

ishka View

EXTRA

ESG AND SUSTAINABLE AVIATION

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This is the sixth in a series of supplements delivering 'The Ishka View' on aviation's Environmental, Social, Governance (ESG) and other Sustainability developments, including regulatory changes, green finance, sustainable aviation fuel (SAF), hydrogen propulsion, and other decarbonisation efforts. This January 2023 issue covers developments during November and December 2022.

ESG issues permeate every aspect of aviation finance and the industry's long-term strategies have a duty to improve in all three areas. At the same time, the worsening climate crisis has made environmental sustainability a key priority. The global share of greenhouse gas (GHG) emissions from flying has increased steadily, with global aviation emissions doubling since the mid-1980s. The industry has a responsibility to reduce its environmental impact whether through technological innovation and voluntary decarbonisation commitments, or regulator-led initiatives like green finance taxonomies, SAF mandates, taxes, or emissions criteria.

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KEY TAKEAWAY: EU AGREES AVIATION ETS CHANGES BUT SAF RULES SLIP INTO 2023

THE ISHKA VIEW

- The EU continues to make inroads in its advancement of the '**polluter pays principle**' including for aviation. The final legislative position on Aviation EU emission trading scheme (ETS) reform encapsulates this, raising the price of polluting faster over the next two years to already as much as **€5 billion** (\$5.28 billion) by 2025 – around five times of what it paid in 2019 – according to estimates by Airlines for Europe.
- In the EU's race to achieve greenhouse gas emissions (GHG) reductions of at least 55% by 2030 (compared to 1990 levels), aviation was always expected by all stakeholders to have to play a bigger part. However, whether EU member states would dare put an end to the exclusion of **extra-EEA flights** from its ETS was less clear. Finally, a conservative position has prevailed, **kicking the can down to 2026**.
- The onus is now on ICAO to raise the ambitions of CORSIA in its 2025 Assembly to convince the EU that international flight emissions outside the EEA should remain its exclusive purview. But Brussels has become increasingly bold in its handling of GHG resulting from European economic activity beyond its borders, such as efforts to introduce a Carbon Border Adjustment Mechanism (CBAM). If this boldness extends to air travel again in 2026, it could once again upset major powers such as the US and China, which back **in 2012 used Airbus orders** to pressure the EU into not including international flights in its ETS.

EU trilogue* negotiations in December resulted in a final legislative decision to **tighten the EU ETS** application to aviation as part of the EU's ambitious environmental Fit for 55** package, while other legislative proposals under the package – notably the ReFuelEU Aviation proposal introducing SAF mandates – saw its final deliberation slip into 2023.

EU aviation emissions to cost more from 2026

In the [early hours](#) of 7th December, the EU Council and the European Parliament [reached an agreement](#) on **the EU ETS Aviation reform** which paves the way for a faster phase-out of free airline emissions allowances and introduces a system to monitor, report and verify (MRV) non-CO2 emissions as well as a "SAF allowances" pricing scheme. The political agreement must now be formally adopted by the European Parliament and the Council. Once this process is completed, the new rules will be published in the Official Journal of the European Union and enter into force.



Trilogue negotiators on 7th December 2022. Source: EU Climate Action

The [newly agreed measures](#) accelerate the implementation of the 'polluter pays principle' and comprise:

- **Free allowances out by 2026:** Free emissions allowances for airlines covered by the EU ETS will be phased out a year earlier than originally planned, which will raise the operational cost of impacted airlines. Emission allowances will be **phased out gradually from 2024** (25% reduction) and into 2025 (50%). Once phased out, airlines will be subject to full auctioning of allowances.
- **SAF allowances:** Twenty million free allowances (worth approximately **€1.6 billion** or \$1.69 billion) will incentivise the uptake of sustainable aviation fuel (SAF). All fuels eligible under RefuelEU, except fuels derived from fossil fuels, will be eligible for the SAF allowances. The mechanism will be in place until 2030. Small islands, small airports and outermost regions will be able to cover the price differential between kerosene and eligible fuels with 100% of the SAF allowances to ensure the availability of the eligible fuels in these locations with specific supply constraints. For all other airports, the coverage of the price differential will be modulated according to the type of fuel: 95% for renewable fuels of non-biological origin (RFNBOs), 70% for advanced biofuels, and 50% for other eligible fuels.
- **Non-CO2 MRV:** Airlines to start reporting non-CO2 effects (harmful gases, soot particles, contrail formation) from 2025, with a legal proposal in 2027 to codify an extension of the ETS to cover non-CO2 effects.

As regards the use of revenues, co-legislators agreed to transfer five million of allowances from the aviation sector to the Innovation Fund, a large funding programme for the demonstration of innovative low-carbon technologies.

Airline trade association **Airlines for Europe (A4E)** criticised in a [statement](#) on 7th December the accelerated phase-out of emission allowances saying the cost of compliance for the ETS is likely to have increased five times in size by 2025 to over €5 billion (\$5.27 billion) annually. However, A4E welcomed the introduction of a SAF allowances system.

