DAVY Horizons

Helping you define sustainable solutions

Ensuring a sustainable future for aviation

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Davy Group hosted its 13th Annual Transportation Conference on June 17th with a strong representation from Europe's leading airline operators, lessors and key industry contributors including Eurocontrol. For the event's Sustainable Aviation panel Dr Dorothy Maxwell from Davy Horizons was joined by Kevin Soubly, Project Lead, Clean Skies for Tomorrow – World Economic Forum; Thorsten Lange, Executive Vice President, Renewable Aviation, Neste; Jan Melgaard, Executive Chairman, FPG Amentum. Their insights have helped frame the content for this paper.

Key takeaways

Aviation is an essential sector connecting people and economies, but its role is increasingly being challenged by its contribution to global climate change. The sector currently represents c.3%of global Greenhouse Gas emissions[†] and if no interventions are made, emissions from the aviation industry are projected to triple by 2050.

While the COVID-19 pandemic has heavily impacted the industry, fast-tracking the shift to a low and zero carbon future continues to be backed by international commitments and is being viewed by the aviation industry as an innovation opportunity.

The aviation industry has already committed to 50% net CO_2 emissions reduction by 2050, relative to 2005 levels. The next 10 years are critical to getting on a path to achieving those targets.

To meet carbon neutrality, a collaborative approach between government, industry and investors is essential; commercialisation and scale are key to meeting this urgent timetable.

[†] CO_2 and non CO_2

While there is no silver bullet to address the industry's carbon footprint, pathways to carbon-neutral aviation include cleaner propulsion and Sustainable Aviation Fuel (SAF) technologies, air traffic management, market-based measures, industry agreed offsetting and industry collaborations.

SAF are the most promising of those decarbonisation pathways in the near term. A proven technology, SAF is currently on a journey similar to that of wind energy in terms scaling and commercialisation. Its goal is to become a reasonable economic alternative to jet fuel.

SAF has the same characteristics in terms of quality and safety as fossil kerosene used in jet fuel. Depending on the feedstock and production pathway used, SAF produces 80% less CO_2 emissions than normal jet fuel.

If the aviation sector is to meet its CO_2 targets aligned to the Paris Agreement to halt global warming at 1.5°C, there is no time to waste. The actions taken in the next ten years matter. It's time to get off the fence and support the solutions in play.

> *"A transition to carbon-neutral flying is possible and sustainable aviation fuels are the most promising decarbonization pathway in the near term."*
>
> *Kevin Soubly – Project Lead, Clean Skies for Tomorrow, World Economic Forum*

Enabling sustainable aviation by 2050

While there are already promising innovations including; alternatives to fossil fuels, hydrogen and electric powered flight, it is unlikely these solutions will be commercially available until the middle of the 2030s at the earliest. The key insight from our panellists is that there is a ready-made answer - Sustainable Aviation Fuel (SAF). This is a proven technology. According to the International Air Transport Association (IATA), nearly 300,000 flights have flown on a blended mixture of SAF and regular jet fuel. SAF can evolve as a viable game-changer as it utilises existing refuelling infrastructure and has the potential to cut life-cycle emissions by about 80%.

SAF explained

There are two SAF types – biofuels that are available now and e-fuels at early stage development and a longer-term synthetic solution. Both can be used as "drop in" mixed with jet fuel with, no infrastructure change required to the aircraft design or fuel supply.

SAFs are made from different feedstocks such as waste oils, biofuels and synthetic production but have the same characteristics in terms of quality and safety as fossil kerosene used in jet fuel. Depending on the feedstock and production pathway used, SAF produces 80% less CO_2 emissions than normal jet fuel. SAF made from biological feedstocks (biofuels) including waste oils, algae and sugarcane blended with jet fuel, are currently at an advanced stage of development. These have certified pathways approved by ASTM[1] International with HEFA[2] fuel commercially available at industrial scale so far. NESTE take waste oils from many different sources and processes it to make SAF that is 100% comparable to oil-based diesel or kerosene for the aviation industry.

