Viksit Bharat: Shaping the Future of Green Aviation

POWERING CLEAN SKIES



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SAF ASSOCIATION

SEPTEMBER 2026





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FOREWORD

From WriteCanvas

India stands at a decisive inflection point: rapid passenger growth and rising climate commitments make Sustainable Aviation Fuel (SAF) both a strategic necessity and a commercial opportunity. SAF offers lifecycle greenhouse gas reductions. With India's domestic air traffic—over 270 million passengers in 2025 and forecast to grow at 6–7% annually—timely deployment can significantly reduce future emissions.

Our contribution to this report was practical and evidence-led. As operators of ESGNews.earth, we engage regularly with energy, transport, and industrial stakeholders. This cross-sector perspective allows us to surface operational constraints that high-level analyses often miss.

For this report we combined: targeted primary points drawn from the closed-door deliberation hosted by the SAFA India Chapter; synthesis of international best practice and lifecycle studies (ICAO, IATA and peer reviewed assessments); and India specific validation on feedstock availability, refinery configurations, storage and logistics costs. The closed-door roundtable—an open forum allowed stakeholders to articulate barriers, tradeoffs and pragmatic solutions candidly. This report is the result of the open conversations plus subsequent data validation and iterative stakeholder review.

What distinguishes this report is its operational focus. Beyond sector-level consensus, we identified implementable measures that address the immediate commercial barriers to SAF: short term infrastructure interventions, market design options, and financing instruments. Where views diverged, we present clear tradeoffs so policymakers can weigh impact, cost and speed of deployment.

WriteCanvas endorses the recommendations and is committed to partnering with the Association, industry and regulators. We will support targeted workshops, implementation roadmaps, and investor materials to reduce project risk and accelerate capital deployment.

Converting the momentum from the roundtable into concrete SAF deployment is essential to delivering measurable emissions reductions. Having said that, strengthening India's energy resilience and capturing the industrial benefits of the green transition is a collaborative effort.



Renjini Liza Varghese,
CEO, WriteCanvas
Knowledge Partner & Co-author

VERIFICATION NOTE — 3 SEPTEMBER 2026: This edition has been reviewed against the attached Zero Draft SAF Policy and cross-checked, where relevant, against current primary or authoritative sources including ICAO, IATA, Government of India/PIB, Ministry of Civil Aviation, BEE, EU, UK and US government sources, and company disclosures for case studies. The attached SAF Policy remains a draft policy proposal and is not treated as notified law. Forecasts and commercial estimates are labelled as scenarios or illustrative assumptions where no authoritative current market figure is available.

From SAFA Desk

Sustainable Aviation Fuel (SAF) is a strategic imperative for India — essential to meeting our climate commitments. It is also critical for strengthening energy security, and capturing the economic opportunities of the global green transition. Aviation accounts for roughly 2–3% of global CO2 emissions today, while India's air traffic is among the fastest-growing worldwide; scaling SAF can reduce lifecycle greenhouse gas emissions from conventional jet fuel by up to 80% depending on feedstock and pathway.

This report is the result of a deliberate, evidence-led process convened by the SAF Association to identify practical, scalable pathways for SAF deployment in India. It synthesises findings from a closed-door roundtable that brought together airlines, fuel producers, infrastructure and logistics partners, financiers, regulators, and independent technical experts, alongside structured stakeholder engagements, analysis, and a review of international best practice and lifecycle studies. Wherever specific figures are cited, we have drawn on authoritative sources including ICAO, IATA, the Ministry of Civil Aviation, and peer-reviewed assessments.

From the outset, the Association has taken all possible steps to ensure every stakeholder voice is heard and considered. The closed-door roundtable was the first step — a candid, action-oriented forum that surfaced commercial barriers, policy gaps and financing needs. This report carries forward those discussions: its recommendations reflect key insights and perspectives emerging from the stakeholder consultations and subsequent analysis, and offer pragmatic measures for regulators and policymakers to consider in aligning incentives, de-risking investments and catalysing domestic SAF production at scale.

Our aim is to sustain and amplify the momentum created by these initial consultations and to move the dialogue decisively from conversation to implementation. The Association will continue active engagement with stakeholders, regulators and policymakers to align frameworks, unlock financing and build the infrastructure needed to make SAF commercially viable. We remain committed to seeing India's aviation fuel increasingly green — delivering emissions reductions, fostering domestic green industry and strengthening our energy resilience.

I invite industry leaders, policymakers and investors to review the report, engage with the Association, and join us in accelerating India's SAF transition.



Rohit Kumar

Secretary General, SAFA

Executive Summary

BLUEPRINT FOR GREEN SKIES

INDIA'S SAF OPPORTUNITY

India's aviation sector enters an important new phase of CORSIA implementation from 2027. Sustainable Aviation Fuel (SAF) is the principal near- to medium-term fuel-based lever available to reduce aviation lifecycle emissions while supporting the sector's continued growth. The critical question is whether India can scale SAF production and supply quickly enough to meet its emerging requirements

The Metrics Shaping the Case

Up to 80% lower lifecycle emissions: Waste-oil-based SAF, the pathway most producers utilise today, cuts greenhouse gas intensity by roughly 80% compared to conventional jet fuel, with advanced pathways pushing past 90%.