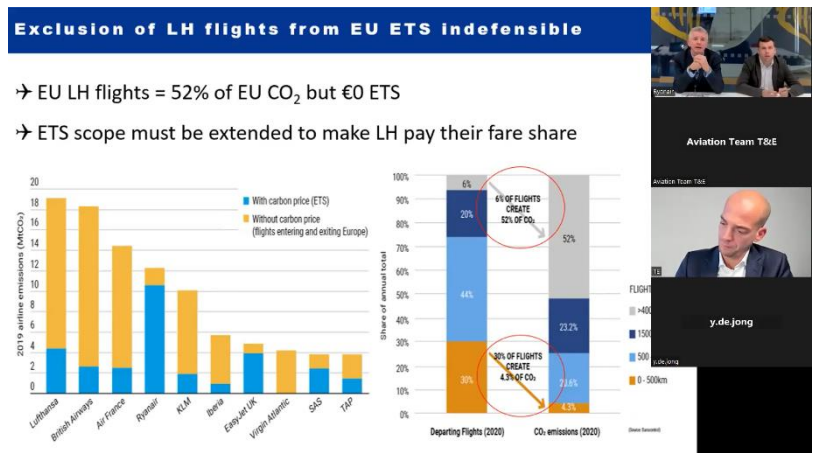
A CORSIA 'last chance' decried by environmentalists... and Ryanair

The agreement reached means the European Commission must assess by 1st July 2026 (after the next ICAO Assembly in 2025) whether CORSIA, ICAO's global flight carbon offsetting instrument, is an effective system to reduce global air travel emissions. If the EU Commission concludes that CORSIA is insufficient, the ETS can begin to apply to international flights departing from the EEA from 2027. However, the **provisional continuation** from the EU ETS of the **extra-EU flight exclusion** (a 'stop the clock' mechanism introduced in 2012, when a previous proposal to include them succumbed to international and industry pressure) remains contentious and is juxtaposed with a [recent decision](#) to incorporate 50% of all incoming and outgoing shipping voyages to and from the EU to the EU ETS.

Green MEP [Bas Eickhout](#) says the exclusion gives ICAO a "last chance" to improve CORSIA, a 'last chance' which appears in particular long-haul airlines (IATA earlier in 2022 [expressed](#) "concern" at the EU Parliament's now-failed proposal to expand the EU ETS scope).

But the EU's compromise on international flights (a result of EU member states blocking the Parliament's proposal) has been criticised by observers and environmental groups. Jonathan Packroff, a policy reporter at *Euractiv*, [cautioned](#) that using CORSIA as an excuse to delay the inclusion of international flights in the EU ETS further **proves warnings by critics of CORSIA** – a scheme with lower decarbonisation incentives. ICAO's CORSIA does not require the offsetting of international aviation emissions, but only those above an 85% threshold based on 2019 levels and using offsets that are significantly cheaper than ETS emission allowances.

The outcome is also favourable for legacy airlines with long-haul routes, which has prompted low-cost **Ryanair** to join forces with an unlikely ally, NGO **Transport & Environment**, to decry their exclusion. In a [joint webinar](#), T&E Executive Director William



Unusual bedfellows: T&E and Ryanair join forces to criticise the exclusion of extra-EEA flights from the EU ETS until at least 2027.

Todts and Ryanair CEO Michael O’Leary criticised the “injustice” of the exclusion. T&E also [criticised](#) it in its website, saying restricting EU ETS coverage to intra-EEA flights will “see another lost decade in tackling emissions” as it leaves 58% of Europe’s aviation CO2 emissions unaccounted. T&E, however, lauded the inclusion of a non-CO2 MRV.

On a related CORSIA development, the **Council of the EU** on 19th December 2022 [adopted a decision](#) enabling member states to fulfil their first annual CORSIA obligation to notify operators’ emissions.

Final SAF mandate deliberation slips into 2023

According to *Euractiv*, negotiators on the **ReFuelEU Aviation** proposal are set to [reconvene](#) in January 2023 when Sweden [takes over](#) the EU Council presidency. *Euroactiv* understands that including nuclear as a potential power source for creating e-fuels was a red line for the Parliament’s socialist and green lawmakers, who reportedly dragged a late-evening trilogue session on 8th December until a 5:00 AM stalemate. *Euroactiv* reports that a Commission suggestion to use a negative multiplier of 0.75 for nuclear-based e-fuels – which would allow but disincentive them – failed to break the impasse. Two groups also wanted to see the possibility of national SAF mandates included in the final agreement.

In an interview with *Argus Media* on 15th December, **European Biodiesel Board (EBB)** secretary general Xavier Noyon said the EBB wanted the EU to broaden the range of feedstocks beyond advanced ones listed in the renewable directive’s Annex IX to so-called mature feedstocks listed in Part B but “that looks like it’s not going to happen.”

For a recap of the main points of contention on the ReFuelEU Aviation proposal, see this [Twitter thread](#) by *Euractiv* transport correspondent Sean Goulding Carroll. Separately, since the last ESG Extra, T&E has [joined forces](#) with the **Global Powerfuels Alliance** to call on the EU Member States and the European Commission to endorse a 2% e-kerosene target in 2030, as adopted by the European Parliament.

EU Commission green-lights France’s short-haul ban

Finally, while not part of the Fit for 55 package, the European Commission has set an [important precedent](#) in allowing France to go ahead for an initial period of three years with its **plan to ban short-haul flights** on environmental grounds between city pairs where time-competitive rail alternatives exist. The French measure prohibits scheduled public passenger air transport services “on all air routes within French territory for which there are several direct rail connections per day, in each direction, of less than two and a half hours.”

