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Beyond Double Charging: Reconciling CORSIA and the EU Emissions Trading System through Climate Policy Coherence, Environmental Integrity and Equitable Aviation Governance

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Abstract

The evolving relationship between the International Civil Aviation Organization's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) and the European Union Emissions Trading System (EU ETS) poses a complex challenge for climate governance. This article uses a critical qualitative literature review of peer-reviewed research published from 2020 through 2026, interpreted alongside authoritative ICAO and European Union materials. It distinguishes overlapping financial obligations from administrative duplication, carbon-credit double claiming, and legitimate concurrent regulation. The thematic synthesis finds that a common global framework improves predictability but does not independently guarantee emissions additionality, while regional cap-and-trade can strengthen carbon-price incentives yet potentially alter competition among air routes and transit hubs. The European Commission's July 2026 aviation proposal, envisaging expanded geographical application from 2029 if adopted, sharpens these tensions. The article develops an operator–route–year diagnostic framework, assesses carbon-market integrity and distributional effects, and proposes a five-part compatibility architecture covering legal-scope mapping, auditable cost deductions, registry safeguards, competition and equity review, and recurrent ICAO–EU dialogue. For Indonesia and other international aviation economies, the preferred approach combines support for CORSIA-centered multilateral coordination with evidence-based engagement on environmental ambition, transparent economic burdens, and direct emissions-reduction investment. The conclusions are interpretive and policy-oriented, not estimates of the future proposal's realized impacts.

Keywords: CORSIA, EU Emissions Trading System, International Aviation, Carbon Pricing, Double Charging, Climate Governance, Carbon Offset Integrity, Carbon Leakage, Aviation Competitiveness, Indonesia.

Introduction

International aviation is structurally different from many sectors addressed by domestic climate policy. Aircraft routinely connect multiple legal jurisdictions, operate through geographically concentrated hubs, and compete through networks that can change when prices or regulations change. Carbon dioxide emitted by an international flight has a global atmospheric effect, but the capacity to govern the flight is divided among departure, arrival, operator, and other states. The result is a persistent mismatch between the global public-good character of emission reductions and the territorial institutions available to require them. Research on aviation growth and the unequal distribution of flying indicates that this mismatch has environmental and distributive consequences, not merely administrative ones [1,2]. Two principal market-based architectures structure the contemporary controversy. The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) was negotiated through the International Civil Aviation Organization (ICAO) to provide a common global framework for offsetting eligible growth in international aviation carbon dioxide emissions. In contrast, the European Union Emissions Trading System (EU ETS) places covered aviation emissions within a cap-and-trade system through which regulated operators surrender tradable allowances. These instruments are often discussed as though both impose identical charges on identical tons of carbon dioxide. Their different baselines, surrender instruments, geographical scopes, and approaches to emissions mitigation make that shorthand misleading, even when an operator may be exposed to both systems [3-5].

The immediate policy setting is unusually consequential. ICAO Council Session 239 is meeting from November 2 to 13, 2026, while the European Commission's July 17, 2026 proposal could expand the geographical reach of aviation emissions trading from 2029. ICAO responded publicly on the date of the proposal, warning about potential double charging and the fragmentation of international decarbonization. At the same time, EU institutions have presented regional pricing as an instrument of climate accountability where they consider global offsetting insufficient. The 2026 proposal is not yet enacted law; the distinction matters because the legal assessment of present obligations should not be

conflated with predictions about future obligations [6-8].

The policy context supplied for the 239th Council discussion reports concerns from Brazil, Singapore, Japan, and the United Arab Emirates about double charging and additional burdens on international airlines. It also describes an Indonesian intervention favoring consistency with the ICAO agreement identifying CORSIA as the sole global market-based measure for international aviation carbon dioxide. These are important issues for analysis, but the named states' exact speeches and the precise wording of Indonesia's position are treated here as contextual meeting notes rather than independently authenticated Council transcripts. That distinction reflects a larger research principle: institutional advocacy must be analyzed carefully without attributing statements that the public evidentiary record does not substantiate [9,10].

The urgency of the problem extends beyond aviation diplomacy. New cost exposure can influence fares, capacity, aircraft choice, and routing, while uncertainty about future policy design can delay investments in efficient fleets and sustainable fuels. Multiple compliance systems can also burden airlines and regulators even when their aggregate carbon payment is not literally duplicated. Evidence from carbon-pricing studies shows that market instruments can affect emissions and airline operations, but the direction and magnitude differ by route, carrier, regulatory coverage, and identification strategy. Hence neither the proposition that regional pricing necessarily harms aviation nor the proposition that it automatically guarantees climate benefits is defensible as a universal conclusion [11-13]. This qualitative literature review seeks to reconcile competing objectives rather than select an institution as the winner of a jurisdictional contest. It asks how CORSIA and the EU ETS interact, when overlapping obligations become double charging, whether carbon pricing and offsetting deliver credible mitigation, who carries the burden, and what institutional arrangements could preserve both global coordination and sufficient climate ambition. Its contribution is a unified framework connecting legal status, route-based liability, cost deduction, carbon-credit quality, network competition, and equitable implementation. That integration extends work on CORSIA-ETS coexistence and broadens the analytical basis for Indonesia's international aviation policy [3,14,15].

Figure 1 provides the chronology required to distinguish current compliance exposure from a prospective extension of the EU ETS. The timeline deliberately separates enacted milestones from the Commission's conditional 2029 proposal.



Figure 1: Regulatory Chronology: Actual Policy Milestones Versus Conditional 2029 Extension.

Figure 1 Synthesizes the Sequence of ICAO and EU Measures; the 2029 Event is a Proposed Future Legal Change, not Binding Regulation.

Figure 1 identifies the decisive regulatory milestones and makes the chronological distinction between present obligations and the proposed 2029 extension explicit. EU aviation emissions trading has operated since 2012, while CORSIA's monitoring provisions began in 2019 and offsetting phases began in 2021, with actual first offsetting obligations emerging after aviation's recovery in 2024. The 2023 EU amendment reshaped coexistence; the 2026 legislative proposal is a new decision point, not a retroactive alteration of those earlier rules. Any causal evaluation must anchor airline responses to the policy actually operative at the observed date rather than to a future scenario [8,16,17].

