



Decarbonizing the sky

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Executive summary

Decarbonizing the sky is no longer a branding choice; it is a multi commodity risk problem that will reshape how airlines, lessors, airports and fuel suppliers think about fuel, balance sheets and competitive advantage over the next decade. Aviation now operates at the intersection of volatile ATF prices, structurally expensive and supply constrained SAF, and tightening carbon price regimes such as EU ETS and CORSIA.

Aviation contributes an estimated 2% to 3% of global carbon emissions, but its share is expected to rise as other sectors decarbonize more rapidly and air travel demand continues to grow, particularly in APAC and India. In response, regulators are hard wiring decarbonization into fuel markets: ReFuelEU Aviation and the UK SAF mandate require a 2% minimum SAF blend from 2025, rising steeply toward 6% in 2030, 20% in 2035 and 70% by 2050¹, with a separate sub mandate for synthetic e fuels. At the same time, CORSIA is moving from pilot to mandatory phases through 2035, expanding offset obligations for international flights between participating states, while regional systems such as the EU ETS impose explicit carbon costs on intra European routes.

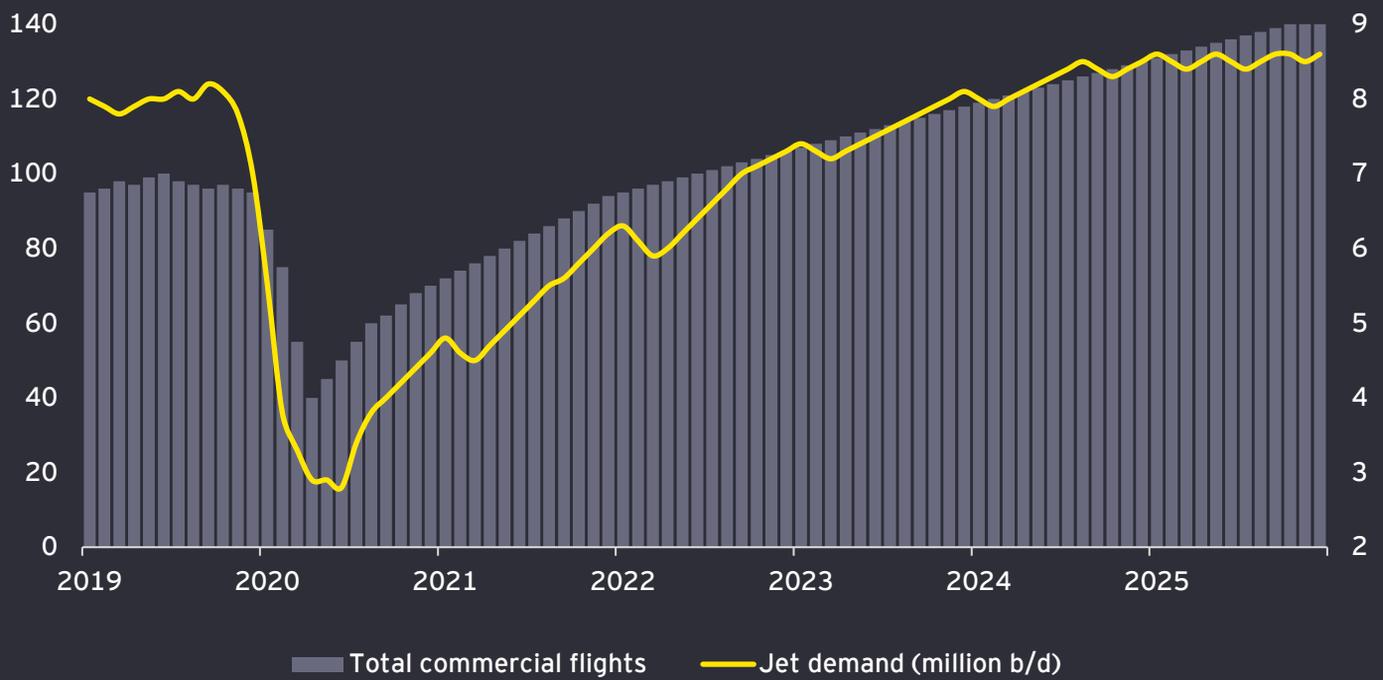
Yet global SAF production is expected to reach just 1.9 million tons in 2025² – around 0.6% of total jet fuel consumption – and SAF prices still range from roughly two to as much as five times the cost of fossil jet fuel in mandated markets, translating into several billion dollars of incremental fuel expense for airlines in 2025 alone. Carbon prices are also trending upward: EU ETS allowances have previously touched levels near 100 EUR/tCO₂, and estimates by professionals suggest that global “optimal” carbon prices consistent with Paris targets should lie in the range of 50-100 US\$/tCO₂ by 2030, materially above current averages.

