Meeting the challenge of 1.5c: Towards climate-neutral aviation

CLEAN AVIATION

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Clean Sky 2 Joint Undertaking

16th Florence Air Forum: Navigating towards the Decarbonisation of European Aviation
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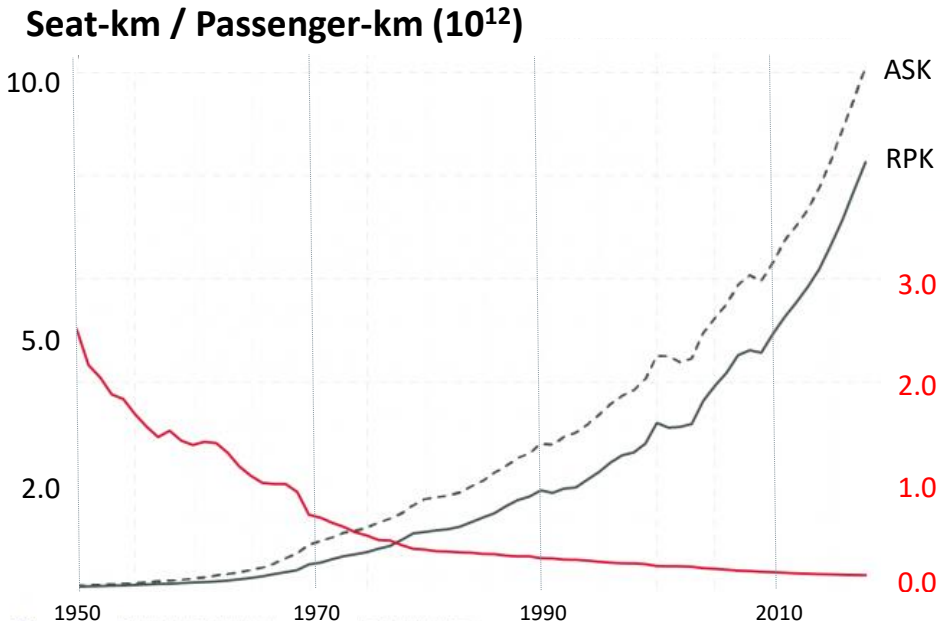
Great strides made in air transport efficiency

But growth has consistently outpaced these gains: persistent growth in absolute emissions



Source and copyright: OurWorldinData.org

1989 – 2019:

- Air transport system quadrupled
- Emissions doubled
- Superb efficiency gains but absolute emissions growth = *exponential*…

2018: 0.125kg CO_2 per RPK

Globally, flights <4000km dominate flights *and* emissions (!)