Literature Review: Conceptual and Theoretical Foundations

Global aviation Climate Governance and Institutional Pluralism

International aviation climate governance exhibits a familiar problem in regime complexity: multiple institutions possess different mandates over activities that are economically integrated and environmentally connected. ICAO promotes a globally coordinated approach to emissions from international aviation, whereas European institutions also pursue binding territorial climate objectives. States retain important responsibilities for implementing ICAO standards, administering airlines, and negotiating air-services rights. These intersecting sources of authority generate gaps, ambiguities, and productive opportunities for cooperation. The existence of multiple policy centers therefore does not establish that one center is legally invalid, but it does increase the burden of demonstrating consistency, proportionality, and effectiveness [9,18].

The distinction between political legitimacy and formal legal authority is especially important when evaluating the phrase 'the only global market-based measure.' CORSIA's ICAO designation recognizes a globally harmonized scheme for international aviation carbon dioxide and an important negotiated compromise among states. It does not, without further legal analysis, resolve every question about the ability of a state or regional bloc to impose another environmental measure on flights within its lawful jurisdiction. Conversely, a region's regulatory competence does not by itself prove that additional measures will improve global environmental outcomes. Both claims require attention to treaty interpretation, emissions boundaries, enforcement, and the consequences of unilateral regulatory expansion [3,4,9].

Offsetting, Cap-and-Trade and Economic Incidence

CORSIA regulates participating international routes through a baseline-and-growth offsetting architecture. The 2024-2035 baseline is defined at 85% of relevant 2019 emissions, while an operator's obligations depend on covered emissions and the applicable sector growth factor. The approach seeks to compensate for specified emissions growth by requiring cancellation of eligible emissions units rather than imposing a universal absolute cap on all international aviation emissions. Its effectiveness therefore depends on accurate emissions reporting, the legitimacy of baseline assumptions, the actual availability of qualifying credits, and whether credited mitigation would have occurred without the offset payment [14,17,19]. Under the EU ETS, eligible aviation emissions are associated with the surrender of allowances under the system's cap, thereby linking the economic cost of emitting to a constrained allowance supply. The EU's phased elimination of free aviation allowances culminates in full auctioning in 2026, strengthening the cost exposure that airlines may face on routes within the current scope. Allowance surrender and CORSIA credit cancellation are not interchangeable accounting actions: an EU

allowance is connected to emissions within a cap, whereas an offset credit purports to represent mitigation in another activity or location. This distinction is fundamental when considering environmental equivalence, deductible costs, and incentives for in-sector investment [11,16,20].

Economic incidence is not the same as the statutory identity of the party required to comply. An airline can respond to an emissions price by increasing fares, using different aircraft, reducing frequencies, adjusting load factors, or reorganizing its network. The extent to which costs reach passengers or logistics customers depends on competition, elasticities, airport constraints, and market positioning. Theoretical studies also reveal that airline strategy under carbon pricing can vary with the presence of low-cost carriers and strategic interaction among firms. These mechanisms make uniform claims about passenger price increases or competitive disadvantages unreliable without route-specific evidence [21-23].

Interaction, Policy Overlap, and Carbon Leakage

Multiple climate policies can be complementary where they correct different market failures or jointly increase credible abatement, yet they can also interact in ways that change total emissions less than expected. Research on overlapping climate policies highlights the importance of cap design, jurisdiction, timing, and the response of firms and consumers. In a binding cap-and-trade system, an overlapping instrument may redistribute abatement or allowance demand rather than automatically reduce aggregate emissions; other arrangements may create additional reductions. This possibility means that the number of instruments is not an environmental-performance indicator. Compatibility must be evaluated through marginal incentives and the integrity of the resulting emissions accounting [15,24]. A sector-level evaluation of the EU ETS also found emission reductions despite historically low allowance prices, highlighting the importance of credible long-run policy expectations rather than treating the observed price alone as a measure of effectiveness [25].

Aviation adds a distinctive form of leakage because carriers can shift passengers through competing hubs. An emissions charge on a direct or connecting itinerary can alter the attractiveness of routings through a covered European hub compared with an otherwise similar connection outside the covered market. The resulting changes may shift activity rather than eliminate the underlying demand for long-haul travel. Recent empirical work finds evidence of hub responses to European carbon prices, while studies of destinations suggest that some regulated routes become more efficient without necessarily losing tourists. The contrast demonstrates why a carefully designed policy needs both aviation-network analysis and credible accounting of displaced emissions [26,27].

Environmental Integrity, Carbon Accounting, and Climate Outcomes

A carbon offset's nominal tonnage is not automatically equivalent to a permanent reduction in atmospheric greenhouse gases. Additionality tests whether mitigation exceeds a credible counterfactual; permanence considers reversal risk; leakage identifies displaced emissions; and baseline quality determines how much activity is credited. Recent evaluations of forest carbon markets report serious over-crediting and low-quality project selection, although their conclusions cannot be mechanically generalized to every eligible CORSIA unit. The proper lesson is institutional: offset eligibility should be supported by transparent authorization, conservative quantification, independent verification, and credible cancellation before climate benefits are claimed [28-30].

Two different meanings of double counting require special attention. A mitigation outcome can be counted toward more than one party's climate target or be represented by more than one issued or used credit. Article 6 accounting arrangements and corresponding adjustments aim to address cross-border double claiming. Such accounting misconduct is conceptually distinct from an airline paying two compliant, legally imposed costs on the same route. The former undermines the asserted quantity of climate benefits; the latter raises concerns about fairness and instrument interaction even if each payment is properly recorded. A credible policy assessment must test both concerns separately rather than treating deduction of an airline's cost as a complete solution to carbon-market integrity [18,31].

