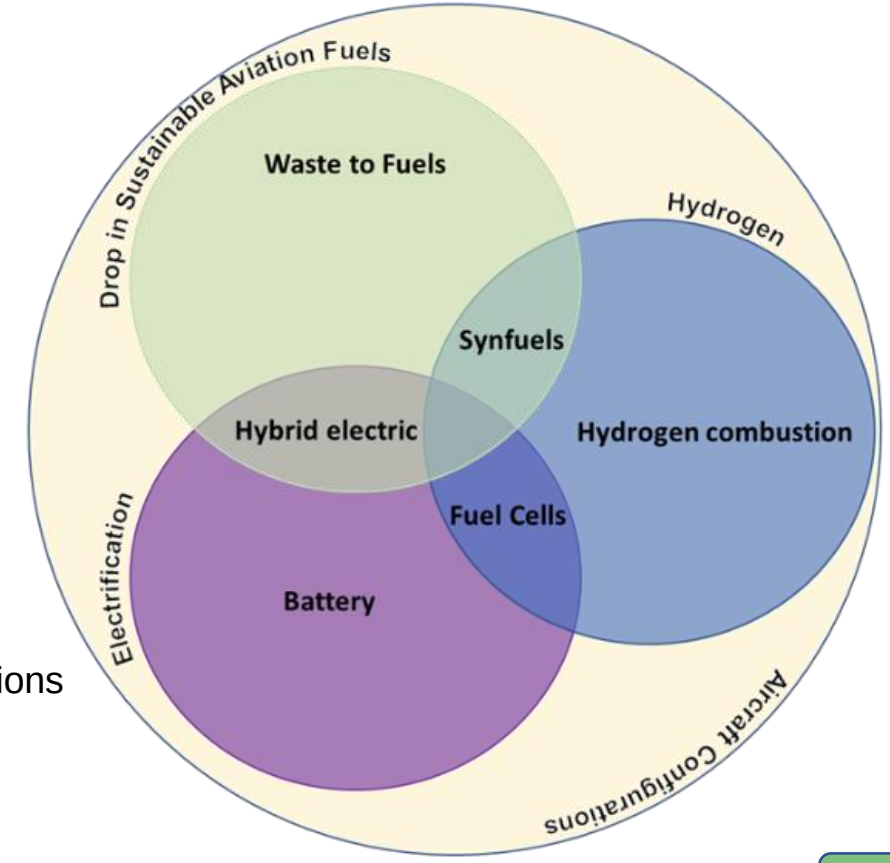
Two-thirds of CO2 is in the > 1000nm ranges.