In this emerging landscape, traditional ATF hedging – often cross hedging jet exposure with crude and gasoil or kerosene – remains necessary but is no longer sufficient. Airlines and other aviation stakeholders should shift to managing a “carbon adjusted fuel cost” that combines ATF, SAF premia and carbon obligations into a single risk metric and then hedge that composite exposure using a mix of fuel derivatives, SAF offtakes and carbon instruments. The prize is not only downside protection but also strategic optionality: the ability to allocate scarce capital between SAF, offsets, fleet renewal and route economics with a clear view of risk adjusted returns. The perspective in this paper is that decarbonizing the sky is fundamentally about building an integrated fuel and carbon market capability. For airlines, lessors, airports and fuel suppliers in the EU/UK and APAC/India, this means three things: reframing ATF hedging through a carbon lens; treating SAF offtake contracts and carbon credit portfolios as part of the same commodity stack; and establishing a cross functional aviation fuel and carbon desk with the analytics, governance and technology to manage these exposures at scale.

1. International airlines face major CORSIA offset costs from 2027, says IBA - GreenAir News

2. CLECAT | IATA WARNS OF SLOWING SAF PRODUCTION GROWTH AHEAD OF UPCOMING EU MANDATES

Commercial growth vs. jet demand³



Global jet demand recovery lags commercial flight growth



SECTION 2

The new operating context for aviation

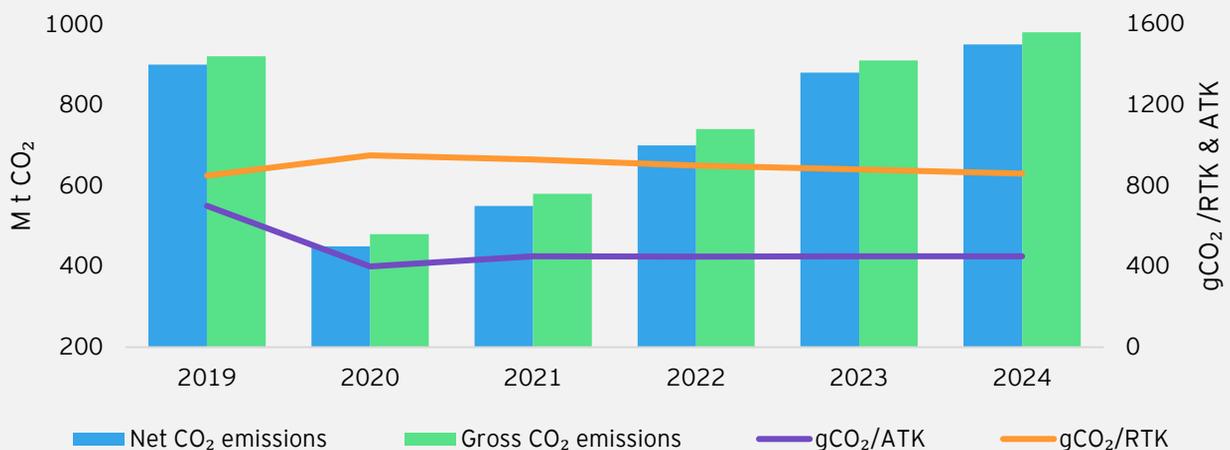


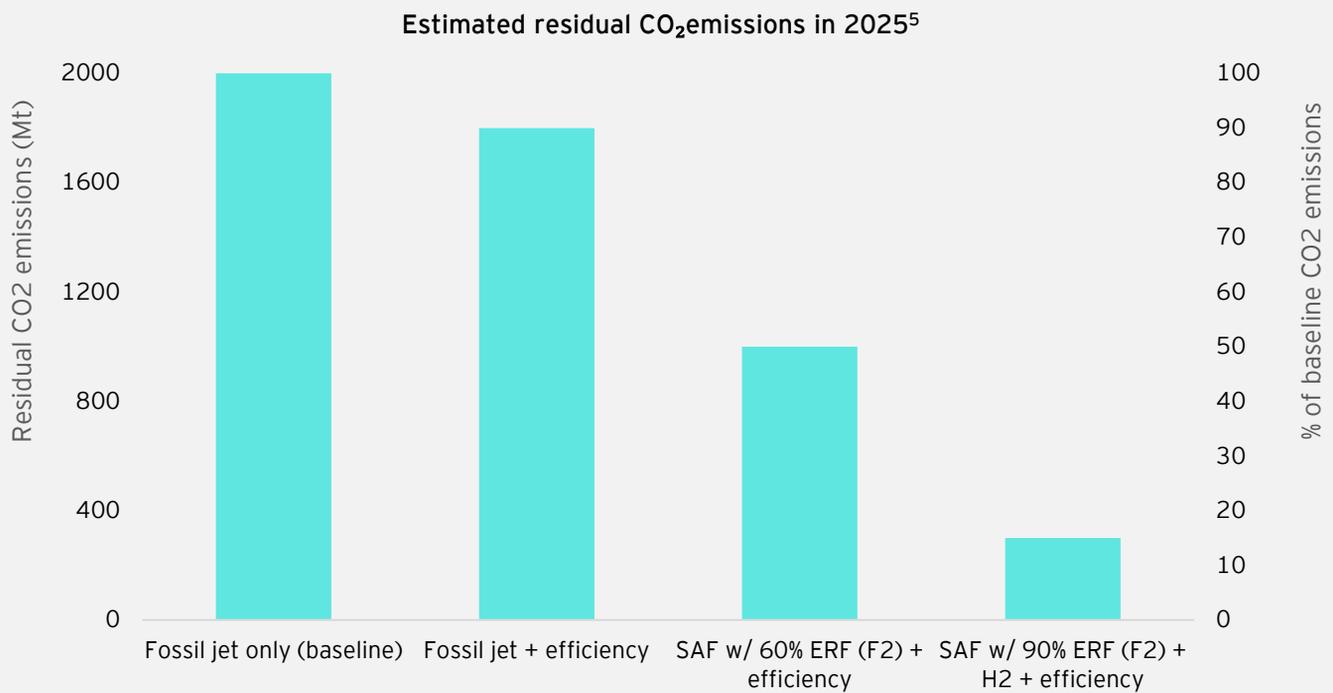
2.1 Demand growth meets hard climate constraints

Long term traffic forecasts continue to anticipate robust growth in passenger kilometers, with much of the incremental demand coming from emerging and middle income markets in Asia, including India. At the same time, the global climate policy architecture – from the Paris Agreement to national net zero commitments – is tightening the allowable emissions envelope, making aviation’s 2% to 3% share of global carbon emissions commercially sensitive.