Nearly triple the cost for now: IndianOil's chairman has indicated that SAF is close to three times the price of standard Aviation Turbine Fuel (ATF) at current volumes—a steep premium that is expected to compress rapidly as production scales.

Recent industry cost models suggest that selected Indian SAF pathways, including power-and-biomass-to-liquids (PBtL), could approach cost parity with fossil jet fuel by the mid-2030s. This is subject to technology maturity, feedstock availability, energy costs, financing conditions and scale, shielding domestic producers from rupee depreciation and import-price shocks.

India generates approximately 230 million tonnes of surplus agricultural residue annually, including sugarcane bagasse, rice straw and crop waste. Feasibility studies indicate this is more than sufficient to cover domestic SAF requirements and support exports.

These figures are not built on speculative projections; they are drawn from live pilots, refinery roadmaps currently under construction and pricing benchmarks published this year.

The Policy Ask:

India has set an indicative trajectory: 1% SAF blending by 2027, 2% by 2028 and 5% by 2030 for international flights, while the framework for domestic SAF blending remains under discussion. However, policy direction does not



The critical question is whether India can scale SAF production and supply quickly enough to meet its emerging requirements



guarantee delivery. The industry's requirements focus on five concrete pillars:

Fiscal Support: Production-linked incentives, GST rationalisation and customs relief on plant equipment are essential to bridge the price gap while volumes remain low.

Offtake Certainty: Long-term purchase commitments from public sector undertakings (PSUs) and airlines, backed by viability gap funding, will give refiners the confidence to commit capital rather than delay investment.

Feedstock Mobilisation: Agricultural residue aggregation networks, used cooking oil (UCO) collection systems and municipal waste channels are needed to convert India's biomass surplus into accessible feedstock.

Infrastructure Integration: Dedicated blending and storage facilities at major airports, alongside enhanced pipeline and rail connectivity, will ensure SAF can drop into existing fuel systems with zero operational disruption.

R&D and Global Standards: Targeted support for Alcohol-to-Jet (ATJ), Fischer-Tropsch and e-fuel pathways must align with ASTM D7566 and CORSIA to unlock international carbon-credit recognition and protect export value.

The SAF Association (SAFA), alongside airlines, refiners, feedstock aggregators and technology partners, is de-risking this transition by aligning Indian SAF standards with ICAO CORSIA and ASTM D7566 to ensure output is globally bankable, whilst providing evidence-based inputs to the Civil Aviation and Petroleum Ministries.

The Road to 2030

2025–27: 1% indicative SAF blending target for international flights; IndianOil's Panipat complex progresses toward commercial-scale SAF production.

2028: 2% indicative SAF blending target; feedstock aggregation systems and refining capacities are expected to scale up.

2030: 5% indicative SAF blending target; PBtL and ATJ pathways are expected to progress toward greater market cost-competitiveness.

None of this will occur on autopilot. It demands that policy, finance, feedstock and infrastructure move in unison. This coordination is precisely where SAFA and its partners are anchoring the ecosystem.



SAF is not a distant prospect; it is the principal fuel-based decarbonisation lever available to Indian aviation today.

The Takeaway:

SAF is not a distant prospect; it is the principal fuel-based decarbonisation lever available to Indian aviation today. For airlines, it offers compliance and market differentiation; for refiners, it represents a resilient growth line and a hedge against carbon risk; and for investors, it stands as a policy-backed asset class ripe for early-stage positioning.

The requirement is straightforward -- policy certainty, fiscal backing and coordinated execution. The return is a more competitive aviation sector that drives decarbonisation without compromising India's economic momentum.

Disclaimer: *The analysis, recommendations and proposed measures presented in this report are based on stakeholder consultations, available evidence and the authors' analysis. They are intended to inform industry and policy dialogue and should not be construed as notified Government policy or as the formal position of any individual stakeholder, unless expressly stated.*