Equity, Differentiated Responsibilities and Governance Capacity

The global benefits of aviation do not accrue equally, nor are the financial and technological capacities of states uniform. Differences in historical aviation activity, income, airline networks, and the ability to pay create disagreements about how offsetting responsibility should be allocated. Studies comparing CORSIA with alternative burden-sharing principles show that country preferences can diverge substantially. This supports a justice-oriented assessment in which uniform rules are evaluated together with their impact on states at different stages of aviation development. Equal application of a formula may be procedurally simple without being fully equivalent to equitable economic or developmental consequences [1,10]. The governance literature also emphasizes the role of practical enforcement. ICAO's standards rely on state implementation and compliance arrangements, and recent legal research identifies bilateral air-services agreements as possible channels through which environmental standards can gain operational force. Such a mechanism is potentially significant for aviation because market access and authorization are already managed through a dense set of bilateral relationships. However, using air-services agreements to support climate rules must be calibrated to avoid disproportionate or inconsistent restrictions on connectivity. Institutional legitimacy rests not only on formally agreed standards but also on verifiable implementation, transparency, and predictable consequences for non-compliance [3,9].

Socio-Technical Transition and Nonmarket Complements

Aviation's route toward substantially lower climate impacts cannot depend only on purchasing market instruments. Fleet renewal, operations, demand management, alternative fuels, and eventually new propulsion technologies interact with financial constraints and infrastructure availability. Research on aviation transitions identifies technological lock-in, high investment costs, production constraints, and slow governance adaptation as mutually reinforcing barriers. Studies of post-pandemic recovery likewise show that the sector's trajectory depends on policy choices and long-lived assets, not simply on short-term airline profitability. Consequently, market design should be assessed as one element of a broader transition system [32-35]. Sustainable aviation fuel (SAF) promises potentially significant life-cycle reductions but is heterogeneous across feedstocks, production pathways, electricity sources, and land-use effects. Comparative analysis

finds that some biofuel pathways carry substantial land-use carbon debts, whereas alternative feedstocks and low-carbon energy can improve outcomes under specified assumptions. The economics of CORSIA can also influence whether airlines purchase SAF or offsets, depending on price differentials and eligibility rules. Thus a policy that claims environmental success from fuel substitution must evaluate complete life-cycle emissions and verify that book-and-claim or registry practices do not attribute the same benefit multiple times [36-38].

The climate system also imposes a boundary on the carbon-dioxide-only framing of aviation policy. In addition to long-lived CO2, aircraft induce non-CO2 effects, particularly contrails, which contribute to aviation's overall warming impact. Scientific estimates contain uncertainty that is material to policy design, but the existence of non-CO2 effects is not in serious doubt. A carbon offsetting system focused on CO2 therefore should not be described as a complete climate solution for aviation. Parallel monitoring and mitigation strategies for non-CO2 effects may complement rather than duplicate carbon pricing, as long as units, metrics, and objectives remain transparent [2,39,40]. Recent research explores pathways for incorporating aviation's non-CO2 climate effects into the EU ETS and emphasizes the measurement challenges and uncertainties that such an approach would entail [41].

Figure 2 portrays how the competing legal architectures converge on a common airline route-year accounting unit. This shared analytical unit enables comparisons without presuming that the two instruments have identical legal scope or accounting functions.

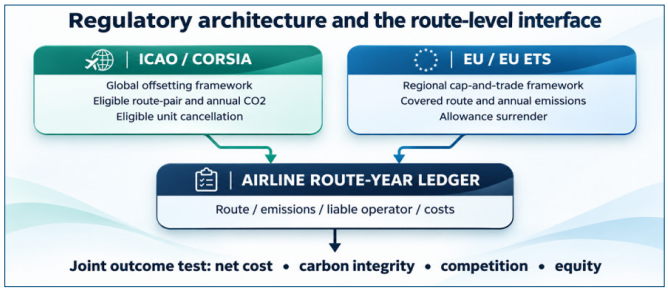


Figure 2: Multilevel Aviation Climate Governance and the Operator–Route–Year Interface.

Conceptual architecture constructed by the author from reviewed literature and institutional documents.

Figure 2 depicts four nested levels of policy analysis: institutions, regulated routes, financial liabilities, and environmental outcomes. The distinction corrects an analytical error common to debates about overlapping emissions systems, namely jumping from the presence of two institutions directly to a conclusion about duplicated emissions benefits or payments. Legal scope must first be mapped to specific routes and operators; costs must then be measured at the appropriate compliance period; and the credits or allowances used must be assessed for additionality and environmental consequences. The same map helps organize conflicting claims without presuming an outcome in advance [14,15].

Method: A Critical Qualitative Literature Review

Review Purpose, Boundary and Epistemology

This study employs a qualitative literature review (QLR) with a critical, interpretive, and integrative orientation. A QLR is appropriate where the central objective is to connect legal interpretations, political positions, economic findings, and environmental science rather than aggregate estimates of a single standardized treatment effect. The question is not whether every study containing particular search terms has been retrieved, but whether the key conceptual positions and the strongest contradictory evidence have been represented adequately. The review therefore does not claim the exhaustive coverage, database protocol, screening counts, or statistical pooling associated with a systematic literature review or meta-analysis. The substantive literature boundary is 2020 through November 10, 2026, with emphasis on peer-reviewed journal articles about aviation carbon pricing, international climate governance, offset integrity, air-transport competition, SAF policy, and transition barriers. Authoritative primary documents from ICAO, the European Commission, the European Parliament and Council, and the European Union Aviation Safety Agency are treated separately as legal and institutional evidence. This distinction is indispensable because a peer-reviewed paper can assess regulations at the date it was published, but only the competent legislative and aviation institutions establish the most recent formal status of a policy [6,8,16].