Initially, the measure will only affect three routes between Paris-Orly and Bordeaux, Nantes and Lyon – fewer than the eight routes originally targeted, but the number could increase if rail connections improve (such as those replacing flight routes between Paris Charles de Gaulle and Lyon and Rennes, and between Lyon and Marseille) or if rail journey times are further shortened (such as Paris CDG to Bordeaux and Nantes). The measure has been criticised by airlines. **European Regions Airline Association (ERA)** director general Monsterrat Barriga referred to it as “sustainable theatre” in a LinkedIn post. T&E [welcomed](#) it but highlighted it only covers 0.3% of France’s air travel emissions.

Separately, in a related development, French state-owned rail company **SNCF** has been criticised for **greenwashing** its own emissions vis-à-vis aviation. According to a [report](#) by *Le Point* on 13th December, the train operator claimed high-speed trains were 80 times less carbon intensive than air travel. The French National Aviation Merchant Federation (FNAM) brought a case against the campaign at France’s advertising ethics jury, who on 5th December sided with FNAM. For a roadmap to how airlines can avoid greenwashing accusations, consultancy **Simplifying** has a [new whitepaper](#).

COP27: EU suggests aviation levies for landmark fund

Away from Brussels, **European Commission** climate policy chief Frans Timmermans said at COP27 that innovative sources of finance would be needed to fund the landmark Loss and Damage facility announced at the summit, including levies on aviation, shipping, and fossil fuels. Irish environment minister Eamon Ryan made similar comments upon returning from COP27. *Ishka Insights* subscribers can find a detailed summary of [COP27 aviation developments here](#).

* [Trilogues](#) are held between representatives from the EU’s three legislative bodies: the European Commission, the European Parliament, and the Council of Europe. ** For a re-cap on the aviation implications of the Fit for 55 package see previous editions of *Ishka’s ESG Extra* or listen to this 24th November 2022 *Euractiv* [podcast](#) discussing the “death” of cheap flights.

SUSTAINABLE FINANCE

THE ISHKA VIEW

- The small increase in sustainable finance transactions involving aircraft or airlines in 2022 is not necessarily indicative of declining interest, but heightened caution around greenwashing, a fast-changing regulatory landscape, and best-practice expectations being developed by aviation finance stakeholder initiatives.
- The addition of two new carriers – **Jet2** and **Viva Aerobus** – to the list of airline sustainable debt borrowers, Ishka believes, prefaces a broadening of the issuer base in 2023. Also in November, **Deutsche Post DHL Group** – an owner of five cargo airlines – published its sustainability-linked finance framework which also touches on sustainable aviation, presaging sustainability-linked issuances.

2022 ends with nine sust finance transactions in aviation – Ishka recorded nine sustainable finance transactions involving aircraft or airlines in 2022, one more than the eight recorded in 2021. Deals mainly involved private and bank lending, with capital market issuances declining amid rising interest rates. A sustainability-linked revolving credit facility by British leisure carrier **Jet2** and a sustainability-linked bond by Mexican LCC **Viva Aerobus** announced in November were the last two additions to Ishka's tally. For more details, *Ishka Insights* subscribers can access [this report](#) and *Ishka+* subscribers can watch a [new Ishka+ Original](#) examining 2022 sustainable finance trends and 2023 expectations.

NGO experts to publish science-based Taxonomy – NGO experts who in 2022 withdrew from the EU's Taxonomy Group over the inclusion of gas and nuclear energy (a group that included influential transport environmental NGO **Transport & Environment**) are now [expected](#) to publish an independent science-based Taxonomy in January 2023 on the website [greenwashed.net](#). In the same blog post, T&E sustainable finance director Luca Bonaccorsi, expects increased corporate sustainability disclosure requirements in 2023 to result in higher scrutiny of transportation Scope 3 emissions (a point also highlighted by **Vedder Price** in a [7th December review](#) of the aircraft leasing's relationship with the carbon markets). The EU Parliament on 10th November [adopted](#) the **Corporate Sustainability Reporting Directive (CSRD)** which expands ESG transparency requirements to around 50,000 companies up from the current 11,700. On a related note, the **Central Bank of Ireland** in November 2022 [published a detailed guide](#) on sustainable finance and the asset management sector, with details on pertinent disclosures, investment processes and risk management.

EU criticised for dragging its feet on transition finance – Independent climate change think tank **E3G** in a 28th November op-ed [criticised](#) the EU for trailing behind other countries in developing its transition finance framework. E3G said the EU is allowing other jurisdictions to shape the regulatory environment. European businesses, it said, need to know the "direction of travel for the transition" to plan their investment flows. The op-ed coincided [with news](#) that Europe's three primary financial regulatory agencies had delayed the review of key rules for financial products under the **Sustainable Finance Disclosure Regulation (SFDR)** by six months to April 2023. Ishka also [noted in October 2022](#) that aviation stakeholders expect the industry's inclusion in the EU Taxonomy (expected for the end of 2022) to slip into 2023 with a delay of six to 12 months. In the meantime, the EU Commission on 19th December published two [draft documents](#) answering frequently asked questions (FAQ) on the EU Taxonomy. EU Taxonomy consultancy Viridad summarises the key takeaways [in this blogpost](#).