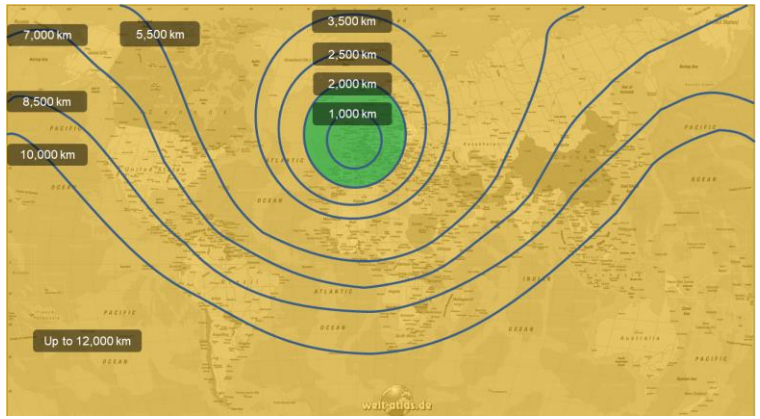
Technology mix is the answer

Looking at solutions from within Aviation

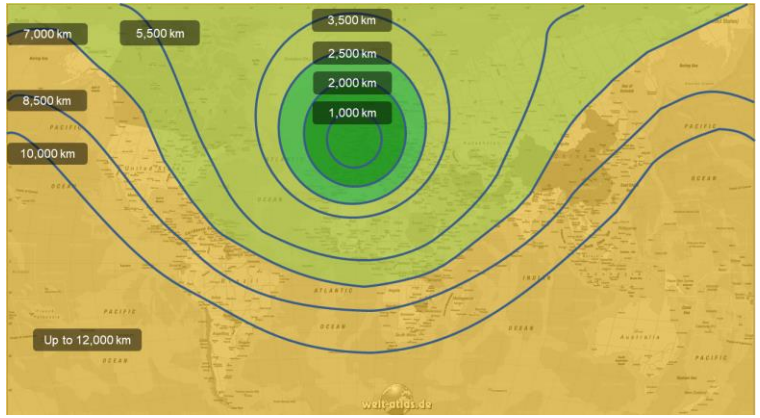
1. Propulsion and Aircraft Technology
2. Alternative energies:
    1. Sustainable Aviation Fuels
    2. Hydrogen (3 pathways)
    3. Electricity

- No silver bullet – Need a silver gun
- Technology interplay
- Technology potential vs actual operations
- Solution vs range vs cost





Technology potential by 2035



Technology potential by 2040

Electric and hydrogen technology certainty

Hydrogen turbine technology certainty

Hydrogen turbine technology potential

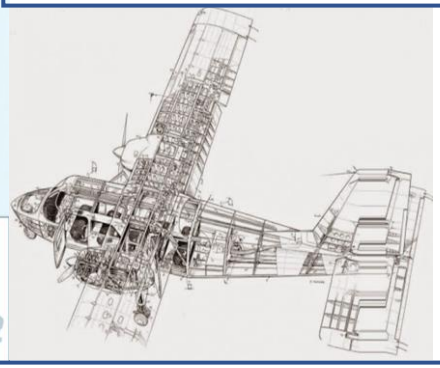
Sustainable Aviation Fuels

Exciting technology in development – more on the way

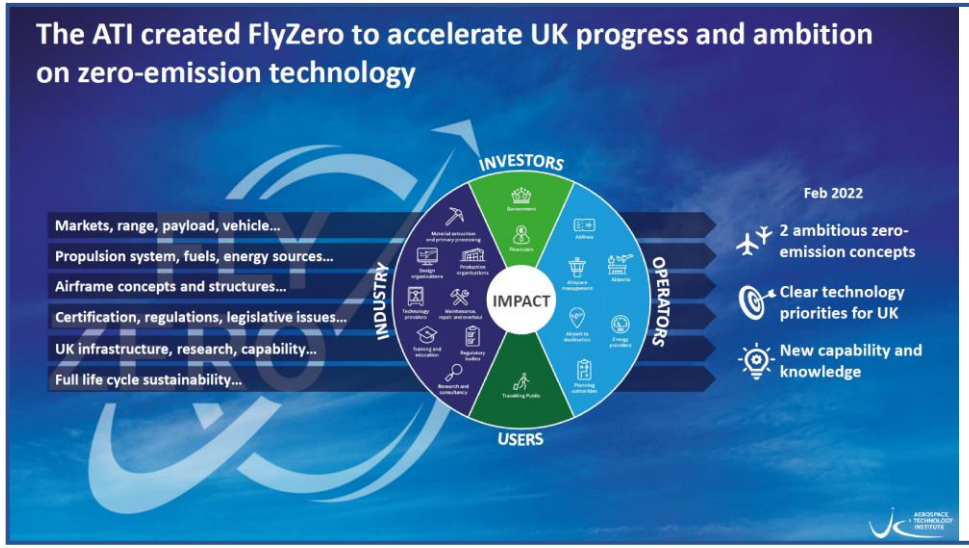
H2GEAR: GKN Aerospace leading a £54m R&T program to develop hydrogen propulsion system for sub-regional aircraft, with EIS as early as 2026

HyFlyer: US SME Zeroavia and Intelligent Energy will create a H2 powered aircraft.

ACCEL: Rolls Royce is partnering with UK SME YASA Motors to design, build and fly a high-performance electric powertrain to accelerate the adoption of all electric aviation.