BACKGROUND AND RATIONALE

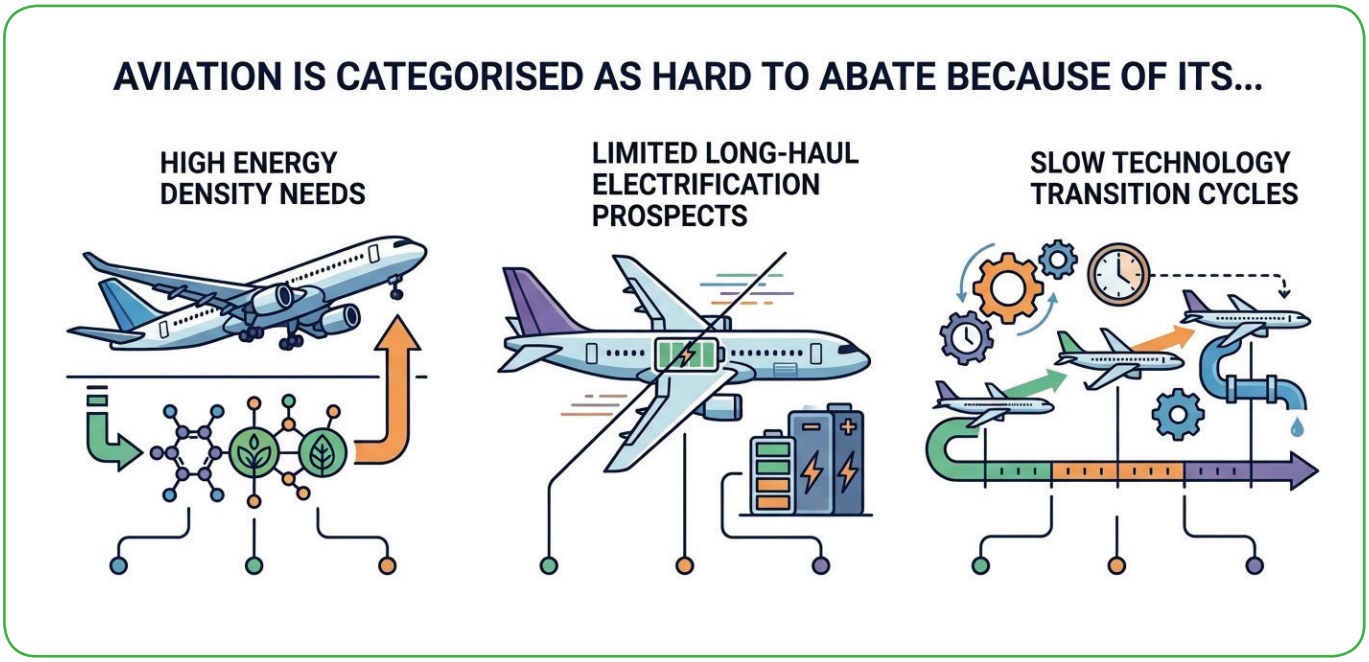
India's aviation sector is one of the fastest-growing markets globally. Driven by surging passenger demand, expanding capacity, and strong policy support, this expansion is expected to create numerous job opportunities and enhance air connectivity. Additionally, investments in airport infrastructure are vital to accommodate the increasing number of travellers and improve overall service quality. It also brings an urgent imperative-- to decarbonise the aviation sector along with aligning to the national net-zero commitments. As the industry scales, Sustainable Aviation Fuel (SAF) emerges as the most viable near- to mid-term lever to reduce lifecycle emissions without compromising growth. This report examines India's decarbonisation pathway, with a focused lens on the role, readiness, and roadmap for SAF adoption across the country's aviation ecosystem.

1.1 What is SAF

Sustainable Aviation Fuel (SAF) is a lower-carbon aviation fuel produced from eligible renewable or waste/residue feedstocks. For approved pathways, it functions as a drop-in fuel within existing aircraft and fuel infrastructure, provided it is blended and certified in accordance with applicable fuel specifications.

1.2 Decarbonisation

Passenger-growth forecasts are presented exclusively as forecasts rather than current facts. The report therefore avoids treating a single annual growth rate as definitive. The latest government and industry evidence confirms the continued expansion of India's aviation market.



Jet-fuel demand is expected to rise materially, but India's initial SAF targets apply exclusively to international flights. Accordingly, the 2030 SAF requirement is modelled against the fuel used or uplifted for the relevant international-flight scope, rather than total domestic ATF demand. Unscoped ATF figures are excluded from the derivation of the 2030 SAF requirement.

Aviation is categorised as hard to abate – because of its

- High energy-density needs
- Limited long-haul electrification prospects
- Slow technology transition cycles

Decarbonisation will require a combination of operational efficiency, fleet and propulsion technology, and SAF. Electric and hydrogen propulsion remain at an early stage of deployment, particularly for larger and longer-range aircraft. SAF is therefore the principal near- and medium-term fuel-based mitigation lever. In the IATA net-zero pathway, SAF accounts for a 65% contribution to the 2050 solution; across ATAG Waypoint 2050 scenarios, its contribution varies by pathway.

CORSIA is a carbon-offsetting scheme, not an absolute emissions limit. ICAO uses 2019 emissions as the baseline for the pilot phase and 85% of 2019 emissions for the 2024–2035 phases. The first two phases are voluntary for participating States, while the second phase commences in 2027. Separately, ICAO's Global Framework adopted a collective, non-binding aspirational vision to reduce international aviation CO_2 emissions by 5% by 2030 through SAF, LCAF, and other cleaner energies.

Claims that India represents 2.5% of global ATF demand or exports half of domestic production are not retained because they could not be independently verified from authoritative sources. The verified national position is that India has indicative SAF blending targets of 1% in 2027, 2% in 2028 and 5% in 2030, initially for international flights.

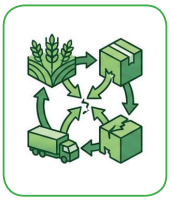
Five bottlenecks stall progress:



High Production Costs: SAF generally carries a material premium over conventional jet fuel. IATA reports that SAF prices can exceed fossil jet fuel by around two times and by up to five times in mandated markets.



Market Opacity: Low visibility on pricing and supply.



Fragmented Supply Chains: Weak coordination between feedstock suppliers, producers, and off-takers.