Purposive Sourcing and Comparative Interpretation

Sources were identified through purposive searches using combinations of CORSIA, EU ETS, aviation, carbon offsetting, market-based measures, environmental integrity, double charging, carbon-credit authorization, hub leakage, airline demand, and sustainable aviation fuel. Relevant articles were evaluated for topical fit, publication date, publisher or journal credibility, transparent methods, and a verifiable DOI. Further studies were selected to supply contrasting theoretical and empirical perspectives, including work that questions offset effectiveness and work that demonstrates carbon-pricing benefits. Such purposive selection is designed for interpretive breadth and credibility, not a numerical claim about all literature published worldwide. The analysis proceeded through thematic reading rather than a predetermined ranking of studies. An initial coding matrix distinguished institutional authority, emissions scope, economic incidence, credit integrity, equity, competition, and transition finance. Subsequent reading added policy-specific codes for the 2026 European proposal, deduction mechanisms, route-level liability, and anticipated 2029 effects. Studies were compared by research design: difference-in-differences estimates were not directly equated with theoretical predictions, while survey-based perceptions were treated as perceptions rather than realized emissions impacts. This evidence-sensitive comparison helps prevent stronger claims than any study's design can support [11,42,43].

Source Triangulation and Evidence Limitations

For legal or time-sensitive assertions, three types of information were distinguished: enacted law, institutional interpretation, and legislative proposal. Directive (EU) 2023/958 and its implementation frame the currently relevant EU system, while the Commission's July 2026 reform and subsequent explanatory material represent prospective choices rather than current obligations. ICAO's public statement is treated as evidence of ICAO's position, not as a court judgment resolving all legal questions. The supplied description of country interventions at the November 2026 Council session informs the policy relevance of the review but is not used as a verbatim record or a substitute for authenticated Council proceedings. The review does not

calculate new global emissions totals, estimate airline-level compliance costs, or conduct original interviews with government delegations. Theoretical examples and proposed tests should therefore be understood as conceptual analytic devices, not as verified accounting statements for particular airlines. A further limitation is that many existing aviation ETS evaluations identify effects during earlier periods with different allowance prices, free-allocation rules, and route coverage. Extrapolating these observations directly to the proposed 2029 expansion would overstate the evidence. Instead, the paper uses historical results to specify mechanisms and hypotheses that prospective analysis should test [13,23,44].

Results: Thematic Findings

The Coexistence of a Global Framework and A Regional Cap

The reviewed evidence reveals two simultaneously valid political rationales. ICAO's rationale is that a global industry requires rules that maintain a level playing field across states and avoid fragmentation of international services. The EU's rationale is that a region with binding economy-wide climate commitments needs an instrument that creates a stronger emissions price signal for covered aviation activity. CORSIA and the EU ETS therefore represent different governance priorities, rather than duplicate copies of an identical system. The tension is compounded when participants frame their preferred arrangement as essential to climate credibility and treat the alternative as disruptive rather than assessing specific points of possible compatibility [3,4,9].

Current EU aviation coverage must be distinguished from the reform under negotiation. Directive (EU) 2023/958 maintained the limited geographical scope of the aviation EU ETS in the immediate period, implemented CORSIA-related obligations for qualifying extra-European operations, and phased out free aviation allowances; full auctioning begins in 2026. The European Commission's July 17, 2026 proposal (COM(2026) 616) would expand EU ETS coverage to certain outbound flights from 2029. Its draft uses a threshold of more than 5,000 km measured from Frankfurt Airport for destinations outside the European Economic Area, with an additional provision for specified lower-emission destinations within that distance and exemptions for qualifying operators. These provisions are subject to legislative deliberation, and the proposed expansion must not be described as if it were currently in force [8,16].

ICAO's formal public objection to the Commission proposal centers on the risk that additional regional liabilities would destabilize the CORSIA compromise and impose duplicative charges. The Commission's own exposition also acknowledges the problem by including a proposal for deductions of eligible CORSIA offsetting costs where the systems overlap. The existence of a proposed deduction is significant: it suggests that at least one form of overlapping financial exposure is recognized as a design problem by the proposing regulator. It does not establish that every operational or environmental concern has already been solved, particularly because deductibility, accounting periods, eligible credits, and net-cost incidence may differ [8,45].

Double Charging is not A Single Economic or Accounting Event

The literature supports a four-way typology. First, legal overlap arises when more than one framework asserts authority over an activity. Second, compliance overlap arises when the same operator must monitor, report, and satisfy multiple requirements related to a route. Third, financial overlap arises when an airline bears both an allowance-surrender cost and an offsetting obligation on covered operations. Fourth, environmental double counting arises when a mitigation outcome is claimed more than once. These forms can coincide, but none logically implies the others. This classification prevents an unnecessary policy choice between total harmonization and unqualified accumulation of obligations [3,15,18]. The principal technical reason is asymmetry of measurement. EU ETS liabilities can be linked to the covered emissions associated with a flight, while CORSIA offsetting is related to covered emissions multiplied by applicable growth factors above a program baseline. Thus the absolute quantities represented by a surrendered EU allowance and a canceled CORSIA credit may not be the same even on a common international itinerary. A nominal overlap at route level does not demonstrate a duplicated charge on every tonne emitted, and a calculation of duplicated costs requires the actual accounting formulas, compliance period, allowance price, and eligible credit transactions to be identified separately [14,17].

A financially meaningful overlap assessment should begin with an operator-route-year ledger. The first column records the emissions and legal eligibility of each operation; the second derives any EU ETS surrender requirement; the third calculates its CORSIA offset requirement; the fourth records the cost and retirement of actual eligible units; and the fifth applies any legally available deduction or exemption. Administrative expenses and time lags should be recorded independently because they can persist when a credit deduction offsets the headline financial payment. The resulting figure is a net incremental burden, not a claim that one scheme automatically cancels the climate function of the other [21,22]. Figure 3 categorizes distinct overlap concerns and the evidence necessary to substantiate each claim. Each category calls for a different regulatory response, so the label 'double charging' should not determine the remedy by itself.