Fresson: Cranfield Aerospace, Rolls Royce and Denis Ferranti will convert a Britten Norman Islander to wholly electric flight for short commercial trips



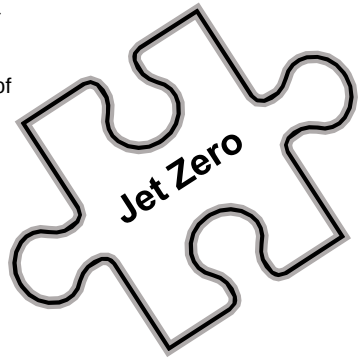
FlyZero

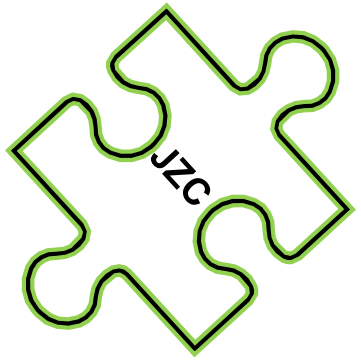
£15m project, 100 researchers, technologists and engineers from across UK industry.

Outputting the next generation of technology roadmaps for zero emissions aircraft for the UK

Many Stakeholders and Activities (UK)

Jet Zero is a political ambition – a "moon shot" for production of a commercially viable zero emission aircraft at a 1000km range and 100 passenger capacity by 2030, leading on to the development of a zero emission demonstrator aircraft able to undertake transatlantic flight by 2040

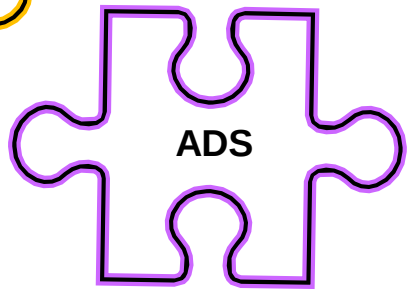




Jet Zero Council, co-chaired by the HMG's Transport and Business Secretaries, stated purpose is to, "…provide advice on the Government's ambition for clean aviation…will focus on developing UK capabilities to deliver net zero emission commercial flight."

Aerospace Growth Partnership is a construct between the UK Government and industry, established to secure the future of the UK aerospace industry

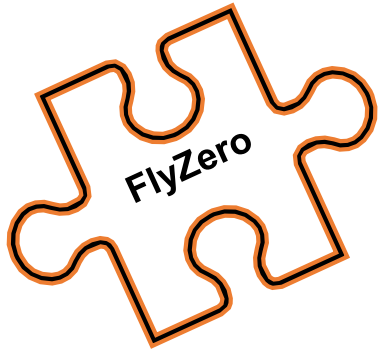
Wider industry, including energy companies, start ups, carbon capture and storage, and many others will need to collaborate in order to deliver on the ambition.



National Trade Body for the Aerospace (and other) industries, focused on supporting 1100 Member companies across the UK

FlyZero is an ATI project to enable the UK to lead a revolution in zero-carbon flight through an initial 12-month programme to look at the design challenges, technology opportunities and market attractiveness of potential zero-emission aircraft concepts

