Efficiency at altitude

Relying solely on sustainable aviation fuel won't deliver the airline sector's climate goals. Hannah Heuser and Kenny Tsang outline other practical steps that airlines can take to reduce emissions and improve profitability.

Setting the scene

Air transport demand is projected to grow by an average of 4.3% per annum over the next 20 years,[1] and already accounts for 2-3% of global carbon dioxide emissions.[2] In response, regulators are tightening emissions requirements. Airlines flying within the EU have been part of the EU's Emissions Trading Scheme (ETS) since 2012 and the ReFuelEU policy package mandates a sustainable aviation fuel (SAF) blend starting at 2% from 2025.[3] The UK is rolling out its own SAF requirement, Brazil has introduced domestic emissions reduction and China is requiring availability on certain routes.

The global Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) requires airlines to buy carbon credits to balance out any increase in emissions from international flights above 2020 levels. For airlines and investors, this means emissions are a core cost and compliance driver. Although the scheme is currently voluntary for participating states, it will become mandatory for nearly all International Civil Aviation Organization member states from 2027, tightening compliance obligations for airlines.

Demand for flights bounced back sharply after the pandemic and remains on an upward trajectory, but uptake of sustainable aviation fuel (SAF) has failed to keep pace. This poses a problem for airlines under pressure to cut their carbon emissions, and for policymakers. While regulations have sought to increase SAF use, relying on SAF alone to curb carbon emissions is neither realistic nor cost-optimal.

We outlined the challenges with SAF in our article on low-emissions fuels, published in the EOS Q1 2025 *Public Engagement Report*.[4] These include limited infrastructure development and production capacity, lengthy and complex certification processes, feedstock availability issues, and regulatory misalignment.

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[1] https://www.gaa.aero/en/industry-outlook/
[2] https://www.iea.org/energy-system/transport/aviation
[3] https://transport.ec.europa.eu/transport-modes/air/environment/refueleu-aviation_en
[4] EOS Public Engagement Report

Some of these challenges were discussed at a Q4 2025 public policy engagement meeting that we attended with EU regulators, an aviation association, several international airlines and a SAF producer. Participants argued that European SAF adoption is hindered by unfair pricing, opaque surcharges, and limited infrastructure access controlled by dominant suppliers.

Airlines face significant compliance fees under the ReFuelEU policy package, and lack transparency or sustainability documentation, reducing their ability to claim SAF benefits. High costs, market distortions, and infrastructure barriers deter new suppliers and early investment. Participants saw an urgent need for policy reform, transparency, and defining standards on infrastructure access to support the development of a market for SAF.

As aviation fuel makes up 25-30% of an airline's operating costs,[5] every percentage point of fuel saved helps to improve operating margins, while also reducing exposure to carbon pricing under emissions trading schemes and CORSIA. There are several ways for airlines to reduce their fuel consumption, which range from the technological to the operational, all of which will help to reduce costs and ultimately increase profitability.

Ground operations

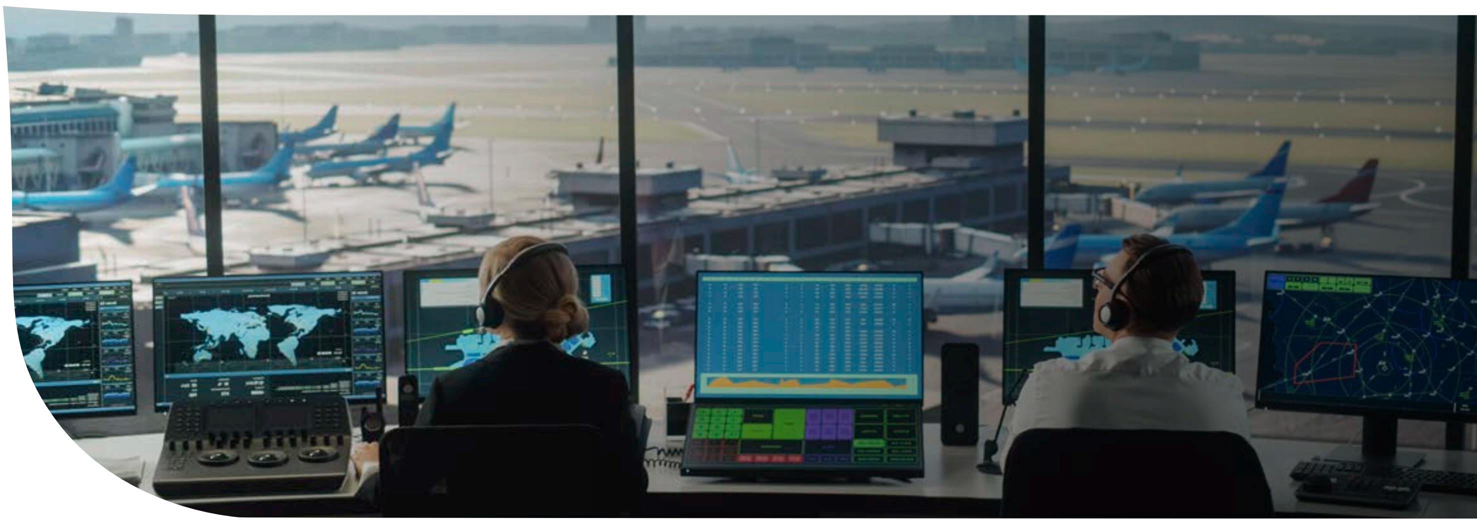
Ground operations are a material component of total aviation sector emissions. Airlines can cut emissions and fuel costs by switching to electric ground support equipment (eGSE) and improving the way that aircraft taxi to and from the runway. Although eGSE requires higher upfront capex, its lower energy use, reduced maintenance requirements, and longer equipment lifespans make it an increasingly attractive choice for airports and airlines seeking to improve their emissions, fuel and cost efficiency.