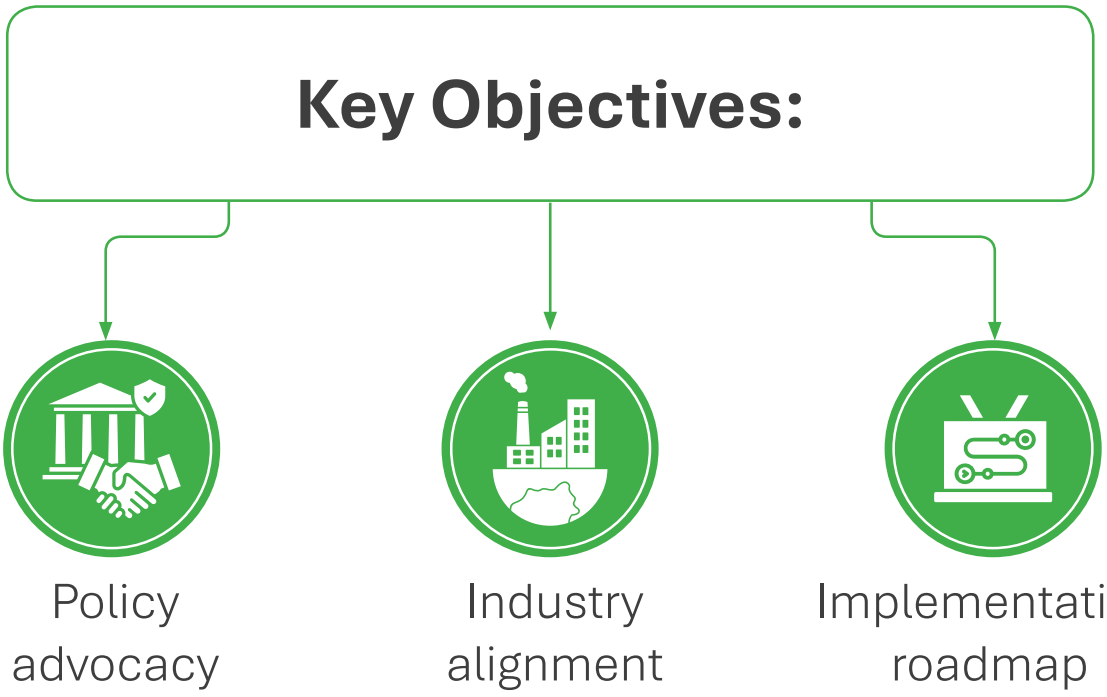


Infrastructure Deficits: Limited blending facilities.



Logistics Gaps: Insufficient storage and transport investment at key aviation hubs.

1.3 Objective of the Report



1.4 India's Net-Zero Commitments (2050 Vision)

India's national net-zero target is set for 2070. For international aviation, the relevant global benchmark is ICAO's Long-Term Aspirational Goal (LTAG) of net-zero carbon emissions by 2050. These remain distinct targets and are not presented as a single domestic aviation legal target.

India's SAF strategy is therefore best framed as part of its 2070 national transition. Its international aviation obligations including CORSIA, must support the competitiveness of Indian airlines and fuel producers on international routes.

1.5 Global Emission Reduction Potential

Aviation is a hard-to-abate sector due to its high energy-density requirements and the limited near-term applicability of electrification and hydrogen to long-haul operations. The sector's net-zero pathway therefore depends on several complementary levers rather than a single technology.

Aviation emissions have historically risen in tandem with passenger demand and the expansion of air travel. The decarbonisation challenge is therefore to accommodate continued connectivity growth while reducing lifecycle and operational emissions.

SAF represents the largest single fuel-based decarbonisation lever across the major industry net-zero pathways.

IATA's net-zero pathway estimates that approximately 21.2 Gt of CO_2 mitigation is required over the 2021–2050 period. Its illustrative contribution split allocates 65% to SAF, 19% to market-based measures such as offsets and carbon capture, 13% to new aircraft and propulsion technology, and 3% to infrastructure and operations.



The earlier estimate that emissions could reach approximately 700 million tonnes CO_2e in the absence of SAF has been omitted as a general forecast. This projection is highly scenario-dependent and lacks a sufficiently clear, current methodology within the scope of this report.

1.6 The India Story:

The 2025 ICAO ACT-SAF feasibility study provides a robust foundation for assessing India's production potential. The study estimates that the evaluated feedstocks offer an approximate SAF production potential of 14–33 Mt/year. Agricultural residues, specifically sugarcane bagasse and rice straw, present substantial potential via alcohol-to-jet pathways. Furthermore, the study notes that supplementary volumes could be derived from waste-gas fermentation and e-fuels.

India's diverse feedstock profile (agricultural residues, used cooking oil, and municipal solid waste) presents a distinct opportunity to establish a domestic SAF ecosystem. The primary strategic priority is to scale production pathways that are technically certified, economically viable, and compliant with rigorous sustainability criteria, while mitigating risks related to food security and high indirect land-use change (ILUC).