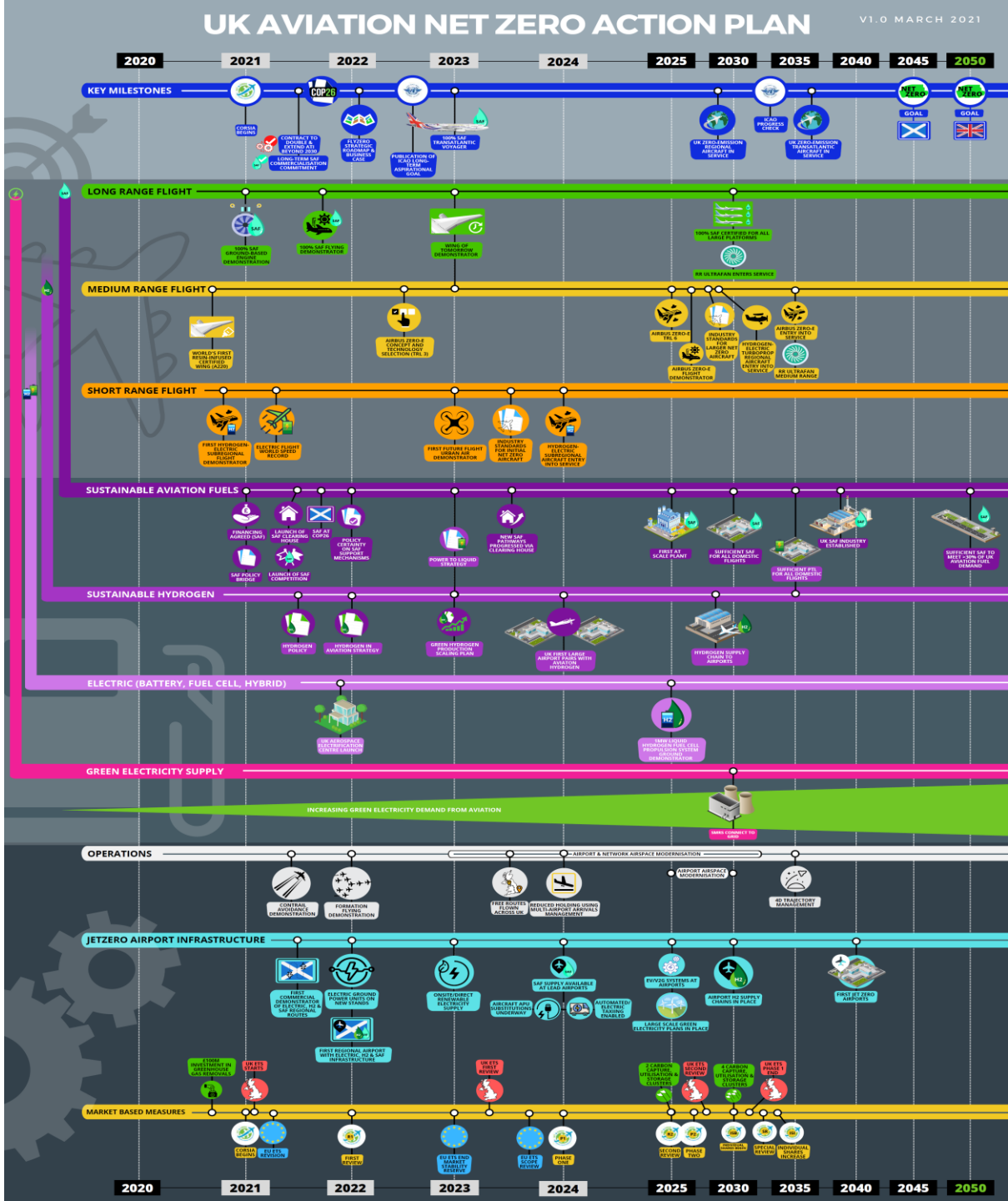
Aerospace Technology Institute develops and publishes the UK's aerospace technology strategy, as well as funds R&T programmes in its priority areas of Vehicles, Propulsion & Power, Systems, Aerostructures



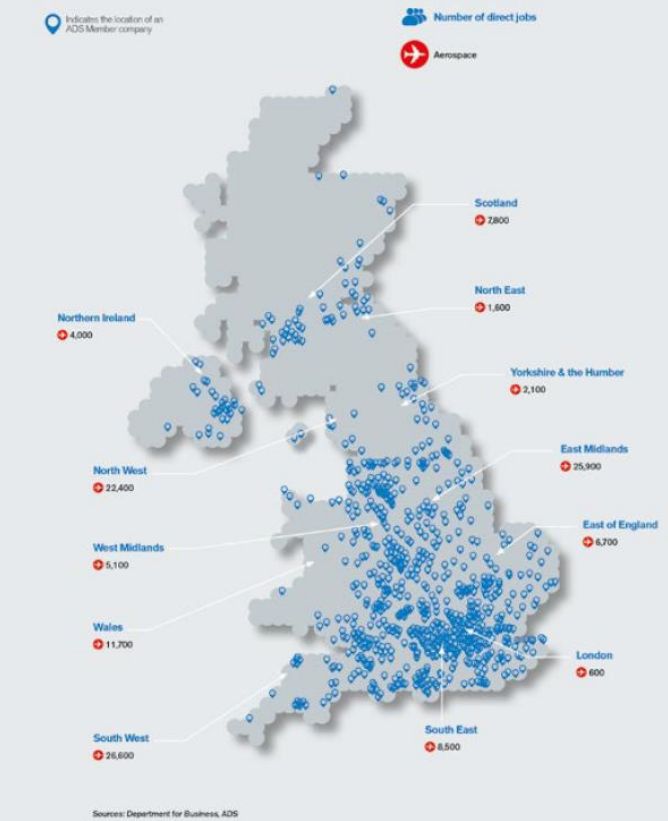
Sustainable Aviation is a coalition of Airports, Airlines and Aerospace manufactures (Airbus and Rolls-Royce) and their respective trade bodies – most notable for its Decarbonisation Roadmap