Meanwhile, something as simple as single-engine taxiing (SET), which involves using only one engine while aircraft are on the ground, can cut fuel use and emissions by at least 7-14%.[6] It also reduces the wear on engines and brakes, as lower volumes of dust and debris are sucked in, and less braking is required. SET is therefore a relatively simple change that can deliver environmental benefits and meaningful fuel savings.

Finally, real-time data and artificial intelligence-assisted surface management to optimise pushback times, taxi routing, and gate allocation can deliver 2-5% of fuel savings across airline operations by reducing idling time and taxiway congestion.[7] Financially, these methods reduce fuel operating expenses and carbon-cost outflows and extend the life of aircraft components, with paybacks that are typically shorter than airframe capex cycles.

Engine testing

Post-maintenance engine testing is a small slice of total emissions, but advanced digital simulation and electric test rigs can trim fuel consumption, cut direct emissions and extend engine lifecycles by reducing the number of test cycles required. At fleet scale, the cumulative effect reduces fuel and maintenance costs and improves asset turnover due to reduced aircraft downtime.



[5] https://www.iata.org/en/publications/newsletters/iata-knowledge-hub/fuel-efficiency-in-aviation-why-it-matters-more-than-ever/
[6] The impact of single engine taxiing on aircraft fuel consumption and pollutant emissions | The Aeronautical Journal | Cambridge Core
[7] How Big Data And AI Help Reduce Airline Fuel Consumption And Lower Emissions

Optimising flight paths

Modern flight path optimisation combines dynamic aircraft-performance models with environmental inputs such as wind speed, temperature, and airspace constraints to find the best path available. Research shows that actual routes flown across the mid-North Atlantic are typically several hundred kilometres longer than the fuel-optimised paths, with some air navigation still reliant on ground station waypoints to help air traffic control space out aircraft.[8] Route optimisation, leveraging satellite coverage and GPS positioning, could yield 6.7 million kg of CO_2 emissions savings across the winter period of each year alone.[9] Selecting altitudes and trajectories that exploit tailwinds and avoid headwinds could reduce global flight costs by 5%.[10]

The same optimisation approach can target contrail avoidance through small vertical or lateral adjustments that bypass ice-supersaturated layers. Contrails are estimated to drive 1-2% of anthropogenic warming,[11] and a small fraction of flights account for most contrail-related warming. For airlines making this change it means an immediate climate-impact reduction, strengthening their social licence to operate, and their resilience to tightening regulation.

> **Companies should consider how their current capital allocation decisions will shape the future aviation landscape and their own longer term competitiveness.**

Speed control

By dynamically adjusting aircraft cruising speeds based on real-time traffic and weather data, airlines can avoid inefficient holding patterns and reduce fuel burn. Slight reductions in cruising speed reduce drag, save fuel and improve schedule reliability when integrated with broader traffic-flow management. The financial effect is twofold in that less fuel is burned, and there are fewer delays disrupting crew and aircraft rotations.

Fleet renewal

While fleet renewal investments are significant for airlines, they can help to reduce operational costs over the longer term. Modern aircraft consume up to 25%[12] less fuel than the models they replace, thanks to advances in aerodynamics, lighter materials, and more efficient engines. Airlines renewing 85% of their fleet have been shown to achieve a 16% reduction in CO_2 emissions.[13]

However, not all retired aircraft are then used for parts or recycled. Aeroplanes that are not immediately sold or leased may be stored in aircraft boneyards, where they are preserved for future use or sale. Older operational aircraft are typically sold to smaller or budget airlines, especially in developing markets where upfront cost is a key factor.