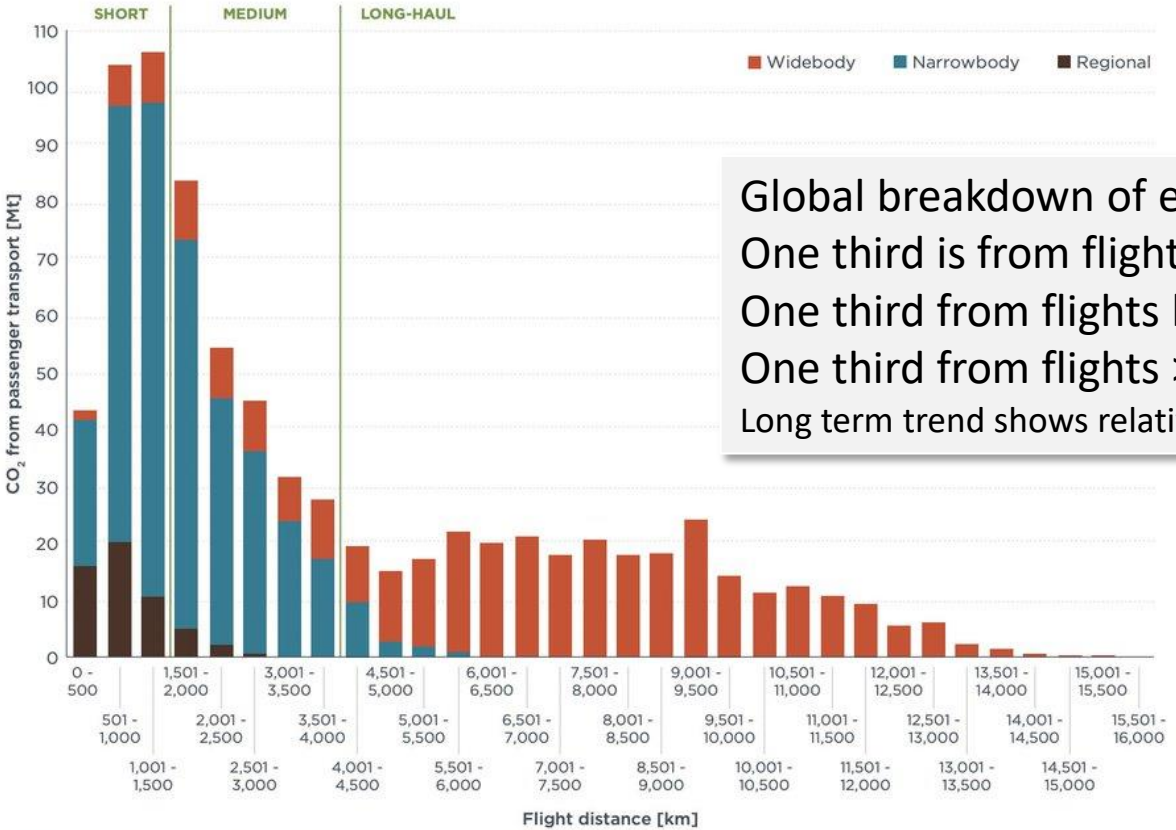


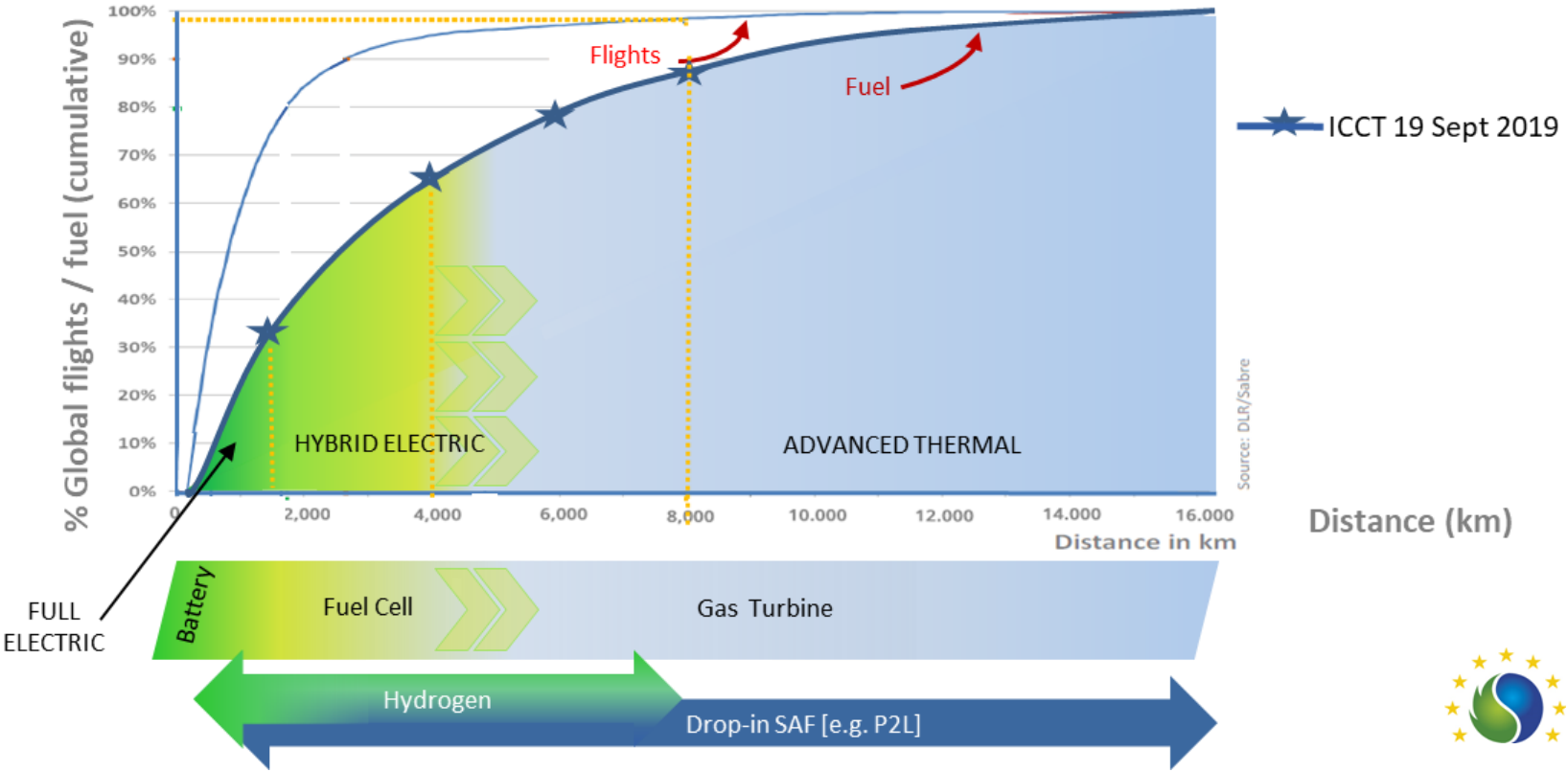
Figure 9. Share of passenger CO_2 emissions in 2019, by stage length and aircraft class