Work has begun on a Net Zero Action Plan

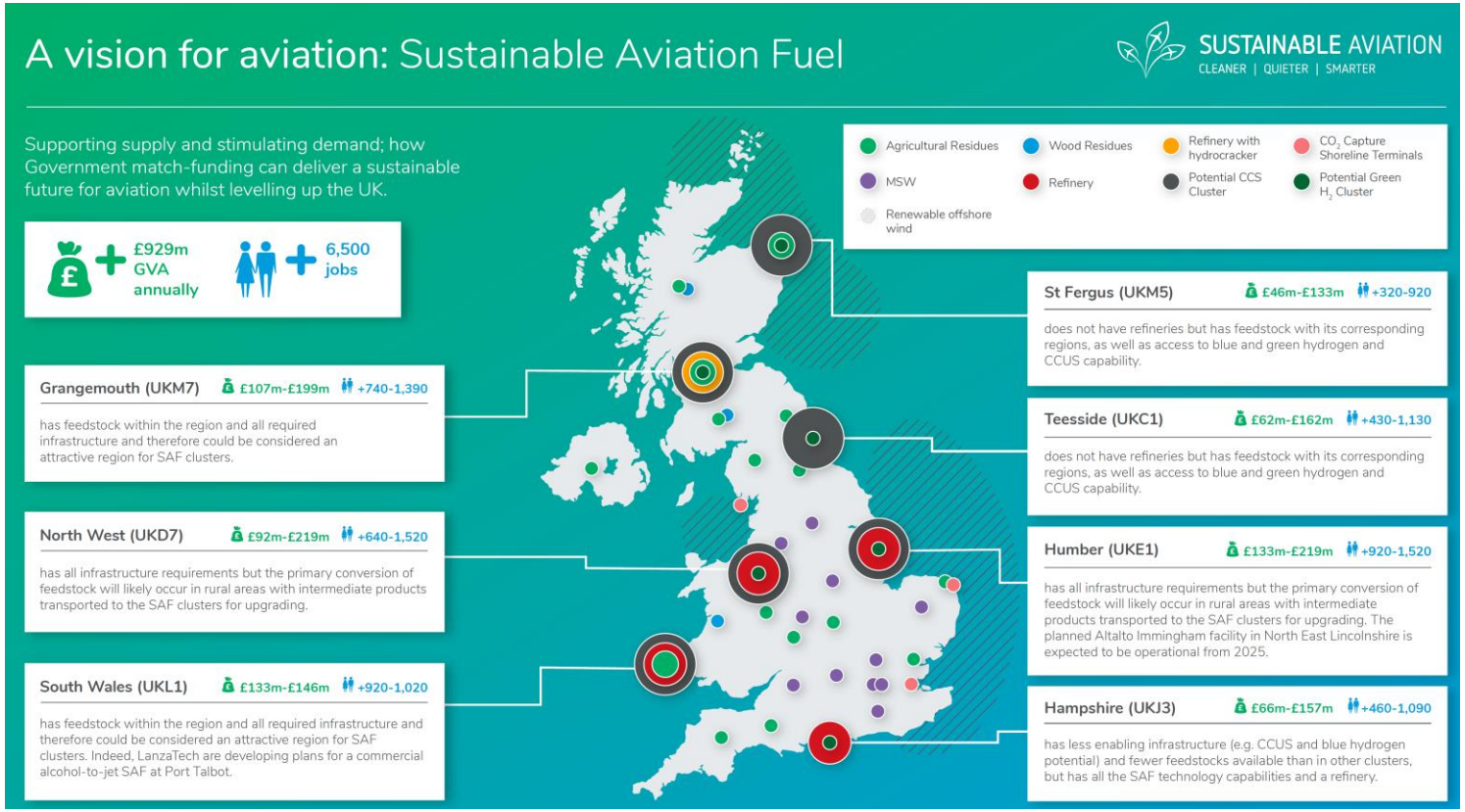
- Rising UK Political ambition for the UK to be a world leader in sustainable aviation solutions.
- Establishment of the Jet Zero Council could be an opportunity to make a step change in a whole-sector approach.
- A high-level draft Action Plan to demonstrate what needs to be done to achieve net-zero aviation in the UK by 2050
- The plan points to many exciting and world leading technology and innovation projects.