Disruptive technologies

Beyond these shorter-term efficiency gains, companies should consider how their current capital allocation decisions will shape the future aviation landscape and their own longer-term competitiveness. Given the longevity of aircraft, investing in a new kerosene-powered fleet could pose a stranded asset risk as electrification and hydrogen technologies for the aviation sector develop. Chinese battery producer CATL and aerospace manufacturer Comac are investing billions in research and development annually, aiming to launch an electric plane with a range of up to 3,000km in the next three to four years.[14]

Finally, as regulation to curb emissions tightens, airlines should look to the future rather than rely solely on marginal advancements in legacy technologies. For example, they could collaborate with aircraft suppliers to develop new propulsion technologies and engines to exploit competitive advantages and avoid losing market share to potential new entrants.

Our engagements

Airlines are aware of the limitations of SAF and are exploring many of the other options described above. In our engagement with the chair of Lufthansa, he reiterated the challenges with SAF and said that fuel burn is the number one

[8] https://www.flightradar24.com/blog/aviation-explainer-series/flight-paths-and-great-circles-why-are-great-circles-the-shortest-flight-path/#:~:text=As%20aircraft%20fly%2C%20they%20pass%20over%20ground,able%20to%20fly%20more%20direct%20flight%20paths.
[9] Reducing transatlantic flight emissions by fuel-optimised routing
[10] journal-ok_1_.pdf
[11] How can the UK lead the way on contrail avoidance? | Aerospace Technology Institute
[12] https://theflyingengineer.com/most-fuel-efficient-airlines/
[13] IATA - CO2 Connect Brings Transparency to Airlines' Decarbonization Efforts
[14] Awaiting take-off - Carbon Tracker Initiative

lever the airline is employing in pursuit of its environmental goals. He highlighted the role of engine producers in developing breakthrough technologies that will help the sector. In recognition of this, the board's ESG committee is being revamped as the innovation, technology, and sustainability committee. The company is also aiming to strengthen the board's AI skills and experience to reflect AI's increasing role within ground operations and flight path optimisation.

Airbus's detailed transition plan shows five levers for achieving its emissions targets, including technology improvements and fostering air traffic management efficiency improvements. The roadmap sets out its key dependencies and how the company is working to overcome these, while investments include a major project to develop a hydrogen aircraft. Delivering the transition plan will help to mitigate transition risks while aligning technology investments with the growing market demand for fuel-efficient aircraft.

At air transportation services company ANA, we engaged with the executive president and chief sustainability officer, and a pilot to understand how operational decisions are made at the point of execution. Pilots remain the ultimate decision-makers on fuel uplift, routing and other real-time choices in the cockpit. But the company has begun to embed environmental considerations in pilot evaluation processes. It is also promoting "green procedures," and using data-driven feedback to encourage adoption. We welcomed this direction and asked the company to formalise these measures within training and flight-simulation modules to drive consistent uptake. The company acknowledged that many of the manoeuvres are straightforward and currently shared as best practice.

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Outlook

It is increasingly important for airlines to address efficiency and emissions reduction through operational levers as demand grows and regulation tightens. Non-compliance and an overreliance on SAF could increase costs and the risk of asset stranding, eroding margins and strategic flexibility. Conversely, making some of the changes we have outlined might help to reduce emissions, and fuel and compliance costs. We will continue to advocate for robust transition plans that prioritise near-term efficiency gains, while also supporting next-generation propulsion development.

Engagement themes for the aviation sector

Industry	Engagement theme	Drivers of long-term value[15]
Aerospace & Defence	Climate Opportunities	There is potential long-term downstream demand from aircraft operators for planes that can run on SAF and electricity. This will require R&D, capex, and new supplier relationships.
Aerospace & Defence	Greenhouse Gas Emissions	There is more immediate downstream demand from aircraft operators for more efficient aircraft. As operators turn over their fleets, the emissions and efficiency profile of aerospace products could be a critical decision point. Keeping pace with these standards will require additional R&D and capex.
Transportation (Air Travel)	Greenhouse Gas Emissions	Aircraft operators and airports face regulatory mandates to reduce emissions and improve the efficiency of their operating activities. Pursuing these ends will require R&D, capex, expense structure changes, and partnerships. The result will be lower operating costs and exposure to global regulatory regimes.
Energy	Climate Opportunities	Energy firms have regulatory and customer-driven tailwinds that are driving further production of SAF. To increase production and realise this revenue opportunity, these companies will have to incur R&D expenses, capex, and changes to operating expenses.

Source: Federated Hermes.
Table compiled by Luke Fleisch, ESG Analyst, FHI
[15] Non-company specific drivers of long-term value

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