UK Green Taxonomy also delayed – Progress to create a **UK Green Taxonomy** is also falling short of expectations, with the UK government failing to move on the legislation in 2022. The sluggishness has been criticised by the Labour opposition and other stakeholders. In early December, **Shadow Treasury Minister** Tulip Siddiq [reportedly](#) called the government "complacent" for delaying the taxonomy, while the **Confederation of British Industry (CBI)** on 9th December [expressed concern](#) "about a lack of policy clarity and absence of public consultation on the future of the UK Taxonomy." **E3G** also [said in a letter](#) that the decision not to prioritise the UK Green Taxonomy is "disappointing" as many UK firms are required to use the EU Taxonomy, meaning that the UK has lost the opportunity for early-mover advantage. In 2021, the UK signalled that some upcoming green finance eligibility requirements under the UK Green Taxonomy would be based on the EU Taxonomy including transportation.

Ryanair signs up to Citi's sustainable deposit solution – **Ryanair** on 16th November 2022 [announced](#) it had partnered with bank **Citi** to become the first European airline to deposit funds in its new **Sustainable Deposit**

Solution. This will enable Ryanair to invest excess cash to support different sustainable financing projects across Citi's portfolio, such as renewable energy, water conservation, healthcare, and education in emerging markets. The initiative supports Ryanair's sustainability agenda. Funds invested are allocated to finance or refinance assets in a portfolio of eligible green and/or social finance projects, based on the criteria set out in the Citi's sustainable finance frameworks.

SUSTAINABLE AVIATION FUEL (SAF)

UK airlines under spotlight for SAF CFD requests – Independent media platform *openDemocracy* on 15th November [revealed](#), based on freedom of information (FOI) requests, that **Virgin Atlantic, IAG and easyJet** are among the companies demanding public money to help them meet a projected UK SAF mandate. Documents released from a **Department for Transport** consultation in 2021 show Virgin Atlantic demanded a "price support mechanism" to help build the industry needed to produce SAF in the UK. It said the mechanism – which could reportedly cost more than £2 billion (\$2.4 billion) a year by 2030 – "could be part funded if government were to shift funding and incentives from road to aviation". The report contains negative reactions from environmental campaigners to the requests by airlines, but also acknowledges alternative ways of funding a CFD mechanism, such as a tax on fossil jet fuel as proposed by **Transport & Environment**, who in a [study](#) published the same day projected the UK could raise £6.7 billion (\$8 billion) a year for the Treasury. **A Free Ride**, a campaign for "fairer, greener" flight taxation, also [endorsed](#) a CFD system provided it is funded by passengers and airlines. The UK government is currently in the midst of a second consultation on the introduction of a 10% SAF mandate by 2030. **Sustainable Aviation**, which brings together UK airlines and other aviation stakeholders, on 29th November said [new analysis](#) from partners ICF showed that the UK has the necessary SAF feedstocks to meet the 10% target through UK production, but policy support, in the form of a price support mechanism, is needed to deliver sufficient SAF facilities to meet this target.

First 50% SAF commercial air route – A new route between Gothenburg and Lyon operated by Swedish regional carrier **Braathens Regional Airlines (BRA)** will be the first commercial route in the world which will be flown with 50% SAF. With two departures per week, Volvo Group [announced](#) on 8th November that as of autumn 2022 would fly their employees between Renault Headquarters in Lyon and Volvo Group headquarters in Gothenburg with "what is today the most sustainable way to fly." Gothenburg airport is one of the European airports with SAF refuelling capabilities, according to **Eurocontrol's** newly unveiled [interactive map](#) of Europe showcase SAF availability. The map was produced [in cooperation](#) with the **European Civil Aviation Conference (ECAC)**.



Source: Volvo Group

New SAF report on state of development in China – A [new report](#) examining the 'Present and Future of Sustainable Aviation Fuels in China' was published by independent think tank Institute of Energy of Peking University in October. The 64-page report makes several policy recommendations for the Chinese government to support SAF production. A recent short summary of the report's contents is [available](#) on *Green Air*.

Position paper calls for Germany to avoid one-sided focus on e-Fuels – A new [position paper](#) authored by [Peter Smeets](#), board member of **Impact on Sustainable Aviation e.V.** and founder and CEO of **360 Aircraft Finance GmbH (360AF)**, advocates the establishment of a roundtable of top representatives from the state government of Hesse, German aviation companies, Fraports, the fuel industry, and KfW bank group, with the goal of discussing and initiating the development of SAF production capacities in the state of Hesse "in a sustainable and comprehensive manner." The paper argues that a one-sided focus on power-to-liquid (PtL) SAF is short-sighted and not expedient. [Impact on Sustainable Aviation e.V.](#) is a non-profit industry association on sustainable aviation financing (of which Ishka is also a member) while 360AF is a consulting company in the field of aviation. In late November, *Handelsblatt* [reported](#) that the German government would provide around €6 million (\$6.36 million) to a new e-Fuel facility in Frankfurt.

New KPMG report on SAF – KPMG in November published a [new report](#) titled 'Sustainable Aviation Fuel Ready for lift off? Aviation 2030 series' which examines SAF demand and supply with an optimistic view on power to liquid (PtL) synthetic fuel which it says "represents the most scalable product for use long term and a yet untapped solution for the aviation market." *Ishka+* subscribers can also [watch a presentation](#) on KPMG's Perspectives on Decarbonising Aviation with one of the report's authors, Christopher Brown, Partner for Aviation Strategy at KPMG Ireland. Separately, for a recap on the state of electrofuels for aviation, see this **World Fund report** published on 5th December. The report offers a more cautious view on e-Fuels in the context of renewable energy priorities.