Global breakdown of emissions:
One third is from flights <1500km
One third from flights between 800 and 4000km
One third from flights >4000km
Long term trend shows relative increase in short range emissions [!]

Source ICCT 2019 global air transport

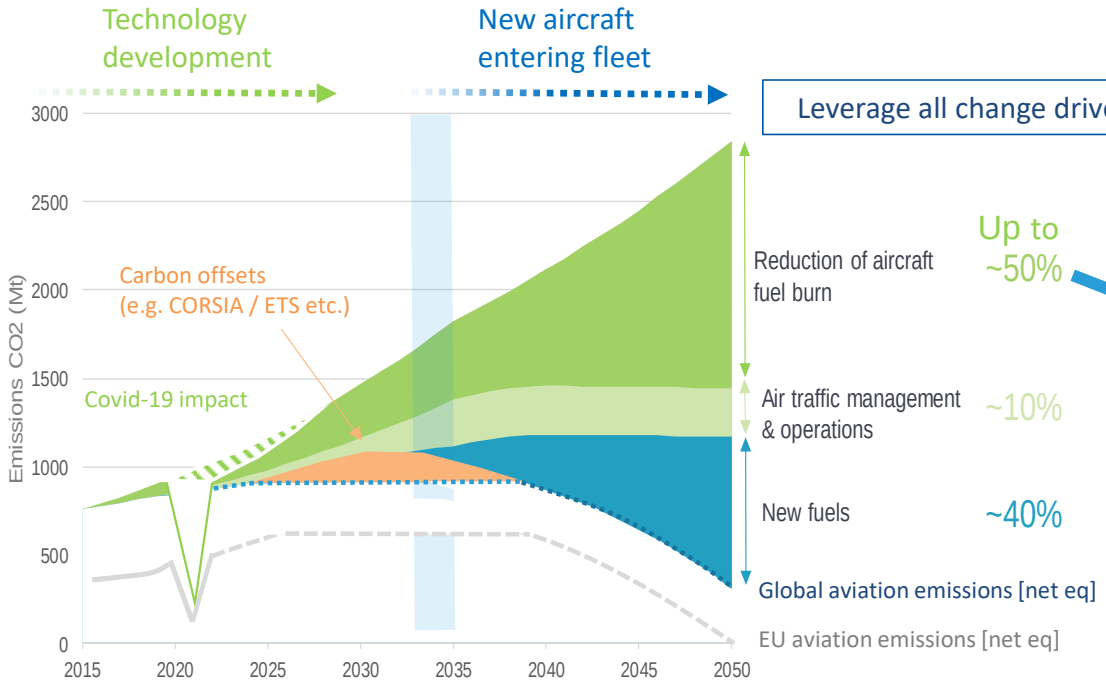
Horses for Courses: more differentiation in aircraft and energy/fuel

With 2/3 of global emissions from flights <4000km, there is scope for technology disruption!



European aviation sector and the European Green Deal

Committed to work towards a climate neutral European aviation system by 2050



Source: IATA / Clean Sky 2 JU

Destination 2050:
A Route To Net Zero European Aviation

Regional:	-50%
Single Aisle:	-30%
Single Aisle/H_2:	-35%
Short/Medium Range Twin Aisle:	-30%
Long Range Twin Aisle:	-30%

(all figures excluding SAF effect)