SAF e-fuels made using synthetic production processes are still at an early stage of development but provide a long-term solution to the decarbonisation of the aviation industry. Synthetic SAF made using the PtL[3] process require only water, renewable energy and CO_2. SAF e-fuels provide a long-term solution to decarbonisation of the industry as they are not limited by the availability of biological feedstock that could be used for food or other fuel sources.

[1] American Society for Testing and Materials
[2] Hydrotreated Esters and Fatty Acid (HEFA)
[3] Power-to-Liquid (PtL)

The key limitations for any industry adopting the new technologies that will decarbonise the sector include commercialisation and upscaling production. However, SAF is an emerging market and we are already seeing countries stepping up their commitments to grow the percentage SAF jet fuel consumed such as Norway (30%), Sweden (27%) and Finland (30%). In the context of their net zero commitments, airlines have begun to sign forward purchase agreements and some are also equity investors in SAF refineries. For example, airline commitments to SAF by 2030 include: Lufthansa (5-10%), Delta (10%), IAG (10%) and Ryanair (12.5%). It is obvious demand for SAF is growing; however, the volume produced is still too low and the cost to high.

> ***"SAF is a game-changer for aviation when it comes to reaching carbon neutrality. The requirement of driving production up and costs down is similar to what we witnessed happening in the wind energy industry a couple of decades ago. The wind energy industry, supported in the past by government collaborations, delivers today at a lower cost than its fossil equivalent. SAF will undergo a similar journey during the next decade or two."***
>
> *Jan Melgaard, Executive Chairman at FPG Amentum*

To grow the available volumes of SAF over the short term (HEFA)[2] and long term (PtL)[3], certified feedstock acceptance , regulatory mandates and investment is crucial. More government collaboration and policy instruments to incentivise demand are needed to scale production and uptake in the timelines required. Including SAF under the Renewable Energy Directive II (RED II) for biofuels and UN CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) for offsets and removals are key incentives in place. Coming down the tracks, the ReFuelEU Aviation, a pending EU initiative, proposes new legislation to incentivise SAF use in Europe. Similarly, in the US, the SAF market is growing supported by the introduction of credits from the Sustainable Skies Act.

SAF is currently more expensive than fossil jet fuel at 2-5x the price of jet A-1 fuel. However, prices will come down as technologies mature and competition grows, similar to what happened with wind technology - which is now cheaper than its fossil fuel competitors. Neste shows below that the impact of blended SAF on ticket price is moderate especially on long-haul flights. For example, a flight from Helsinki to Singapore with a 30% SAF blend would cost an additional €71/passenger. For environmentally-conscious consumers, this increase in ticket prices can be considered reasonable.

SAF blend	5%	14%	30%
Helsinki - Singapore	+€12	+€33	+€71
Helsinki - Munich	+€3	+€9	+€20
Helsinki - Stockholm	+€1	+€4	+€4

Source: Sustainable Aviation Fuel and its Impact presentation by Thorsten Lange, Neste

> ***If the aviation sector is to meet its CO_2 targets aligned to the Paris Agreement to halt global warming at 1.5°C, there is no time to waste. SAF is a proven technology using a platform in place for over 50 years that can enable carbon neutral aviation in the time we have."***
>
> *Thorsten Lange, Executive Vice President of Neste Corporation Renewable Aviation*

It is also feasible that the push for SAF use comes from investors outside of the aviation industry. The Sustainable Aviation Buyers Alliance (SABA) is a joint initiative made up of founding companies such as Netflix, Microsoft, Salesforce and others who want to accelerate the path to net zero aviation by driving investment in high quality SAF.

For the aviation sector to meet its carbon neutrality requirements in the timeframe of the Paris Agreement, a collaborative approach between government, industry and investors is essential. De-carbonising aviation presents a major innovation opportunity for sector, but commercialisation and scale are key to meet the urgent timetable. The actions we take in the next ten years matter. It's time to get off fence and support the solutions in play.

Climate challenge

Aviation is an essential sector connecting people and economies. However, from a Climate Change perspective, the sector contributes ~3% of global GHG emissions – both CO_2 and non CO_2[4]. This is exacerbated by the fact that the sector has been one of the fastest growing sources of GHG emissions and with emissions projected to triple by 2050. Policy actions and the efforts of industry have led to improvements in fuel efficiency, reducing emissions in recent years. For instance, the amount of fuel burned per passenger has dropped by 24% between 2005 and 2017. However, these environmental benefits have been outpaced by a sustained growth in air traffic.