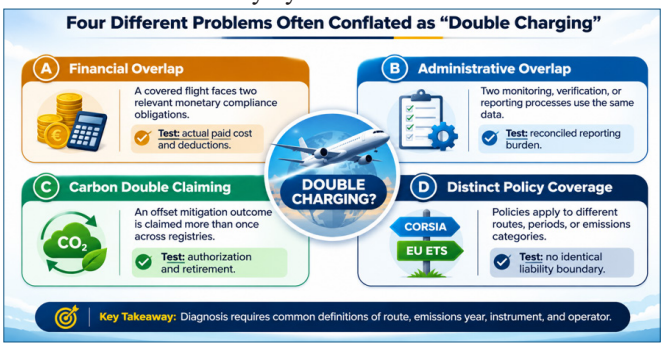


Figure 3: Typology of Financial, Administrative and Carbon-Accounting Overlap.

Figure 3 shows a policy-overlap matrix that separates the type of interaction from the remedy needed. An EU ETS-CORSIA cost overlap may call for verified cost recognition, whereas double counting of a carbon credit requires robust registries, cancellation rules, and corresponding adjustments; a regulatory reporting overlap may instead call for interoperable monitoring and one-stop administration. Such separation matters because a policymaker could successfully prevent duplicate payments while allowing low-integrity credits, or could ensure excellent credit integrity while still imposing unequal transactional burdens on carriers serving the same markets [28,29].

Emissions and Competition Responses are Heterogeneous

The empirical evidence demonstrates that EU aviation carbon

pricing can alter behavior, but does not justify assuming a single effect everywhere. An evaluation of European routes estimates emissions about 4.7% below a relevant counterfactual for regulated routes over the study period, with larger reductions on some shorter routes. Research using alternative methods examines changes in capacity and technology choices, indicating that operators may adjust operational intensity and asset deployment rather than simply cancel service. These findings support the possibility of substantive mitigation, but historical EU ETS effects must be interpreted in the context of the policies and market structures present when they were measured [11,12,46,].

Subsequent studies complicate the picture. One country-panel analysis suggests that aviation ETS effects on international emissions have been more limited than domestic effects, while recent work on policy shocks finds a stronger response for domestic and intra-European operations than for extra-European flights. Such variation may be attributed to the limited current geographic coverage, differences in airline response, and the role of modal alternatives. It also illustrates why an expanded international scope could have effects that are not well represented by earlier analyses limited to intra-European routes. Strong research should separate the plausibility of an effect from its quantitatively established magnitude [23,44].

Route and hub competition create effects beyond a single airline's costs. Evidence on intercontinental connections indicates that higher European allowance prices can reduce traffic passing through European hubs relative to competing routings, creating potential hub carbon leakage. Meanwhile, another destination-level study finds that EU ETS participation has reduced flights and emissions without a significant loss of passenger arrivals in its study sample. These results are compatible rather than contradictory: a region can realize efficiency improvements on some routes while experiencing displacement of connecting traffic on others. The overall climate effect depends on the alternative routing's emissions, aircraft use, and demand response [26,27]. Two additional findings matter for policy evaluation. Carbon pricing can encourage low-carbon technology diffusion, not solely immediate reductions in flight frequencies; however, its effectiveness may depend on access to modern aircraft and finance. Equally, a competitive carrier may adjust ticket prices differently from a network airline, and a regional rule can change the strategic interaction between operators. A policy that ignores these differences risks conflating legal uniformity with competitive neutrality. This warrants testing outcomes across carrier business models and contrasting airline networks, not merely comparing the nominal charge per unit of carbon dioxide [21,22,47].

CORSIA Credit Integrity and Mitigation Credibility

CORSIA's environmental effectiveness is contingent on the quality of emission units and the credibility of baseline and growth calculations. A critical assessment of credits eligible in the CORSIA environment raises doubts about whether many offsets deliver the mitigation they claim. A separate review of voluntary aviation offset programs finds that much of the literature concerns passenger behavior and willingness to pay, whereas effectiveness of mitigation is less certain. These studies address different mechanisms but converge on a common caution: purchasing and canceling a credit is a compliance action, not by itself conclusive evidence of equivalent atmospheric benefit [14,19]. Concerns are reinforced by evidence from the broader voluntary carbon market. Investigations of corporate offset retirement and forest conservation crediting identify projects with high risk of limited additional reductions and sizable over-crediting relative to evaluated outcomes. Because CORSIA imposes eligibility conditions, results from these broader populations should not be treated as direct estimates of all CORSIA credits. Nonetheless, the studies show why transparent unit quality, independent counterfactual testing, and ex-post assessment are necessary for defensible accounting. They also demonstrate that low credit prices may be evidence of limited confidence, rather than proof of cost-effective mitigation [28-30].

International credit authorization creates another integrity challenge. CORSIA-related mitigation may be hosted in a country that also has a nationally determined contribution under the Paris Agreement. To avoid asserting the same outcome twice, project authorization and accounting adjustments must be coherent with Article 6 rules, host-state systems, and the use of eligible emission units. This is an accounting issue distinct from the political question of whether an EU allowance should be deducted against a CORSIA compliance expense. Weakness in either system can undermine legitimacy, but different audit evidence and different institutions are required to correct the respective problems [9,18,31].

Equity and Regulatory Capacity

Distributional considerations extend from passengers and airlines to national aviation development. CORSIA's sectoral growth architecture and alternative burden-sharing formulas can allocate offsetting responsibility differently across countries with different historical emissions profiles. A country with growing connectivity and limited access to fuel technology may perceive a global system and an additional regional price as constraints on development; a jurisdiction with longstanding climate commitments may regard additional action as necessary to address underpriced emissions. The tension does not disappear by simply declaring one interest dominant. It requires transparent impact assessment across international markets and explicit consideration of ability to pay, connectivity, and expected climate benefits [1,10]. The reported concerns of Brazil, Singapore, Japan, and the United Arab Emirates illustrate the range of potentially affected route structures, although the exact content of each Council intervention remains to be authenticated. For Indonesia, the issue has practical importance because long-haul access, hub connectivity, airline competition, and aviation-sector investment are linked to international regulatory decisions. An equitable response would test whether operators serving the same routes face comparable net obligations, whether smaller states can meet monitoring and credit authorization requirements, and whether exemptions produce unintended distortions. Such analysis should remain fact-specific rather than presuming that any one nation's competitive position is representative of all states [10,43].