REGULATION

UK's Jet Zero Strategy faces political scrutiny –

The UK's **Jet Zero Strategy** was scrutinised by opposition parties during a session in the House of Lords on 14th November. A list of the questions scrutinising the climate viability of the strategy posed to the Parliamentary Under-Secretary for Department for Transport, Baroness Vere of Norbiton, and her responses are [available here](#). Separately, one of the UK government's innovation goals related to the strategy, a [competition](#) to run the first-ever **transatlantic aircraft powered by 100% SAF** between the UK and the US, saw its winner [announced](#) on 16th December: **Virgin Atlantic**. The airline [will operate](#) a Boeing 787 from London to New York using solely SAF in 2023. It will work with a consortium that includes Rolls-Royce,



Source: Virgin Atlantic

Boeing, Pratt & Whitney Canada, Imperial College London, University of Sheffield, RMI, and ICF. Separately on 22nd December, the UK [announced five SAF projects](#) to receive share of £165 million (\$199 million) Advanced Fuels Fund. The [successful projects](#) include SAF plants in Teesside, Immingham and Ellesmere Port which will convert everyday household and commercial waste, such as black bin bags, into SAF. Other successful projects include a SAF plant in Port Talbot which will convert steel mill off-gases into SAF and the early development of a SAF plant using carbon capture and hydrogen made from renewable electricity.

Taking the temperature on aviation mentions in European climate plans – A [recent academic paper](#) published last September conducted a content analysis on all 54 draft and final EU National Energy and Climate Plans (NECPs) to identify how frequently 11 aviation-related terms were used. 'Brace for turbulence: EU Member States' climate strategies in the aviation sector' found 238 aviation-related references, or 4.8 references per 100 pages. Austria was the only state that did not mention aviation, with few references from Romania (1), Finland (2) and Poland (2). **France** (33) and **Spain** (33) referenced aviation in their drafts the most frequently. The final NECPs showed a 134% increase in average aviation-related references per country compared to the drafts. On a related EU development, [Ch-Aviation reports](#) that **Hungary** has quietly altered, without any prior notice, a **windfall tax** on airlines from one designed to counter price rises and fund defence spending, to one that is **based on carbon emissions**. An airline with an aircraft conducting an intra-Europe flight with an emissions value per seat that is lower than 10.5 kilogrammes will pay HUF2,700 (\$6.91) per passenger; HUF3,900 (\$10.42) per passenger for an aircraft with 10.5 to 17.5 kilogrammes per seat; and HUF5,100 (\$13.05) per passenger for aircraft with an emissions value per seat in excess of 17.50 kilogrammes.

CARBON CORNER

IATA warns of costs to reach net zero – IATA director general Willie Walsh told journalists at an end-of-year media event in December that getting to net zero emissions by 2050 would be "very challenging and very expensive," [Green Air](#) reported. Walsh reportedly said there were already signs of increased operating costs related with the transition to net zero, which will start to grow faster from 2024. Walsh's comments coincide with the publication of a [new academic paper](#) in an upcoming issue of the *Journal of Air Transport Management* titled '**Net-zero aviation: Time for a new business model?**' which questions the viability of industry growth in alignment with net zero targets. The paper discusses the implications of continued growth in light of the sector's financial situation and models the cost of biomass-

based and non-biogenic synthetic (electric) fuels in combination with carbon taxes. The paper concludes that if the current business model – volume growth with very small profit margins – is continued, it is likely that aviation's contribution to climate change will grow, due to constraints in biofuel production, cost, and an increase in non-CO2 warming. To stay within 1.5 °C warming, **the sector has to reassess capacity** and its relationship with profitability; and to possibly embrace an altogether different business model. On a related note, Dr Naomi Allen of the UK's **Aerospace Technology Institute (ATI)** published a pertinent [blogpost](#) on 30th November on why aircraft entry-into-service (EIS) dates matter for Net Zero by 2050 targets. Finally, two other relevant reports published in November include a new [Roadmap to True Zero](#) for aviation by consultancy **Roland Berger**, and a [new report](#) with recommendations on developing clear standards for net zero pledges made by businesses by a **UN expert group**, the High-Level Expert Group on the Net-Zero Emissions Commitments of Non-State Entities.

Airlines move to SBTi – JetBlue and Air France-KLM have had their respective emission reduction targets approved by the **Science Based Targets Initiative (SBTi)**. **JetBlue** on 6th December [announced](#) it received SBTi's approval for a strategy to achieve **Net Zero by 2040**, committing to reduce jet fuel emissions 50% per revenue tonne kilometre (RTK) by 2035 from 2019 levels. With this target, JetBlue commits to reducing well-to-wake (lifecycle) scope 1 and 3 greenhouse gas (GHG) emissions related to jet fuel. This science-based target aligns with the goals of the Paris Agreement. **Air France-KLM** on 1st December [announced](#) a commitment to reduce its well-to-wake scope 1 and 3 jet fuel greenhouse gas protocol emissions by 30% per revenue tonne kilometre (RTK) by 2030 compared to 2019, which was approved by the SBTi's Target Validation Team.