This tension is being internalized into aviation markets through three linked levers. First, SAF mandates in the EU, UK and other jurisdictions are forcing the physical decarbonization of uplifted fuel. Second, carbon markets such as the EU ETS and CORSIA are attaching an explicit price to residual emissions from certain routes. Third, investors, customers and corporate travel buyers are applying their own decarbonization criteria, favoring carriers and airports with credible net zero strategies.

Total airline sector gross and net CO₂ emissions and CO₂ intensity (2019-2024)⁴





2.2 EU/UK and APAC/India: Different starting points, converging pressures

The EU's ReFuelEU Aviation Regulation sets a minimum SAF share in jet fuel supplied at EU airports of 2% in 2025, 6% in 2030, 20% in 2035 and 70% by 2050, with synthetic e fuel sub targets rising from 0.7% in 2030 to 35% by 2050⁶. The UK's parallel SAF mandate starts at 2% in 2025 and ramps up toward 10% in 2030 and higher thereafter, placing comparable obligations on fuel suppliers and, indirectly, on airlines operating from UK hubs.⁷

APAC and India are at an earlier regulatory stage but face similar directional pressures. Several jurisdictions are piloting SAF

incentives, blending targets or green aviation roadmaps, often with a mix of tax incentives, feed in tariffs and public private collaborations. India's growth as an aviation market – with rapidly increasing domestic and international connectivity – places it on a trajectory where future SAF obligations, participation in regional ETS schemes or alignment with CORSIA could become material cost drivers within the investment horizon of today's fleets.