The possibility of different outcomes across developing aviation systems is illustrated by research examining CORSIA and selected APEC developing economies. That study reports counterintuitive associations between policy participation and emissions outcomes in its specified sample and period. Its central contribution to this review is not a universal claim that CORSIA always increases emissions; rather, it draws attention to the interaction of global policy design with local innovation constraints, industrial structures, and fossil-fuel support. A fair international framework must therefore consider the institutional capacity needed to convert price incentives into actual investment and abatement [42,43].

The Fuel Transition and the Limits of Accounting-Only Responses

The scholarly literature increasingly questions reliance on optimistic SAF deployment assumptions without comparable progress in production capacity. Economic reviews identify the cost of low-carbon fuels, energy-conversion inefficiency, investment requirements, and demand growth as significant obstacles to aviation decarbonization. Prospective analyses also show that different fuel pathways can shift environmental pressures toward land, energy, freshwater, and other ecological boundaries. Accordingly, carbon-pricing revenues and aviation policy should help unlock verifiable direct emissions reductions rather than merely substitute financial certificates for transformation of the aviation energy system [48-50]. Detailed lifecycle studies strengthen this finding. Aviation fuel carbon intensity varies with feedstock transport, electricity generation, hydrogen supply, conversion technology, and the treatment of land-use change. The environmental performance of a nominally sustainable fuel therefore cannot be inferred from the label alone. Policy design must reward actual life-cycle performance and establish compatible sustainability criteria across CORSIA, EU rules, and national programs. Where inconsistent accounting leads producers to optimize for one reporting system rather than real climate benefit, simultaneous policies may increase complexity without creating additional emissions savings [36,38,51].

Emerging research on sustainable aviation fuel regulations finds both opportunities and barriers arising from different regional mandates. European case studies emphasize competitive implications of fuel obligations, policy analysis highlights coordination among international and national instruments, and modeling compares alternative e-fuel mandate designs. These are not arguments for removing fuel standards; rather, they identify the need for harmonized product accounting, careful treatment of eligibility and lifecycle factors, and realistic investment incentives. The broader lesson for the CORSIA-ETS interaction is that multiple climate instruments should be examined as an interconnected policy portfolio, not as isolated charges that automatically add their declared benefits [52-54]. The transition literature adds institutional and financial dimensions. Stakeholder analysis of European SAF policy identifies fragmentation across ReFuelEU, CORSIA, and other frameworks as a barrier to scaling high-integrity pathways. Studies of hydrogen-based aviation and general airline net-zero commitments similarly emphasize infrastructure, regulatory certainty, and investment constraints. These findings imply that a cost-deduction compromise, while useful for overlapping market instruments, will not by itself finance the technology transition. A credible governance solution should integrate a pathway for channeling resources toward high-quality direct mitigation and improving interoperability of fuel sustainability data [55-57]. An assessment of science-based climate targets in aviation also identifies gaps between the ambition of corporate commitments and their implementation, underscoring the need to verify measurable actions rather than rely solely on announced trajectories [58].

Figure 4 organizes the thematic evidence around four successive but interacting analytical layers. Its arrows represent plausible mechanisms that require empirical testing rather than estimated causal coefficients.

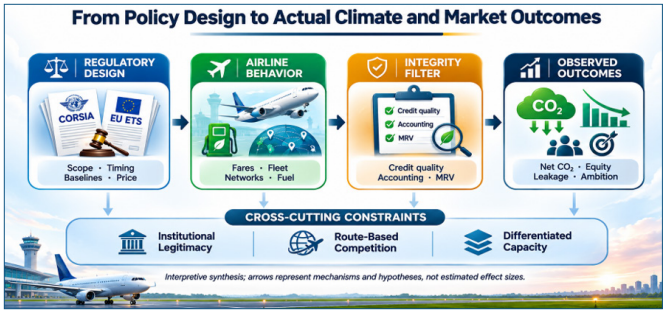


Figure 4: Thematic Framework Linking Policy Design, Airline Responses, Integrity and Outcomes.

Arrows indicate possible pathways and conditional relationships rather than proven causal coefficients.

Figure 4 summarizes the interaction between carbon pricing, airline behavior, offset integrity, and ultimate climate outcomes. The figure deliberately avoids treating financial expenditure as the endpoint: an airline may face higher costs while emissions shift to other hubs, while a low-cost credit may create a compliance claim without a fully additional emissions reduction. Conversely, well-designed prices can support operational efficiency and capital investment when financing and technology are available. The relevant test is therefore the verified net reduction in climate impacts, adjusted for network displacement and the ecological consequences of alternative fuels [26,29,50].

Discussion and Analysis

Reconciling Global Harmonization with Regional Climate Ambition

The central normative question is not whether multilateralism or regional action is inherently superior. It is whether the total policy architecture produces additional and fairly distributed climate benefits at an acceptable administrative cost. A globally harmonized CORSIA system can reduce fragmentation and provide predictability across international routes, but it faces concerns about offset quality, enforcement, and whether its ambition matches long-run decarbonization needs. The EU ETS can establish a stronger price signal within its legal scope, but an expansion risks changing route incentives, increasing complexity, and challenging confidence in ICAO's agreement. A credible solution must take both sets of risks seriously [3,4,20].

A regime-complexity interpretation clarifies why neither actor's statement alone resolves this tension. ICAO's designation of a global market-based measure establishes strong political and institutional expectations of coordinated treatment, especially where countries regard CORSIA as the negotiated substitute for competing regional regimes. EU institutions retain legal obligations and authority under their climate framework, and the current EU aviation rules expressly address the interface with CORSIA. Disagreement can therefore concern both the scope of permissible unilateral measures and their policy wisdom. The more constructive debate evaluates how these systems can avoid unnecessary duplication and prove their environmental results rather than treating a political slogan as a complete legal analysis [9,15].