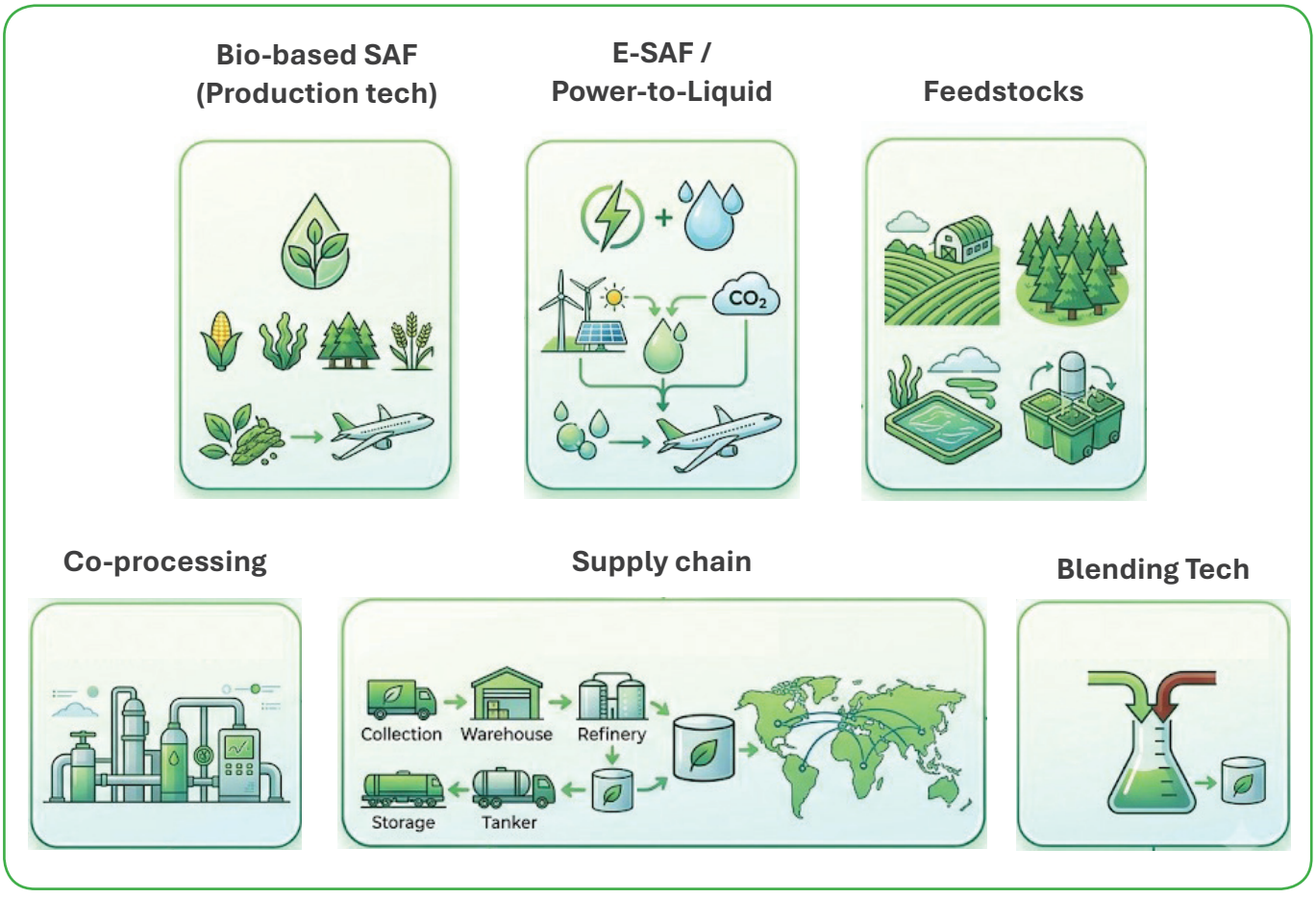
PATHWAYS, IMPACTS AND TRADE-OFFS

2.1 Impact on the Environment and Health

SAF can deliver environmental benefits that extend beyond lifecycle GHG reductions. Depending on fuel composition and engine conditions, reduced sulphur and aromatic content can mitigate sulphur oxides and particulate matter emissions. Certain SAF pathways may also attenuate soot-related non-CO_2 climate effects, including contrail-induced impacts. However, these effects remain highly dependent on the production pathway, engine specifications, and operating conditions, and are therefore not treated as universal public health or climate benefits.

Waste- and residue-based SAF can support circular-economy objectives by converting materials such as used cooking oil (UCO), agricultural residues, and suitable municipal waste into aviation fuel. Robust sustainability safeguards are essential to mitigate the risks of biodiversity loss, indirect land-use impacts, food competition, and other unintended ecological or social consequences.

2.2 The SAF Pathways



01

HEFA (Hydro-processed Esters and Fatty Acids)

Feedstock: UCO, animal fats, vegetable oils

Process: Hydrogenation and refining of fats/oils in existing refineries during conventional fuel production

Status: Most commercially mature and widely used

Advantage: Drop-in fuel compatible with existing aircraft

Limitation: Feedstock availability, traceability and hydrogen demand can constrain scale-up.

02

FT (Fischer–Tropsch Synthesis)

Feedstock: Biomass (agricultural residues, forestry waste), MSW

Process: Gasification → Syngas → Liquid fuel via Fischer–Tropsch synthesis

Status: Commercially demonstrated; capital-intensive.