5. IATA

6. International airlines face major CORSIA offset costs from 2027, says IBA - GreenAir News

7. ReFuelEU Aviation - Policy Tracker

SECTION 3

Three intertwined markets: ATF, SAF and carbon



3.1 ATF: A familiar but still dominant risk

Jet fuel typically represents 20% to 30% of an airline's operating costs, and volatility in crude and refining margins can quickly translate into swings in earnings and cash flow. Airlines have historically managed this exposure through a mix of physical procurement strategies and financial hedging, including cross hedging with crude oil, gasoil and jet fuel derivatives. Academic and industry studies, including work focusing on Indian airlines, show that well designed hedging programs can materially reduce fuel cost variance and value at risk.⁸

However, years of volatile hedging outcomes, including periods where hedges locked in prices above spot, have prompted some carriers to scale back or abandon hedging, choosing instead to accept spot price risk and relying on fare adjustments and balance sheet resilience. This shift may underestimate the emerging interaction between fuel price risk and carbon related costs: as SAF and carbon prices become embedded in the marginal cost of flying, the volatility profile of "true" fuel cost will change.

3.2 SAF: Structurally scarce and expensive-for now

Global SAF production reached approximately 1.9 million tons in 2025, double 2024 levels but still only around 0.6% of estimated global jet fuel demand. Despite new plants and announced capacities, growth is projected to slow in 2026, with output expected to reach only 2.4 million tons and remain well below what would be required to meet long term net zero trajectories.⁹

Prices reflect this scarcity and policy driven demand. Industry assessments suggest SAF currently trades at roughly two to five times the price of fossil jet fuel in markets with mandates or strong incentives, with the premium varying by feedstock, pathway and region. IATA estimates show that airlines globally paid a SAF premium of around US\$2.9-3.6 billion¹⁰ in 2025 alone, on top of the underlying fossil fuel cost. In mandated markets such as the EU and UK, this premium is effectively non discretionary, making SAF procurement a strategic cost management issue rather than a voluntary sustainability initiative.¹¹

8. [How Much Of An Airline's Expenses Are Jet Fuel?](#)

9. [CLECAT | IATA WARNS OF SLOWING SAF PRODUCTION GROWTH AHEAD OF UPCOMING EU MANDATES](#)