The July 2026 proposal offers a useful stress test because the Commission explicitly proposes a mechanism to deduct qualifying CORSIA offsetting costs in overlapping cases. Yet recognition of

offset costs does not necessarily imply complete equivalence of legal obligations or of emissions units. A euro paid for a carbon offset is not the same environmental object as an EU allowance surrendered under a cap. If a deduction reflects only cash costs, it may reduce financial incidence without changing how much verified climate mitigation the operator ultimately supports. Any compatibility mechanism therefore needs distinct financial and environmental ledgers, with transparent rules for both [8,14,60].

An Operator-Route-Year Test of Overlapping Liabilities

A practical assessment should begin with the smallest comparable unit: a specific airline, a specific route, and a specific compliance year. This avoids treating all international emissions from a carrier as though they carried the same liability. First, the regulator identifies whether the route falls under an EU ETS or CORSIA geographical rule; second, it determines the applicable emissions quantity and growth factor; third, it records the allowances and qualifying offset credits actually surrendered or canceled; and fourth, it deducts only payments or units that satisfy the governing rule. The approach is administratively demanding but makes disputed double-charging claims capable of independent verification [3,22].

For conceptual clarity, net incremental financial burden can be represented by an accounting identity that separates allowance spending, offset-compliance expenditure, applicable deductions, and administrative expenses. This expression is a diagnostic framework, not a statistically estimated effect or a prediction that the pending EU proposal will use an identical accounting formula.

$$B_{net} = C_{ETS} + C_{CORSIA} - D_{eligible} + C_{admin}$$

In this identity, C_{ETS} denotes effective allowance costs, C_{CORSIA} denotes eligible offsetting expenditure, $D_{eligible}$ denotes the legally recognized deduction, and C_{admin} denotes incremental administrative and financing costs. The components must be calculated for comparable operators, routes, compliance periods, and currencies; actual procurement prices and the timing of deductions can materially affect the outcome [13,21].

A second ledger should track environmental claims separately. Each canceled offset unit needs a unique identifier, eligible vintage, authorization trail, verifiable underlying mitigation activity, and protection against duplicate claims. EU allowances need a distinct surrender and cancellation trail appropriate to cap-and-trade accounting. Combining the two ledgers into one undifferentiated balance could obscure whether a deduction merely recognizes an expenditure or also changes the climate obligation. Such separation would make it easier to identify a technically valid double-payment complaint without mistakenly treating environmental double claiming as a question that can be repaired with a refund [18,29,30].

Testing Additional Mitigation and Avoiding Competitive Displacement

Policy coherence also requires an empirical test of additional climate benefit. A proposal that imposes greater costs on particular airlines should show whether emissions fall in the covered operations, whether traffic shifts to noncovered routes, and whether displaced activity has lower or higher emissions. A policy's gross coverage or nominal carbon price alone cannot answer those questions. Recent aviation research shows that efficiency, demand, and hub effects are heterogeneous, while carbon-pricing research in other ETS sectors documents material emission reductions without proportionate declines in economic activity. The aviation-specific evidence should be treated as the primary source for route mechanisms, with broader ETS experience as complementary rather than dispositive evidence [11,25,26,60]. The literature also indicates that market measures influence innovation trajectories. Firm-level ETS evidence suggests that carbon pricing can induce investment and emissions-intensity reductions, while aviation-specific research finds greater diffusion of lower-carbon technology after exposure to pricing. However, high fuel costs and slow infrastructure development constrain how rapidly airline investment can respond. Consequently, higher carbon costs without credible support for fuel supply, clean electricity, and fleet transition could produce financial stress without proportionate near-term mitigation. A balanced policy package would connect pricing to investments whose life-cycle benefits are independently measured [47,48,59].

An Equity-Sensitive Position for Indonesia

Indonesia's preference for consistency with CORSIA can be framed as a principled case for globally harmonized treatment and predictable international market access. Such an intervention need not deny the importance of stronger climate action. It can instead demand that regional measures demonstrate both environmental additionality and a credible mechanism for preventing unjustified duplicate costs. This framing is especially useful for states with developing aviation markets, diverse carriers, and dependency on international connections because it turns a potentially binary diplomatic dispute into a negotiation about verifiable design criteria. The conclusion remains conditional on the final legal text and specific exposure of Indonesian carriers and routes [9,10]. An evidence-based negotiating strategy would request a route-by-route impact assessment, including competitive effects on connecting itineraries, the practical valuation of eligible CORSIA credits, administrative burden, and available exemptions. Indonesia could encourage standardized interfaces between ICAO emissions reporting and EU compliance processes while maintaining clear responsibility for each regulator's legal requirements. Technical dialogue with other concerned states may identify shared difficulties, although the underlying political and economic preferences of Brazil, Singapore, Japan, and the UAE should not be assumed identical without authenticated statements and country-specific evidence [3,26,43]. Indonesia also has interests in the integrity and potential supply of international mitigation outcomes. It is important that any CORSIA-related units linked to host-state activities meet credible environmental standards, are appropriately authorized, and are not simultaneously claimed under incompatible national or international accounting arrangements. The same principle applies to sustainable aviation fuel production: environmental credibility depends on feedstock origin, land-use impacts, lifecycle emissions, and robust certification rather than on the nominal 'sustainable' designation. This creates an opportunity for Indonesia to advance both aviation climate governance and higher-quality domestic carbon and fuel accounting without weakening the requirement for independent verification [31,36,51].