Clean Aviation – linchpin in Europe's R&I for the transition

Hybrid electric and full electric architectures

Disruptive technologies to enable hydrogen – powered aircraft

Ultra-efficient aircraft architectures

Low Emission Hybrid-electric **Regional** Aircraft

Zero Carbon Hydrogen-powered **Short Range** Aircraft

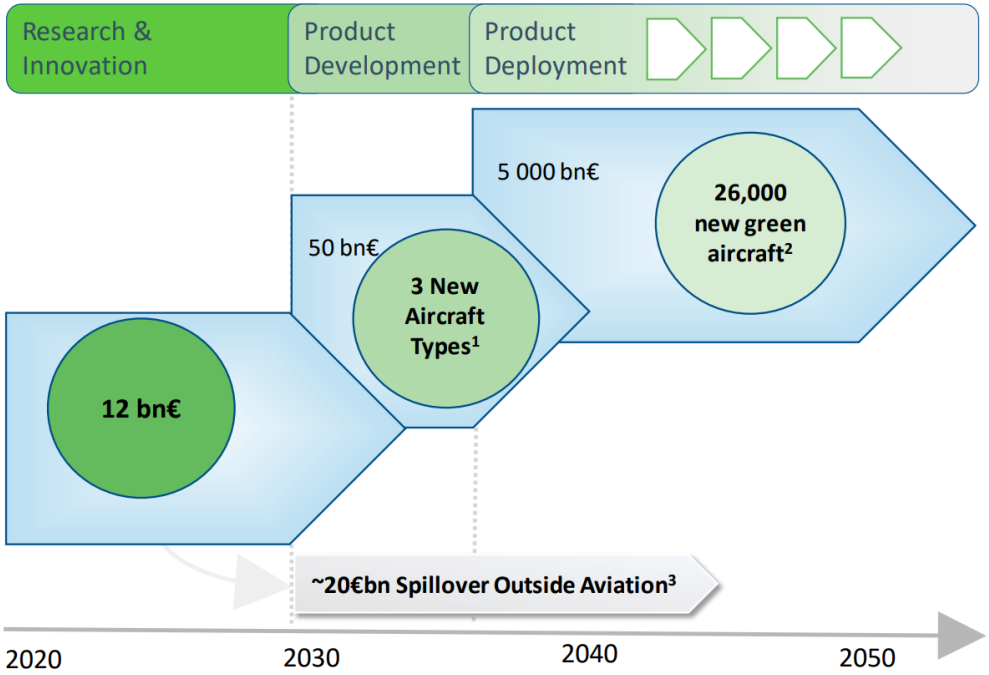
Low Emission **Short / Medium Range** Commercial Aircraft

Long Range Aircraft Concepts progressing towards climate neutrality

Flight demonstration in Clean Aviation JU and Impact by 2035

Development of disruptive technology options

Huge R&I challenge, but great potential impact and opportunity



1. Based on aircraft 'clean sheet' programmes covering ≥80% of passenger RPK
2. Investment covers fleet replacement only

The journey needs to start yesterday!

In summary [1]

New aircraft concepts

- As witnessed by the 2021 IPCC report: drastic and urgent action towards 'net-zero' GHG emissions by 2050 needed. **Aviation will not be exempt from pressures to decarbonise radically and rapidly**.
- Skip-a-Generation technology leap needed by 2030: **30-50% extra energy efficiency is possible**.
- **System of Systems approach**: design; payload/ range and cruise speed, operations, and networks. Another 20% to be gained in propulsive energy efficiency, 10+% in aircraft/airframe; another 20+% by tailoring aircraft to routes.
- Air transport system needs to have **~75% of the global fleet replaced by 2050**, while tripling in size from 2020: major implications for production system, 'cycle time' and reduction of development and production costs.

In summary [2]

New propulsion concepts

- Drop-in SAF will help, but **only a true net-zero fuel if produced with DAC.** Using 'point source' carbon gives <50% net CO_2 reduction and <30% reduction in climate impact. Gross CO_2 emissions aren't reduced, and non-CO2 also only modest impact.
- Non drop-in fuel / energy will become **inevitable**, it is not 'if' but 'when'. **LH_2 is by far the most promising. Aircraft design options enabling H_2 propulsion need to emerge in this decade.**
- Regardless of the mix of synfuel to LH_2, **adequate and cost-effective production of 'green hydrogen'** will be essential for a healthy and viable aviation system >2050.
- Need to keep pushing envelope in 'traditional' aeronautical sciences. **New disciplines will bring key enablers**: electrical power, thermal management, hybridisation, LH_2 based propulsion/power (fuel cells, combustion, storage), HTSC, autonomous systems.

Key takeaways

- The technology journey towards the next generation of aircraft needs to start today
- Technology, alternative low-carbon fuel/energy need to go hand in hand, and operating models cannot remain sacrosanct
- Drop-in SAF is a good interim step, by not sufficient and not optimal across the full aviation system. And not penetrating market fast enough
- A system-wide approach will be needed, allowing infrastructure and fleet replacement to follow new technology and fuels in ‘lock step’.
- New approaches to financing the transformation will need to be considered. New EU approaches can define the pathway.
- The EU can *lead the transformation*

Shared vision for the proposed Clean Aviation Partnership

Up to 3bn€ private commitment expressed to the EC in support of the Partnership

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