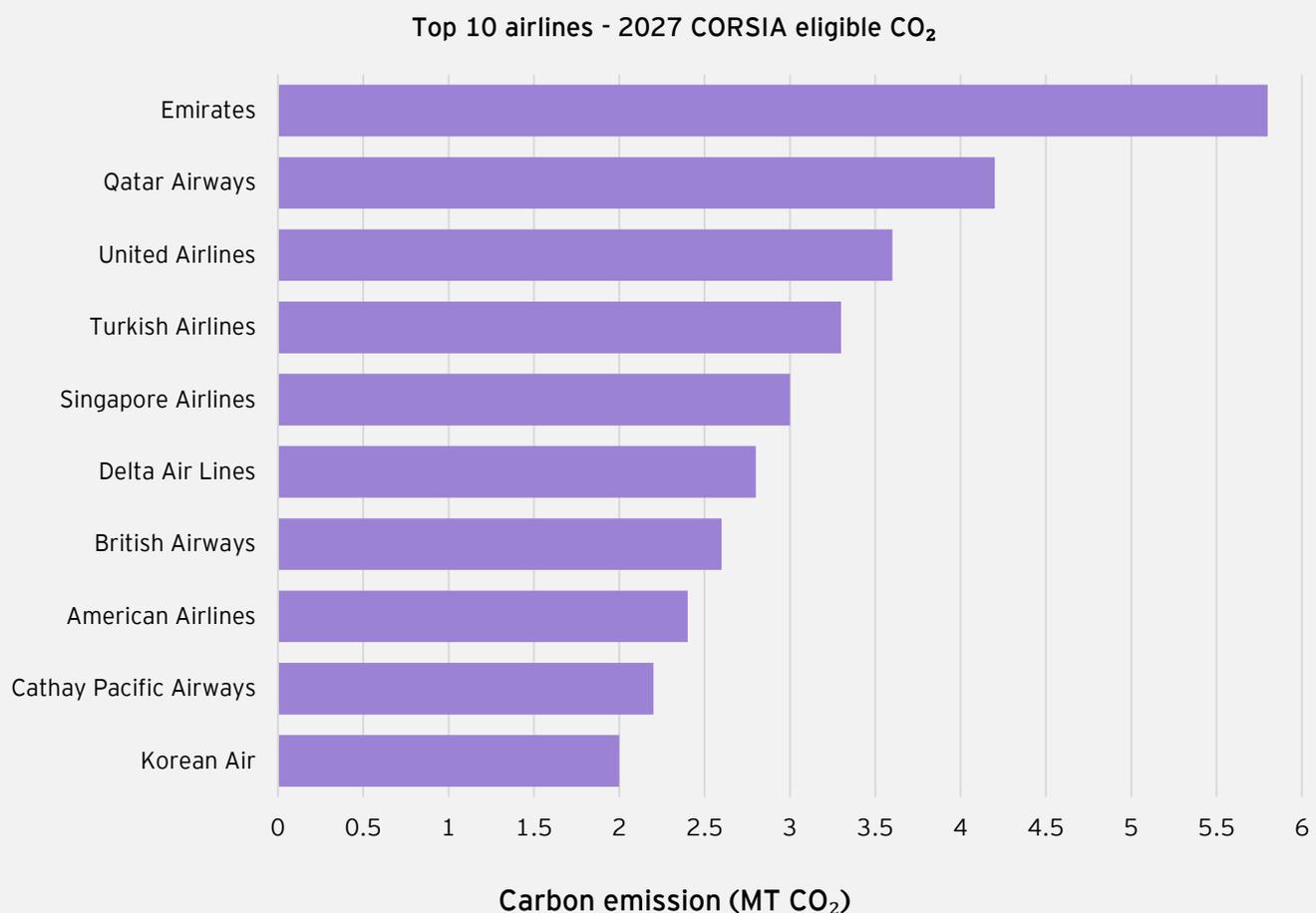
10. [Global SAF supply to slow in 2026 on high costs, policy issues: IATA | S&P Global](#)

11. [Global demand for sustainable aviation fuel \(SAF\) to explode by 2030](#)

3.3 Carbon: From policy instrument to commodity

Carbon markets are evolving into a distinct commodity class in their own right. The EU ETS covers roughly 40% of EU emissions, with aviation increasingly drawn into its scope, while linked systems in the UK and other jurisdictions deepen liquidity and complexity. EU ETS allowances have experienced robust price growth over the last decade, with values periodically touching around 100 EUR/tCO₂, and market turnover in the hundreds of billions of euros annually, underlining its role as a sizeable financial market.

For aviation specifically, CORSIA establishes a global offsetting scheme for international flights, implemented in three phases: a pilot phase (2021-2023), Phase 1 (2024-2026) and Phase 2 (2027-2035), with the latter applying to most international routes between participating states, except certain least developed or small markets. Airlines should monitor and report emissions, then purchase and retire eligible carbon credits to offset emissions above a baseline linked to 2019 levels. Phase 2 is expected to generate substantial offset demand; for example, estimates suggest that in 2027, the top 10 airlines alone could face offset obligations of around 29 million tons of CO₂.¹²



Global top 10 operators' forecasted CORSIA eligible carbon emissions in 2027

12. [International airlines face major CORSIA offset costs from 2027, says IBA - GreenAir News](#)

13. [IBA's Sustainability Watch: August 2025 | IBA Group](#)

SECTION 4**Why siloed approaches fail****4.1 Misaligned risk management and strategy**

When ATF hedging, SAF procurement and carbon compliance are managed in separate silos, organizations risk mispricing their overall exposure. Treasury and risk teams may hedge ATF volumes based on projected fuel burn without fully accounting for mandated SAF blends or the carbon price trajectory, leading to over hedging of fossil jet volumes and under investment in SAF or carbon instruments.