Advantage: Can use diverse waste feedstocks

Limitation: High cost and complex infrastructure

03

ATJ (Alcohol-to-Jet)

Feedstock: Ethanol, methanol (from biomass or industrial CO_2)

Process: Alcohol conversion → dehydration → oligomerisation → jet fuel

Status: Early commercial stage

Advantage: Leverages existing ethanol industry

Limitation: Efficiency losses during conversion

04

PtL / e-SAF (Power-to-Liquid)

Feedstock: Green hydrogen + captured CO_2

Process: Electrolysis + synthesis (often via Fischer–Tropsch synthesis)

Status: Emerging / future pathway

Advantage: Potentially very low lifecycle emissions when powered by low-carbon energy and using appropriately sourced CO_2.

Limitation: Very high cost and energy intensive

05

Emerging thermochemical routes

Feedstock: Agricultural residues and other waste streams, depending on the technology and certification pathway.

Process: Thermal decomposition → upgrading to jet fuel

Status: Emerging; pathway-specific qualification and upgrading requirements apply.

Advantage: Waste-to-fuel potential

Limitation: Requires upgrading for aviation-grade fuel

2.3 SAF vs ATF

Parameter	SAF	Conventional ATF
Definition	Alternative aviation fuel derived from sustainable feedstocks	Fossil-derived jet fuel refined from crude oil
Feedstock	UCO, agricultural residues, waste/residue streams, and renewable electricity + captured CO_2 for PtL	Crude oil (petroleum)
Carbon Emissions	Up to ~80% lifecycle GHG reduction for many SAF pathways, depending on feedstock, pathway and methodology	Fossil-based lifecycle emissions
Sustainability	Renewable, circular economy Aligned	Non-renewable, fossil-based
Sulphur Content	Typically, low sulphur particulate effects vary by fuel and engine	Contains sulphur and Aromatics
Aromatic content	Certified blends; many approved pathways permit up to 50%, but pathway-specific limits vary	100% conventional ATF is the baseline fuel Specification
Drop-in Capability	Certified blends up to 50% Currently	Fully compatible (100%)
Technology Pathways	HEFA, ATJ, FT, PtL/e-SAF and other approved/ emerging pathways	Conventional refining
Cost	Typically, materially higher than fossil jet fuel; IATA reports ~2x and up to 5x in mandated markets	Established supply chains; generally lower cost
Availability	Limited, scaling stage	Widely available Globally
Policy Support	Can reduce lifecycle GHGs and support waste/ residue utilisation, subject to sustainability controls	Significant source of aviation CO_2 emissions
Environmental Impact	Reduces GHG emissions, supports waste utilisation	Contributes significantly to aviation emissions

GLOBAL SAF LANDSCAPE

The global SAF market remains severely supply-constrained. IATA estimates global SAF production at approximately 1.9 Mt in 2025 and 2.4 Mt in 2026, representing roughly 0.6% and 0.8% of total jet-fuel consumption respectively. Based on this baseline denominator, achieving a 10% global share would require approximately 30 Mt/year—representing a 12.5-fold increase over 2026 production levels, rather than the previously stated 50-fold increment. Prohibitive costs, limited supply volumes, and fragmented policy frameworks continue to act as primary systemic constraints. Ultimately, IATA estimates that the industry's 2050 net-zero pathway will require an annual SAF volume of approximately 500 Mt. Consequently, verified actual production is strictly differentiated from announced or projected capacity metrics within this report.

3.2 Key Policies & Mandates

- CORSIA
- EU ETS
- US SAF Incentives

Mandates: CORSIA

CORSIA operates as a market-based offsetting mechanism. Eligible SAF can reduce an aircraft operator's offsetting obligations provided the fuel satisfies all applicable CORSIA sustainability, certification, and accounting criteria. ICAO adopted CORSIA in 2016; the pilot phase concluded over the 2021–2023 period. The first phase spans 2024–2026, and the second phase commences in 2027. For the 2026 reporting year, 130 States are participating on a voluntary basis.

India's 1%, 2%, and 5% SAF figures represent national indicative blending targets for international flights rather than CORSIA-mandated blending percentages.

3.3 Regional Policies



European Union: The ReFuelEU Aviation initiative mandates a minimum SAF blending share of 2% in 2025, 6% in 2030, 20% in 2035, and 70% in 2050, alongside a distinct sub-target for synthetic fuels. Separately, the EU Emissions Trading System (EU ETS) has reserved a pool of up to 20 million allowances (carbon credits) for the 2024–2030 period. These allowances are allocated to cover all or part of the price differential between eligible alternative aviation fuels and traditional fossil kerosene on covered flights.



United Kingdom: The UK mandate commences with a 2% SAF requirement in 2025, scaling to 10% by 2030 and 22% by 2040. While hydroprocessed esters and fatty acids (HEFA) can fulfill 100% of the core obligation through 2026, its contribution will be capped at 71% by 2030 and 35% by 2040 to incentivize alternative SAF technologies.



Asia-Pacific: SAF regulatory frameworks are progressively evolving across key regional markets, including Singapore, Japan, South Korea, China, Indonesia, and India. Policy design and implementation methodologies continue to vary materially by jurisdiction.