New airline task force to tackle contrail impacts – The non-profit **Rocky Mountain Institute (RMI)** on 21st November announced the creation of a [cross-sector task force](#) of aviation industry, tech sector, and academic leaders to explore opportunities to address the warming impact of certain contrails. The **Contrail Impact Task Force** is the first cross-sector forum to address the potential climate impact of contrails, one of the main non-CO2 effects of aviation. The task force was created by Alaska Airlines, American Airlines, Southwest Airlines, United Airlines, Virgin Atlantic, Airbus, Boeing, Breakthrough Energy, Flightkeys, Google Research, Imperial College London, and RMI.

Carbon removals continue to gain traction – **British Airways** on 23rd November announced that carbon removals would join its carbon products along with offsets and SAF via its [CO2llaborate](#) platform. Two carbon removal projects are now available: Blue Carbon Mangrove Project and Freres Biochar Project – the latter ties into a [SAF project](#) in collaboration with LanzaJet and Nova Pangaea Technologies. Separately, **Airbus** and **Air Canada** on 17th November [announced](#) "millions" of investment into Canadian firm **Carbon Engineering** to support direct air carbon capture (DACC) technology. Separately, aviation marketing consultancy **SimpliFlying** published a [mythbuster report](#) in late October 2022 examining some of the claims on airline offsetting by popular comedian John Oliver earlier in 2022.

AIRCRAFT LESSORS AND ASSET MANAGERS

THE ISHKA VIEW

- The fact that there are now more than 10 lessors and asset managers with an interest in **alternative propulsion** fixed-wing aircraft is a pivotal development. In late 2021 Ishka identified just 12 aviation ESG investments by lessors and asset managers (i.e. investments beyond conventional aircraft using current propulsion technology with best-in-class fuel efficiency, such as an Airbus A320neo). That loosely defined list included e-VTOLs (excluded from Ishka's latest analysis) and investments or partnerships by differentiated parent entities. Twelve months on, orders and LOIs for new propulsion assets by the leasing and asset management sectors are numerous enough to be measured as their own market segment.

Lessors and asset managers now make up 1/3 of 'next tech' commitments – Aircraft lessors and asset managers now account for approximately one-third of all commitments for fixed-wing **alternative propulsion clean-sheet** aircraft and **retrofit** programmes, marking a surge of interest by the aircraft financing sector in zero- and low-tailpipe emission assets. Ishka has identified 11 lessors and asset managers with purchase commitments or partnerships designed to make them financing intermediaries in the alternative propulsion regional and subregional aircraft sectors.

The commitments are contained in 15 announcements and related to the purchase of up to 1,110 products. *Ishka Insights* subscribers can learn more in [this report](#).

Lessor Avolon launches SAF feasibility study in Ireland – Avolon on 10th December [announced](#) a collaboration with Boeing, ORIX Aviation, SFS Ireland and SkyNRG, to conduct a feasibility study into the production of SAF in Ireland. Avolon said the partnership reflects its and its partners’ commitment to taking a leading role in helping develop future technologies that reduce the aviation sector’s carbon footprint.

OEM FUTURE PROGRAMMES

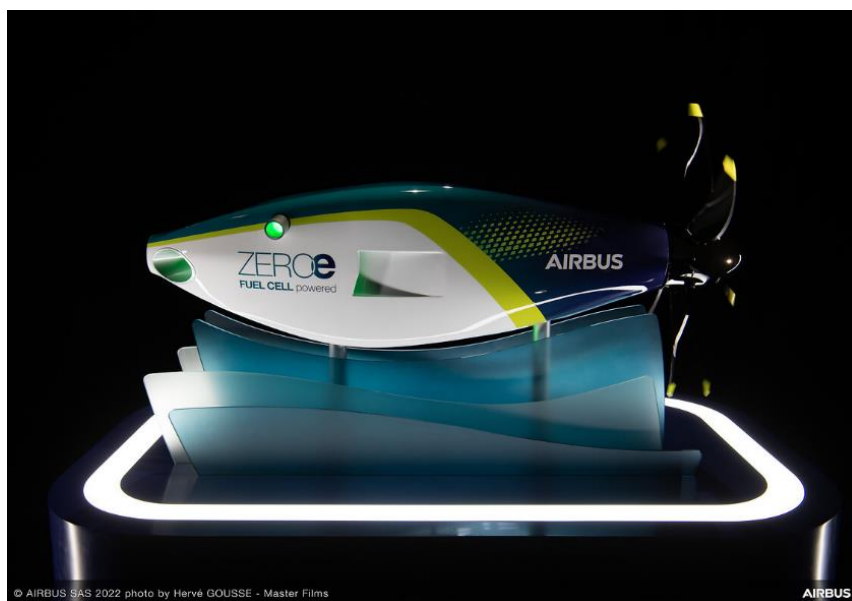
THE ISHKA VIEW

- It has taken a relatively short time (two years) for **alternative propulsion** conversion kits and clean sheet designs to grow from unfamiliar possibilities to propositions with quantifiable customer validation. Several of these designs remain in the drawing board, a few are in the process of undertaking ground tests, and an even smaller number have taken their first flight (Ampaire’s Eco Caravan, VoltAero’s Cassio 330, and more recently, Eviation’s Alice). However, most of the 15 OEMs recently analysed by Ishka have EIS targets in the mid-2020s, which should see many more taking to the air in the next year or two.
- Collectively, firms selling this technology have picked up 3,000-plus commitments, including from lessors. The number of orders show the interest from customers in transitioning towards new technologies aimed at decarbonising air travel – one of the key decarbonisation levers available to the industry. At present, the products gathering commercial commitments only have the potential to decarbonise regional and subregional air services. Nevertheless, they are an important steppingstone for the aviation industry.