Outside of climate change, the sector's other environmental impacts include noise, air pollution, resource consumption and generation of waste, including single-use plastics. As we recover from COVID and passengers are free to fly again, tackling climate change and these wider impacts is essential to building back better. The aviation industry is committed to reducing CO_2 emissions by 50% from 2005 levels by 2050. What we do in the next 10 years is key to achieving this.

Policy framework

Climate change policy, targets and market-based measures have been agreed internationally for the sector. For the EU, these are mirrored in EU Climate, EU Emissions Trading Scheme (ETS) & Green Deal policies.

The **International Air Transport Association (IATA)** which represents over 290 airlines, some 82% of total air traffic, has set the industry targets for tackling climate change.
Their targets include:

- Stabilise net CO_2 emissions at 2020 levels with carbon-neutral growth from 2020.
- Reduce emissions by 50% by 2050 versus 2005 levels and 1.5% efficiency improvement per annum to 2020.

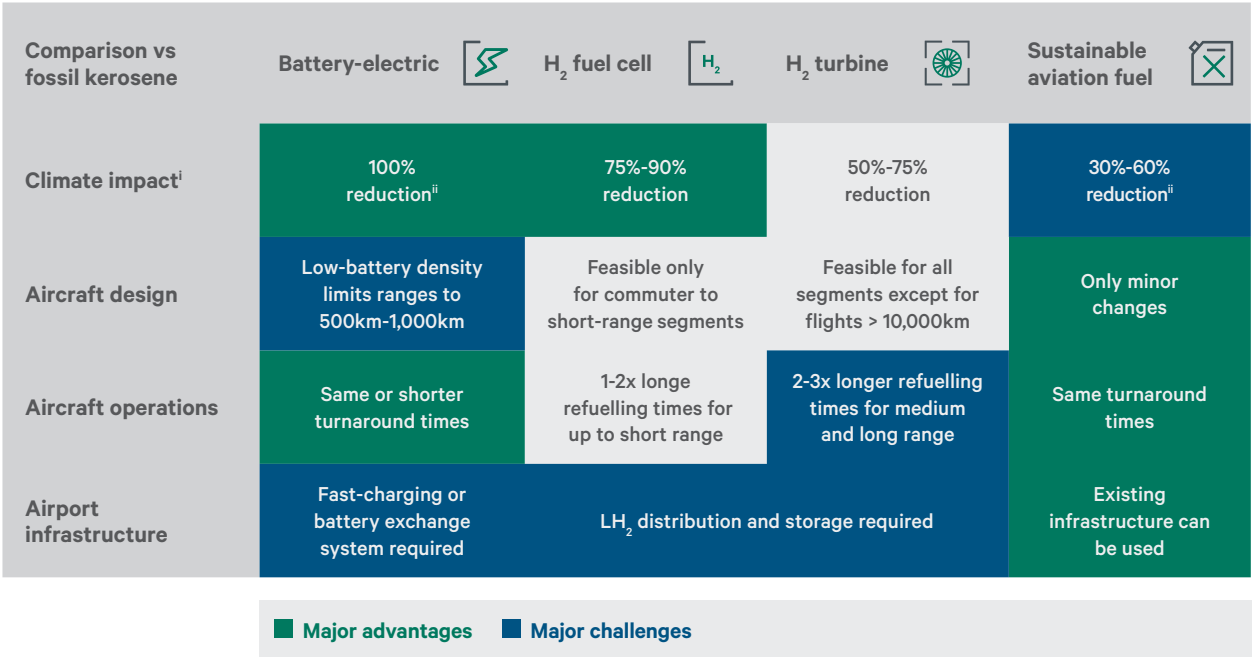
Internationally the **UN CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation)** Global Carbon Offsetting mechanism aims to deliver the industry goal of carbon-neutral growth from 2020 and a 50% net reduction by 2050 versus 2005. Under CORSIA, airlines are required to monitor emissions on all international routes. They must offset emissions from routes included in the scheme by purchasing eligible emission units generated by projects that reduce emissions in other sectors (such as renewable energy). Currently this scheme is in the voluntary stage (2021-2023). However, this will become mandatory from 2027 when offsetting rules are finalised. During 2021-2035, and based on expected participation, the scheme is estimated to offset around 80% of the emissions above 2020 levels.