United States: The Section 45Z Clean Fuel Production Credit remains active through 2029. However, the specialised SAF supplementary rate was eliminated for fuel produced after 31 December 2025. Consequently, the US incentive framework is characterised as an evolving clean-fuel production-credit regime rather than the historical $1.25–$1.75 per gallon SAF credit structure.

Regulatory Synthesis: This global landscape encompasses a diverse mix of penalties and fiscal incentives engineered to accelerate SAF manufacturing capacity and stimulate regional market growth.

3.4 Global SAF Supply

Global SAF supply is quantified primarily through verified actual production. IATA estimates global SAF production at approximately 2.4 Mt in 2026, representing 0.8% of global jet-fuel consumption. Announced capacity metrics are delineated separately and are not presented as delivered supply in the absence of a dated project database and a transparent commissioning methodology.

IATA estimates global SAF production at approximately 2.4 Mt in 2026, representing 0.8% of global jet-fuel consumption.

Major SAF producers and market participants encompass entities such as Neste and other refiners, fuel suppliers, and logistics providers. Company-level project capacity figures and commissioning timelines are not asserted within this report owing to absent current corporate disclosures.

Airport availability percentages previously cited for Europe, North America, and Asia have been omitted because a current, authoritative dataset could not be identified during the verification process.

Commercial market-size forecasts vary materially by methodology and provider. The core market narrative therefore prioritises IATA production metrics and ICAO policy data; third-party market-research forecasts are treated as commercial estimates rather than authoritative industry benchmarks.

3.5 Case Studies

Signature Aviation at Los Angeles International Airport (LAX)

Background: On 14 May, 2024, Signature Aviation announced that its LAX private-aviation terminal had become the second Signature location worldwide to ensure a 100% supply of blended Neste MY Sustainable Aviation Fuel.

Implementation: Every gallon supplied to Signature's LAX guests was a blended SAF product comprising 30% Neste MY SAF and 70% conventional jet fuel. This was a terminal-level offering and is not described as a 30% SAF blend across all LAX airport operations.

Results: Signature states that the 30% Neste MY blend can enable a 24% decrease in GHG emissions from air travel. The 24% figure refers to the blended product's stated lifecycle GHG benefit, not a measured reduction for every LAX flight.

Standards context: SAF blending limits are pathway-specific under applicable ASTM specifications. Many approved synthetic blending pathways permit blends up to 50%, while some pathways have lower limits. Therefore, 50% is not a universal limit for every SAF pathway, and the LAX 30/70 product was within the applicable specification.

At a Glance

Aspect	Detail
Supply arrangement	Signature LAX: 100% of fuel supplied at the terminal was blended SAF
Blend ratio	30% Neste MY SAF + 70% conventional jet fuel
Stated GHG benefit	24% decrease in GHG emissions from air travel for the blended product





British Airways

Background: British Airways has pursued SAF as part of its pathway to net zero by 2050.

Implementation: In September 2021, British Airways operated its first passenger flight directly powered by SAF, BA1476 from London Heathrow to Glasgow, using a 35% SAF blend supplied by bp.

Results: British Airways reported that the flight achieved a 62% CO_2 reduction compared with the earlier benchmark flight, with 28 % points attributed to SAF, 34 to aircraft and operational improvements, and the remainder addressed through offsets. The SAF itself was reported to provide up to an 80% lifecycle carbon reduction versus the fossil fuel it replaced.

Challenges Overcome: The case illustrates the need to combine fuel supply, aircraft compatibility, airport infrastructure, operational measures and credible lifecycle accounting.

At a Glance

Aspect	Detail
SAF Introduction	First passenger flight directly powered by SAF: BA1476, London Heathrow–Glasgow, September 2021
Reduction Achieved	35% SAF blend; the flight reported 62% lower CO_2 versus the 2010 benchmark flight, with SAF contributing 28 percentage points
Public Engagement	Lifecycle SAF benefit of up to 80% versus the fossil fuel it replaced

Neste and Finnair Collaboration

Background: Finnair has used SAF from Neste as part of its emissions-reduction strategy and has worked to expand SAF procurement and customer participation.

Implementation: Finnair and Neste have collaborated on SAF use at Helsinki and, more recently, on book-and-claim approaches that allow corporate customers to support SAF environmental attributes.

Results: Finnair's published corporate target was to reduce net emissions by 50% by the end of 2025 compared with 2019 and reach carbon neutrality by 2045. The target is not treated as evidence that SAF alone delivered the reduction.

Challenges Overcome: The case highlights the importance of supply availability, customer participation, book-and-claim accounting and integration with existing fuel infrastructure.

At a Glance

Aspect	Detail
SAF Supply	Neste SAF used by Finnair from Helsinki; collaboration expanded to customer book-and-claim
Operational Goal	Corporate target: 50% net-emissions reduction by end-2025 versus 2019; carbon neutrality by 2045
Infrastructure	Existing fuel infrastructure and book-and-claim accounting support scale-up



3.6 Lessons for India:

India's earlier production-potential estimate of 19–24 Mt/year has been superseded by the 2025 ICAO ACT-SAF feasibility study, which evaluates an approximate SAF potential of 14–33 Mt/year from the assessed feedstocks. Deloitte's independent projection of 8–10 Mt/year by FY2040, alongside an estimated US$70–85 billion investment requirement, is treated as a distinct commercial forecast and is not conflated with the ICAO baseline metrics.