‘Next-tech’ propulsion LOIs and orders surpass 3,400 – Subregional and regional aircraft fixed-wing clean-sheet designs or propulsion conversion kits to retrofit existing aircraft types have seen a surge in customer interest over the past 12 months, with dozens of LOIs and orders signed by prospective customers including some lessors and asset managers. **Ishka** has compiled a list of commitments (orders and LOIs) for fixed-wing alternative propulsion aircraft and conversion kits in the regional and sub-regional space. As of 13th December 2022, Ishka had identified **3,435 commitments** of which at least 2,813 are under LOIs (based on the wording of the announcements). Ishka took a broad view of fixed-wing products to include two seaglidars and one eSTOL (electric Short Takeoff and Landing). Overall, commitments are evenly split across hydrogen-electric propulsion (893), jet fuel-assisted hybrid-electric (945), battery electric (1,056), and products straddling both full electric and hybrid-electric configurations (515). *Ishka Insights* subscribers can find a detailed summary [here](#). Recent notable developments involving the OEMs analysed by Ishka include **Eviation** [announcing](#) on 2nd November that its orders have surpassed \$2 billion (followed on 10th November by an [order](#) by **Northern Territory Air Services**), **Cranfield Aerospace Solutions (CAeS)** and **MONTE** announcing on 3rd November the [signing](#) a deal for 40 Britten-Norman Islander hydrogen-electric modification kits (followed by [news](#) on 15th November that **EVIA AERO** has added five more conversion kits to its existing LOI), [news](#) on 10th November that the **FAA** has upgraded its testing laboratory to test electric propulsion, **Ampaire** [flying](#) its first hybrid-electric aircraft (the Eco Caravan) on 18th November, and **Air New Zealand** on 14th December [announcing](#) its Mission Next Gen Aircraft Partners which comprise **Beta**, **VoltAero**, **Eviation** and **CAeS** – the last two with [respective LOIs](#) for up to 23 orders each. Separately, Spanish carriers **Air Nostrum** and **Volotea** [announced](#) on 20th December the acquisition of minority stakes in **Dante Aeronautical** (which is working on electrifying small sub-regional aircraft), and **Universal Hydrogen** [plans](#) on flying its converted Dash 8 for the first time in January 2023 following ground tests before the holiday season. UH’s rival **ZeroAvia** [also plans](#) to begin the first test flights of its 600kW hydrogen-electric powertrain in early 2023 after securing a Part 21 permit to fly for retrofitted Dornier 228 from the UK’s Civil Aviation Authority. ZeroAvia also hosted its annual Hydrogen Aviation Summit in December. Recap and recordings are [available here](#). Finally, senior figures from **Eviation** and **MagniX** were among transport industry leaders sharing their 2023 predictions for aviation decarbonisation in this *GreenBiz* [report](#) published on 3rd January 2023.

Airbus makes hydrogen combustion and refuelling announcements

– Airbus made several technology demonstrator and partnership announcements at its Airbus Summit taking place 30th November and 1st December, including some involving hydrogen propulsion. Chiefly, Airbus [revealed](#) that it is developing a **hydrogen-powered fuel cell engine** and is being considered as one of the potential solutions to equip its zero-emission aircraft that will enter service by 2035. Airbus will start ground and flight testing this fuel cell engine architecture onboard its ZEROe demonstrator aircraft towards the middle of the decade. The A380 MSN1 flight test aircraft is currently being modified to carry liquid hydrogen tanks and their associated distribution systems and will initially test a hydrogen combustion propulsion system by



Airbus ZEROe fuel cell engine. Source: Airbus

2025. Airbus and ArianeGroup, a joint venture equally owned by Airbus and Safran, also [announced](#) plans to work together to build a **liquid hydrogen refuelling facility** for ZEROe aircraft at Toulouse-Blagnac airport. The station will be operational in 2025. The OEM has also [signed](#) a partnership agreement with HyPort, a joint venture between ENGIE Solutions and the Regional Agency for Energy and Climate in Occitanie (AREC), to support the development of one of the world's first **low carbon hydrogen production and distribution stations** at an airport. Construction of the hydrogen station at Toulouse-Blagnac airport was completed earlier in 2022 and the production, storage and distribution systems are currently undergoing final testing. The station is slated to enter service in early 2023 with a capacity to produce around 400 kg of hydrogen per day, providing the possibility to power some 50 ground transportation vehicles. Separately during the event, Airbus CEO Guillaume Faury reportedly [raised concerns](#) on the pace of investment in facilities to produce green hydrogen and SAF.

Embraer unveils new Energia aircraft concepts – Embraer on 5th December [revealed](#) new [aircraft concepts](#) as part of the company's progress report on Energia - Embraer's initiative to get the aviation industry to net-zero by 2050. The company has been focusing on two 19-30 seater designs for hybrid electric and hydrogen electric propulsion: **Energia Hybrid (E19-HE and E30-HE)** – revealed as a nine seater in 2021, Embraer is exploring a 19 and a 30 seater variant: parallel hybrid-electric propulsion, up to 90% CO2 emissions reduction when using SAF, rear-mounted engines, readiness by early 2030's. **Energia H2 Fuel Cell (E19-H2FC and E30-H2FC)** – revealed as a 19 seater in 2021, Embraer is exploring a 30 seater variant: hydrogen-electric propulsion, zero CO2 emissions, variants rear-mounted electric engines, readiness by 2035. The concepts remain at the evaluation phase, while the architectures and technologies are being assessed for technical and commercial viability.