[4] Non CO_2 GHG emissions are NOx plus water vapour, soot, sulphates and contrails with at least as significant a Global Warming Potential due to so called 'Effective Radiative Forcing'.

Technological solutions

Several solutions are being explored by key stakeholders; airlines, IATA, government agencies, NGOs, engine and airframe OEMs, oil producers, fuel suppliers and researchers. These include aircraft fuel efficiencies, improved air traffic management, new clean propulsion technologies and SAF. The most promising options to make aviation sustainable are propulsion technologies and new fuels.

While SAF is an accelerant of the move towards lower emissions, the most immediate change is the rolling over of the fleet from "current-generation" aircraft families like the A320ceo and 737NG to the "next-generation" families like the A320neo and 737MAX – these bring about a ~20% improvement in fuel burn and given that Airbus/Boeing are making the latter only, that rolling over effect should be very helpful over the next 10-15 years.



[i] Including CO_2, NOx, water vapour and contrails [ii] Assuming 100% renewable electricity [iii] For e-fuels with fully decarbonised supply chain.
Source : WEF Clean Skies for Tomorrow Sustainable Aviation Fuels as a Pathway to Net-Zero Aviation Insight Report November 2020

Clean propulsion technologies include battery electric, fuel cell and hydrogen. While there have been some recent successes such as ZeroAvia conducting the world's first hydrogen fuel cell powered flight of a commercial-grade aircraft in September 2020. The technology is still years out from being commercially viable and able to abate the emissions from long-haul flights. As long-haul flights are responsible for >70% of aviation CO_2 emissions, solutions for these are key to achieving climate change goals. Hybrid-electric and hydrogen-powered aircraft development and deployment at scale could take 10-20 years and the technology will be initially limited to smaller, shorter-range aircraft. As a result, SAF is seen as the most viable way to reach aviation climate change targets in time.

Innovation and evolution

With the changes in technology underway, fleet renewal is a key part of airline and lessor climate change strategies. Early retirement of inefficient older aircraft and the addition of new more efficient aircraft or new technical innovations are key focus areas. At the short haul entrepreneurial end of the market there are innovation opportunities. For example, the lessor Avolon see zero-emission electric aircraft as key for the ultra-short-haul urban air industry to transport people across the world's major cities in minutes. Avolon is a front running innovator having invested in 500 zero emissions, electric, vertical take-off and landing planes.

> ***"We're going to become the first lessor to lead what I believe will be the next leap forward in the transportation industry. It's not science fiction; it's real, it's here and we're committing a lot of dollars"***
>
> *Dómhnal Slattery, CEO, Avolon*

Stakeholder collaboration

The World Economic Forum's Clean Skies for Tomorrow coalition aims to scale SAF as the most promising option to reduce the aviation industry's carbon emissions in the near term. Working in collaboration with the Rocky Mountain Institute and the Energy Transitions Commission, the Coalition provides a global mechanism for business and public sector leaders, across and beyond the aviation value chain, to align on a transition to SAF and proactively achieve carbon-neutral flying. The aim is to carry the initial cost burden of investing in new technologies to reach a scale where they are competitive with existing fossil fuel-derived options.

There are over 80 organisations engaged to date with founding champions including Airbus Group, Heathrow Airport, KLM Royal Dutch Airlines, Royal Schiphol Group, Shell, SkyNRG, SpiceJet and The Boeing Company. Champions of the Clean Skies for Tomorrow Coalition will advance co-developed initiatives to break this impasse, to advance the commercial scale of viable production of sustainable low-carbon aviation fuels (biofuels and e-fuels) for broad adoption in the industry by 2030. Initiatives include a mechanism for aggregating demand for carbon-neutral flying, a co-investment vehicle, and geographically specific value-chain pilots.

> ***"We need to move from a room that is called fear to a room that is called hope!"***
>
> *Peter Vanacker Neste CEO from Outrage & Optimism Oct 2020*

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