Executing these plans will create high value jobs in the UK

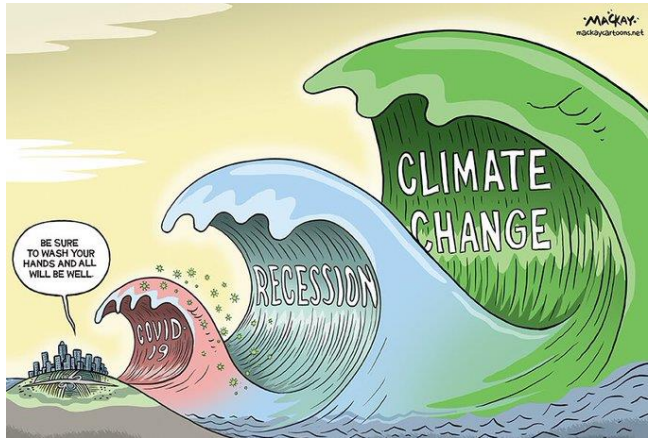


Investment in Aerospace R&D permeates right across the UK. ATI has funded over 200 SMEs; NATEP has funded over 300 SMEs. High value jobs invariably track R&D location.



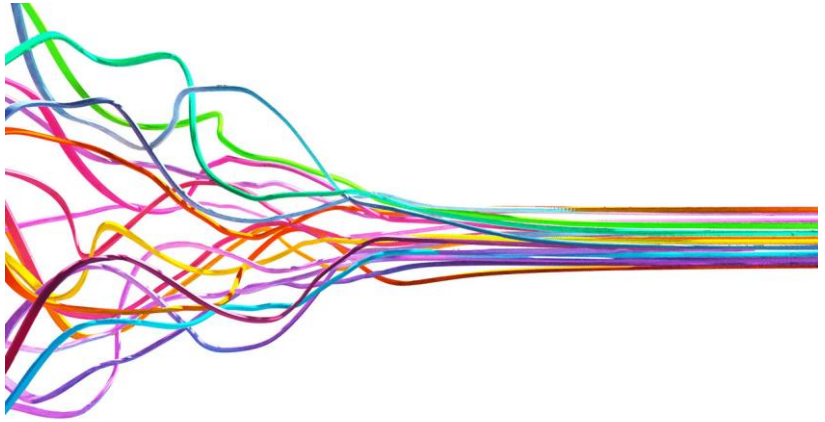
The UK has a great opportunity to establish a new industry with significant GVA and jobs across UK. SAFs are essential to decarbonising Aviation – technology alone will not meet net zero 2050 goal. They have been certified for use but are not available at commercial volumes and prices to enable their widespread use.

In Summary



Tackling climate change is central to the Aerospace industry's post-COVID recovery strategies.

UK Aviation sees a growth scenario that is compatible with our climate goals and is committed to Net Zero 2050.



Many complexities need to be overcome to achieve Net Zero by 2050, and work is underway to define and deliver a long-term plan to get there.

Despite the current situation in industry, the future is bright, green and prosperous

Questions and discussion?

After the COVID-19 crisis...The great test of whether this new hierarchy of values will prevail is climate change.

After all, climate change is an issue that:

(i) involves the entire world, from which no one will be able to self-isolate;

(ii) is predicted by science to be the central risk tomorrow;

(iii) we can only address if we act in advance and in solidarity.

Mark Carney