Institutional Design and Practical Safeguards

The analysis yields a five-component compatibility architecture. The first is a shared understanding of route and operator coverage, including the status of proposed changes. The second is a financial ledger for identifying and recognizing eligible CORSIA offset expenditures without confusing these with the value of EU allowances. The third is an environmental claims ledger for

eligibility, authorization, issuance, retirement, and corresponding adjustments. The fourth is an equity and competition test that evaluates hub displacement, administrative costs, and access to technology. The fifth is a joint review process that revisits rules when evidence shows excessive duplication, poor mitigation, or unequal burdens [9,15,55]. A staged approach could improve practical feasibility. In the short term, competent authorities and operators should identify affected routes, separate already-enacted requirements from prospective reforms, and standardize the documentation of actual CORSIA unit purchases and cancellation. In the medium term, independent auditors could test reconciliation of carbon claims across registries and evaluate leakage around major hub connections. Longer term, ICAO and EU actors could publish comparable measures of verified additional mitigation and periodically review whether proposed remedies affect total emissions or merely redistribute costs. Such arrangements support cooperation without requiring every institution to adopt an identical political position [14,19,52].

Figure 5 offers a procedural framework for policy compatibility, combining accounting safeguards with environmental and distributive review. The five elements form a policy proposal rather than an agreement already reached by ICAO and the European Union.

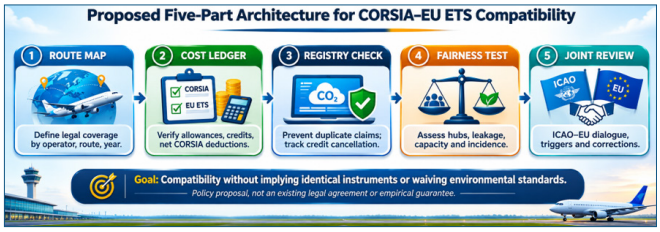


Figure 5: Proposed Five-Part Institutional Compatibility and Safeguard Mechanism.

Original policy-design proposal derived from the qualitative synthesis; not an existing agreement.

Figure 5 converts the proposed approach into a governance process. Each instrument retains its legal identity, while transparency occurs at the shared interface: route coverage, documented financial obligations, independently verified credits, and auditable climate outcomes. The model is deliberately modular so that the EU could adjust the design of its proposals and ICAO could strengthen CORSIA without abandoning the compatibility principles. It does not assume that the two systems already have interoperable registries or that the necessary rules have been agreed. Instead, it sets out practical criteria against which future negotiations and legislative decisions could be assessed [4,9,55].

Three Scenarios and Their Comparative Implications

The first scenario is continued functional separation: the EU ETS remains focused on the current specified European scope, with CORSIA applying to qualifying extra-European operations. It maximizes short-term clarity where existing arrangements are understood, but may not satisfy the EU's assessment of international aviation's contribution to climate goals. The second scenario is a broadened EU ETS with verified CORSIA cost deductions beginning in 2029, subject to legislative adoption. It could enhance regional carbon pricing but requires more sophisticated overlap administration and safeguards against diversion. The third scenario is a strengthened CORSIA accompanied by coordinated regional support for direct reductions, which places greater weight on multilateral negotiation and the credibility of global rules [3,8,20,]. No scenario can be declared universally best from the available literature. A complete appraisal needs prospective emissions modeling, credit market evidence, airline route data, and a distributive assessment. An integration of technology, demand, environmental integrity, and financial effects is particularly important because existing net-zero roadmaps face substantial practical constraints. Expert surveys find skepticism about the pace of transition, while analyses of global roadmaps indicate significant ecological pressures even under ambitious fuel substitution. The lesson is that the policy dispute should be assessed against observed climate and development outcomes, not merely the procedural elegance of one mechanism [42,50,61].

Conclusion and Recommendations

The CORSIA-EU ETS controversy demonstrates that international climate governance cannot be evaluated using only the number of instruments applied to aviation. CORSIA represents the negotiated global approach to market-based CO2 offsetting for international flights, while the EU ETS provides a cap-based carbon price within the territory and routes defined by European legislation. Their coexistence creates real risks of financial overlap, administrative complexity, competitive diversion, and environmental misrepresentation. Yet those risks are distinct and must be diagnosed through the relevant legal scope, emissions accounting, airline behavior, and evidence about the quality of mitigation outcomes. A single legal or political slogan does not settle all four dimensions. The July 2026 European Commission proposal makes the issue immediate but should not be mischaracterized as already binding for outbound flights in 2029. Its recognition of eligible CORSIA cost deductions is a constructive starting point, provided that future arrangements are precise, transparent, and administratively feasible. A deduction alone cannot demonstrate that policies are climate-effective, nor can the presence of a regional carbon price prove an infringement of the multilateral framework without fuller legal and institutional analysis. The decisive question is whether the combined architecture creates credible additional mitigation without disproportionate burdens on airlines, connecting markets, and states with different development capacities.

For ICAO, the priority is to improve the transparency, environmental integrity, and predictability of CORSIA while creating structured avenues for dialogue over the interaction with regional measures. For the EU, the priority is to provide demonstrable evidence of the additional climate benefit of proposed scope extensions, quantify route-diversion effects, and publish workable rules for recognition of legitimate CORSIA-related costs. For both, the desirable outcome is a shared set of compatibility tests, not necessarily identical instruments: route boundaries, financial incidence, carbon unit quality, accounting integrity, and distributional consequences should be subject to comparable scrutiny. For Indonesia, a defensible position is to uphold CORSIA's global coordinating role while participating actively in evidence-based examination of the EU proposal. The country should invest in route-level compliance readiness, verified offset and allowance records, credible mitigation authorization, and analytical capacity to assess hub leakage and competitive exposure. It should also support practical mechanisms that protect smaller and developing aviation markets without diluting climate integrity. Such an approach combines multilateral consistency with technical engagement, provides a constructive basis for cooperation with other affected states, and places environmental

accountability alongside the preservation of reliable international connectivity.

This review is a conceptual synthesis rather than an original empirical measurement of double charging or emissions. Future research should obtain comparable airline-level compliance data, examine legal provisions as they progress through the European legislative process, test alternative deduction formulas, and model emissions leakage through global network hubs. Another priority is to trace verified credit retirement and corresponding adjustments alongside the development of sustainable aviation fuels and non-CO2 mitigation. These inquiries would enable a more definitive evaluation of how coordinated global and regional policy can support aviation decarbonization while remaining economically feasible, administratively transparent, and internationally fair.

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