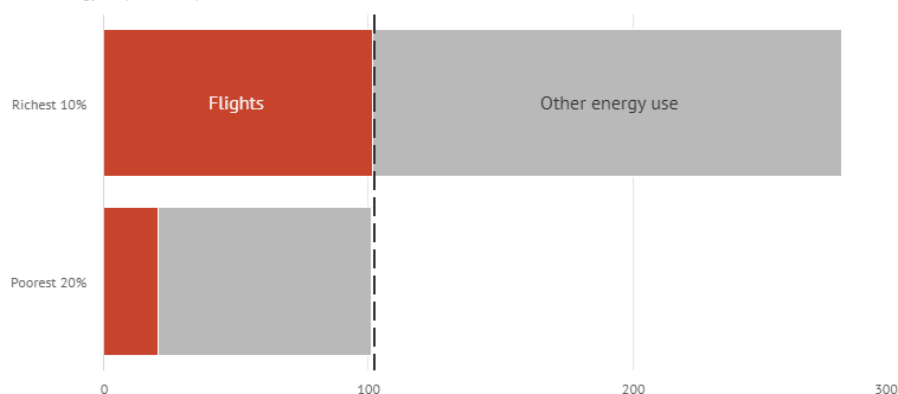
Rolls-Royce tests hydrogen on converted AE 2100-A regional aircraft engine – **Rolls-Royce** and **easyJet** on 28th November [confirmed](#) the world's first successful run of a modern aero engine on hydrogen. The ground test was [conducted](#) on an early concept demonstrator using green hydrogen. The test took place at an outdoor test facility at MoD Boscombe Down, UK, using a converted **Rolls-Royce AE 2100-A** regional aircraft engine which powers, among other aircraft, the Saab 2000. Following analysis of this test, the partnership plans further rig tests leading up to a full-scale ground test of a Rolls-Royce Pearl 15 jet engine, and a longer-term ambition of carrying out flight tests. Separately, on 17th November Rolls-Royce [announced](#) that it successfully entered the final phase of testing its **ALECSys (Advanced Low Emissions Combustion System)** demonstrator engine, this time at altitude, in Tucson, Arizona, USA. The innovative lean-burn combustion system improves the pre-mixing of fuel and air prior to ignition, enabling cleaner combustion of the fuel, which results in lower NOX and particulate emissions.

OTHER DEVELOPMENTS

New whitepaper outlines airport hydrogen hub model – The US-based **Vertical Flight Society (VFS)**, a non-profit organization working to advance vertical flight, on 21st December [published](#) a [whitepaper](#) for multimodal hydrogen airport. The goal of the **VFS H2-Aero whitepaper**, “Multimodal Hydrogen Airport Hub,” is to propose a repeatable hydrogen hub for the airport, first with a ground vehicle fueling station, and later expanding to an airport-based hub supplying multiple modes of transportation. The H2-Aero Team was formed in 2022 with the goal to decarbonize aviation with carbon-free hydrogen, as a follow-on to SAF. Whitepaper leads include ZeroAvia’s Todd Solomon, Shell’s Griffin Valentich, and Bell Textron’s Joe Rainville. On a related aviation hydrogen research development, modelling by aviation experts at **Cranfield University** [unveiled](#) on 13th December, as part of a major UK aviation consortium, has shown that passengers could be flying between UK regions on planes with zero carbon emissions as soon as 2026. Cranfield also [produced](#) a Technical Report looking at the Ownership and Operating Cost Model as part of the project.

The richest British people use **more energy flying** than the poorest use overall

Annual energy use per adult equivalent, GJ



Source: Baltruszewicz et al. (2022). Chart by Carbon Brief.



New research tackles UK flying inequity and tourism role in climate change – A [new academic paper](#) to be published in an upcoming issue of the *Ecological Economics* journal, ‘Social outcomes of energy use in the United Kingdom: Household energy footprints and their links to well-being’, examines the inequalities in the annual energy footprint of people in the UK. It shows domestic and international flights taken by people with the highest incomes used around five times more energy than those taken by the poorest. *Carbon Brief* has produced a

[summary](#) of the paper’s findings. Separately, another [academic paper](#) to be published in an upcoming issue of *Tourism Management* journal, ‘A review of tourism and climate change mitigation: The scales, scopes, stakeholders and strategies of carbon management’ concludes that without mitigation efforts, tourism will deplete 40% of the world’s remaining carbon budget to 1.5 °C. Yet, the most powerful decarbonisation measures including those for aviation (the most relevant subsector in this development, with the lowest potential for emission reductions) face major corporate, political and technical barriers.

First session of the Alliance for Zero-Emission Aviation – A recording is [available here](#) of the first session on 14th November of the General Assembly on the **Alliance for Zero-Emission Aviation (AZEA)**, a European Commission-led private-public initiative to prepare the entry into commercial aircraft of hydrogen-powered and electric aircraft.

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