Similarly, sustainability or procurement teams may negotiate long term SAF offtakes based on supply security or reputational benefits, but without integrating these contracts into a consolidated commodity risk view. The result can be a portfolio of SAF commitments, fuel hedges and carbon positions that do not align with the organization's risk appetite or decarbonization pathway, making it difficult to explain to investors and rating agencies.

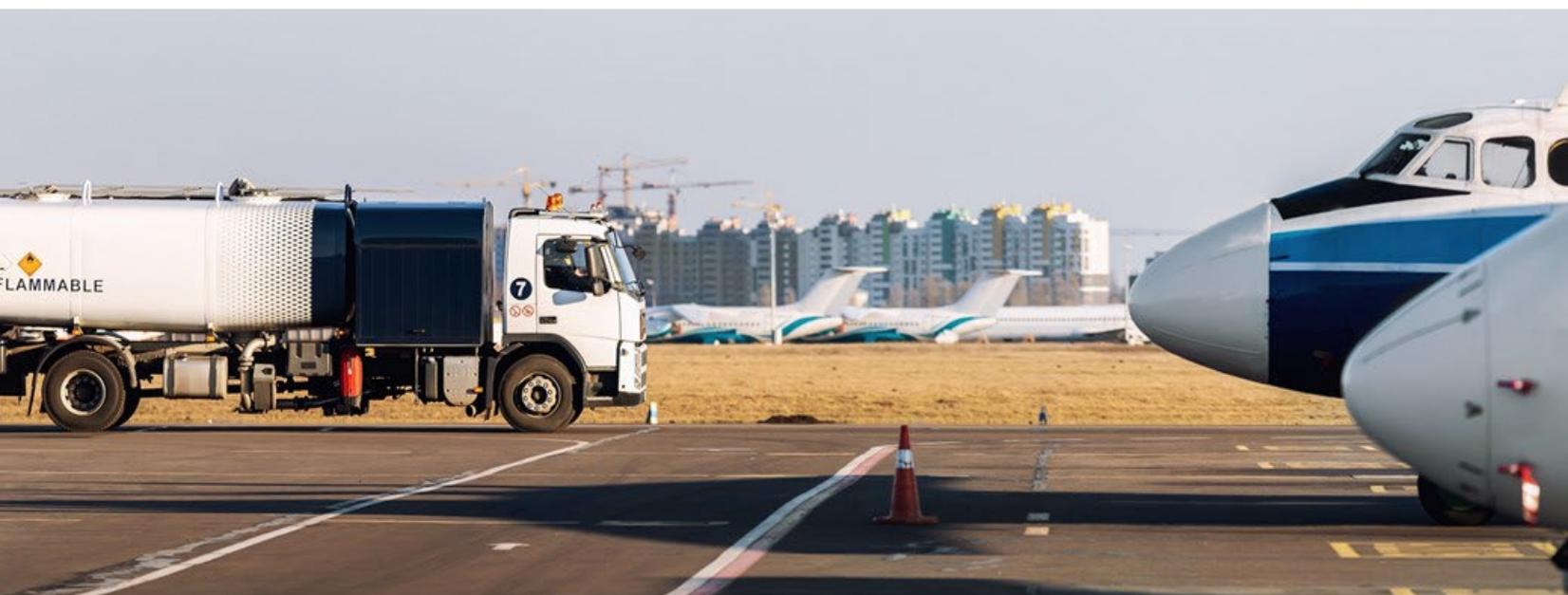
4.2 Missed optionality and value leakage

Treating SAF solely as a compliance fuel and carbon credits solely as a regulatory obligation overlooks their embedded optionality. SAF offtake agreements can provide valuable protection against future SAF price spikes or tightening mandates, effectively functioning as long dated call options on physical decarbonization capacity. Likewise, early positioning in high integrity CORSIA eligible or ETS linked units can create inventory optionality in a tightening market, enabling more flexible timing of compliance and potential trading opportunities.

Without an integrated perspective, these optionalities are rarely quantified, and decisions are made on narrow, project by project metrics rather than on portfolio level risk adjusted returns. This undermines the business case for proactive decarbonization investments and can leave airlines and airports reacting tactically to policy changes rather than shaping them.

SECTION 5

From fuel cost to carbon adjusted fuel cost



5.1 Defining a new core KPI

A practical starting point is to define and manage a “carbon adjusted fuel cost” metric. This metric aggregates three components:

- The cost of conventional ATF uplifted for a given route or network.
- The incremental premium paid for SAF blends relative to ATF, net of any subsidies or credits.
- The explicit carbon cost associated with residual emissions, including EU ETS allowances, CORSIA offsets or domestic carbon taxes and charges where applicable.

Expressed per available seat kilometer or revenue ton kilometer, this composite KPI becomes the anchor for pricing, route economics, capacity planning and hedging strategy. It shifts conversations from “How do we hedge jet?” to “How do we manage volatility in the total carbon adjusted fuel cost, given our decarbonization commitments and regulatory obligations?”

5.2 Implications for hedging strategy

In this framework, hedging is no longer about a single curve. Airlines and fuel exposed stakeholders instead think in terms of a portfolio of exposures - ATF, SAF premia and carbon prices - that should be jointly managed. This typically implies:

- Using a mix of crude, jet and gasoil futures and options to manage the base fossil fuel price risk.
- Treating SAF offtake agreements, with their premia and volume commitments, as structured exposures that need to be modeled alongside financial hedges.
- Building positions or options in carbon markets (EUAs, UKAs, CORSIA eligible units) in line with projected obligations and risk appetite, recognizing basis and integrity risks.

The goal is to reduce the volatility of carbon adjusted fuel cost within target bands while preserving or enhancing upside from favorable market moves, rather than simply enhancing hedge coverage of physical jet volumes.

SECTION 6

SAF offtakes as quasi financial instruments



6.1 Contract structures and embedded risks

SAF offtake contracts are becoming increasingly sophisticated. Airlines and fuel suppliers are signing multi year deals that may include: fixed or formula based premia over jet benchmarks; indexation to feedstock or electricity prices for power to liquids pathways; take or pay obligations; and sometimes equity or pre payment components that provide project finance support.¹⁴

These structures embed multiple risk drivers: feedstock price volatility, technology and ramp up risk, changes in policy eligibility and regional differences in sustainability criteria (for example between EU rules, UK frameworks and emerging APAC standards). For EU hubs, ReFuelEU's mandate and anti tankering provisions effectively lock in local SAF demand, anchoring offtake economics; in APAC and India, early offtakes may be more speculative, banking on future mandates and premium corporate demand.

6.2 Valuing offtakes as options

From a risk and treasury perspective, SAF offtakes can be analyzed using techniques familiar from commodity structured products and project finance. Key value components include:

- The expected compliance cost avoided: By securing SAF at a known or capped premium, the organization hedges against potential SAF cost spikes or future policy shocks¹⁵.
- The potential to generate or reduce carbon obligations: In some regimes, SAF use reduces offset or allowance requirements under schemes such as CORSIA or EU ETS, creating an implicit carbon credit stream.
- Reputational and commercial benefits: Early access to SAF enables more compelling decarbonized products for corporate and retail customers, which can support yield and load factor on key routes.

Embedding these factors into a quantitative valuation framework and integrating them into the same risk dashboards as fuel and carbon positions helps prevent under or over commitment to SAF relative to other decarbonization levers.

14. Asia-Pacific Sustainable Aviation Fuel Outlook 2025: Progress, challenges, and pathways – Sustainable Aviation Futures

15. How SAF mandates in the EU and UK are reshaping aviation fuel markets | Carbon Direct

SECTION 7

Carbon price risk: Learning from broader markets



7.1 Hedging tools and market depth

Some carbon trading studies highlight how ETS and voluntary carbon markets have grown into sizeable, moderately volatile asset classes, with futures, options and structured transactions available to hedge price risk. Many of the same instruments are relevant for aviation: standardized futures on EUAs and UKAs, options strategies to cap upside price risk and forward purchases of CORSIA eligible credits with embedded floors and caps.

Liquidity and credit quality are critical. Aviation specific demand for CORSIA eligible units is likely to increase materially as Phase 1 and Phase 2 obligations ramp up, while the overall pool of “high integrity” voluntary credits shrinks as quality standards tighten. That suggests a premium for early engagement, diversified sourcing across programs and jurisdictions, and careful attention to contract structures, delivery risk and vintage.

7.2 Integrating carbon hedging with fuel strategies

Airlines and airports can integrate carbon hedging into their broader commodity approach in several ways:

- **Overlay strategies:** Using EUA or carbon futures as an overlay to fuel hedges to approximate the total carbon adjusted exposure on covered routes.
- **Corridor strategies:** Combining fuel and carbon options to create corridors for total cost per ton of CO₂ or per ASK, aligning with risk appetite and fare flexibility.
- **Cross market arbitrage:** Where rules permit, comparing the economics of incremental SAF use versus additional carbon credits or allowances, and hedging accordingly.

These approaches require robust analytics and governance to avoid speculative behavior and to keep hedging aligned with the organization’s decarbonization pathway and stakeholder expectations.

SECTION 8

Cash flow and P&L implications



8.1 Short term cost pressure, long term opportunity

In the near term, increased SAF blending and carbon prices will raise operating costs for airlines and, indirectly, for lessors, airports and fuel suppliers through changed demand and investment patterns. For example the latest available estimates from IATA and independent analysts suggest that SAF-related premiums alone could add around US\$3 billion or more to industry fuel bills, even at sub-1% global blending levels¹⁶. Additional EU ETS and CORSIA costs on covered routes further compress margins unless fares, ancillary revenues or efficiency gains offset the impact.

Over the medium term, however, there is a potential competitive dividend for organizations that manage this transition proactively. Those that secure diversified SAF supply, enhance their fuel and carbon hedge books and invest in efficient fleets are better placed to offer stable, predictable pricing to customers and to attract capital that is increasingly conditioned on credible climate risk management. Airports and fuel suppliers that position themselves as low carbon hubs - with reliable SAF availability and transparent emissions data - can also capture traffic and collaboration advantages.

8.2 Scenario analysis and stress testing

Effective decision making under uncertainty requires robust scenario analysis. Organizations should model multiple pathways for:

- Oil and jet fuel prices (from low price, high volatility environments to sustained high price regimes).
- SAF cost and availability (from rapid cost convergence via technology and scale to prolonged scarcity and structural premia).
- Carbon price trajectories in EU ETS, UK ETS and CORSIA, including potential policy shocks or linkage scenarios.

For each scenario, integrated tools can project impacts on carbon adjusted fuel cost, EBITDA, cash flow and key credit metrics, highlighting thresholds where strategy adjustments - such as revising hedge ratios, renegotiating offtakes or accelerating fleet renewal - become value accretive.

16. IATA - SAF Production Growth Rate is Slowing Down, Essential to Correct Course Ahead of e-SAF Mandates

SECTION 9

What leading practice looks like



9.1 Governance and operating model

Experience from broader carbon and commodity markets suggests several features of a mature aviation fuel and carbon risk operating model:

- A cross functional “aviation fuel and carbon desk” that brings together treasury, risk, sustainability, network planning, procurement and operations around shared metrics and decision rights.
- A single, board approved risk appetite statement covering fuel and carbon price risk, SAF commitments and offsetting, with clear limits and escalation processes.
- Integrated data and analytics platforms that consolidate fuel uplift, SAF blends, emissions, carbon positions and hedge books, enabling near real time monitoring and reporting.

This kind of operating model allows organizations to respond quickly to shocks - whether in oil markets, SAF supply chains or carbon policy - while staying aligned with long term decarbonization goals.

9.2 Technology and transparency

Digital tools are central to managing complexity at scale. Emissions data platforms, pricing engines that incorporate carbon and SAF premia and risk analytics capable of simulating correlated moves across fuel and carbon markets all support better decision-making. Transparent reporting - both internally and to investors, customers and regulators - builds trust and can differentiate organizations that can demonstrate disciplined, data driven decarbonization from those relying on ad hoc measures.

Abbreviations

ATF Aviation Turbine Fuel

SAF Sustainable Aviation Fuel

CO₂ Carbon Dioxide

EU ETS European Union Emissions Trading System

CORSIA Carbon Offsetting and Reduction Scheme for International Aviation

APAC Asia-Pacific

ASK Available Seat Kilometers

IATA International Air Transport Association

EUR Euro

EUA European Union Allowance

US\$ United States Dollar

UKA UK Allowance

KPI Key Performance Indicator

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