The global supply-demand deficit remains substantial. IATA estimates global SAF production at merely 2.4 Mt in 2026, representing 0.8% of total jet-fuel consumption. Consequently, India must align its indicative blending targets with targeted production incentives, long-term offtake mechanisms, structured feedstock development, dedicated logistics infrastructure, and robust sustainability/MRV frameworks. This will ensure policy ambition is fully matched by scalable supply capabilities.

Shift From Mandates to Incentive-Based Support:

Rigid mandates can induce severe cost pressures when supply remains constrained. Consequently, India must complement its indicative targets with targeted production incentives, concessional finance, long-term offtake agreements, and other structural de-risking instruments.

While the United States experience serves as a valuable policy-design reference, its historical, SAF-specific $1.25–$1.75 per gallon tax credit has been superseded and does not represent the current US regulatory regime.



Singapore provides a useful cost-sharing benchmark. Its passenger SAF levy applies to flights departing Singapore commencing 1 January 2027, covering ticket and service sales from 1 October 2026. The applicable charges vary by destination and cabin class, ranging from S$1 to S$10.40 for economy passengers and up to S$41.60 for premium cabins. India could evaluate a transparent, distance- and cabin-sensitive levy as a strategic policy option, subject to domestic stakeholder consultations and rigorous affordability analyses.

Thailand's waste-oil collection initiatives demonstrate how distributed used cooking oil (UCO) collection can effectively support renewable-fuel supply chains. India could adapt similar models across its domestic food-service networks and other aggregate collection channels, subject to strict traceability mechanisms and sustainability controls.

Cross-border collaborations present a vital opportunity to combine India's vast feedstock potential with international technology, capital, and off-take commitments. India should actively pursue these partnerships on a project-by-project basis, governed by clear technological performance benchmarks, sustainability standards, and financing criteria.

Book-and-claim frameworks can decouple the physical location of SAF supply from the point of the corresponding environmental claim, provided that the underlying accounting and certification protocols permit such separation. India should design any national book-and-claim framework around a rigid chain-of-custody protocol, centralised registries, and strict anti-double-counting controls.

3.7 Managing Sovereignty and Market Risk:

Fund and Levy Models: Passenger levies and aviation taxation frameworks can be deployed to support decarbonisation efforts; however, international precedents vary significantly in intent and structural design. Singapore's SAF passenger levy serves as the most directly applicable benchmark for India. Other European aviation taxes are not characterized as dedicated SAF funding mechanisms unless explicitly documented as such.

Revenue Certainty: The United Kingdom has established a SAF revenue-certainty mechanism specifically designed to catalyse investment in domestic production capacity. India could evaluate a comparable long-term price-support or contract-based framework.



However, any such Indian instrument remains classified as a policy proposal until it is formally notified by the government.

Flexibility Mechanisms: European SAF implementation strategies demonstrate the operational value of flexible compliance pathways and hub-centric infrastructure deployment. Consequently, India could initially centralise blending, storage, and certification infrastructure at high-volume aviation hubs while progressively expanding access across secondary airports.

Preventing Fraud: To mitigate the risks of feedstock misclassification and double counting, India can deploy auditable chain-of-custody protocols, robust sustainability certifications, batch-level traceability tracking, and immutable digital records. While European sustainability frameworks provide valuable operational benchmarks, India's verification systems must be custom-tailored to align with its distinct domestic regulatory and supply-chain realities.

THE POLICY ARCHITECTURE

India is building a policy and regulatory ecosystem aligned with global mechanisms such as CORSIA

Indicative Blending Targets: 1% by 2027, 2% by 2028, and 5% by 2030.

Policy and Regulatory Framework: The stated metrics represent indicative national targets applicable exclusively to international flights. A definitive volumetric figure (in litres) for 2030 is omitted from this analysis because the required SAF volume depends strictly on the international-flight fuel baseline utilised for the calculation. Structurally, the 2026 amendment to the ATF Control Order serves as an enabling regulatory measure, whereas the dedicated SAF policy remains classified as a draft proposal as of 29 July 2026.

4.1 Feedstock Availability Potential

The 2025 ICAO ACT-SAF India feasibility study assesses an approximate SAF production potential of 14–33 Mt/year from the evaluated feedstocks. The study establishes the following indicative ranges:

Feedstocks	Output (Mt/year)
Used cooking oil (UCO)/HEFA	0.8–1.6
First-generation (1G) ethanol/ATJ	2.9–5.9
Sugarcane bagasse/ATJ	2.3–9.0
Rice straw/ATJ	5.8–11.7
Municipal solid waste (MSW)/ gasificationFT	2.4–4.9

These metrics represent evaluated production-potential scenarios rather than guaranteed commercial output.



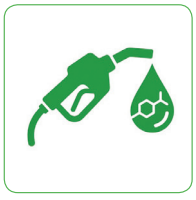
Used Cooking Oil (UCO): This constitutes a primary near-term feedstock for HEFA pathways; however, available supply remains finite and robust traceability mechanisms are critical.



Agricultural Residues: These present a substantial medium- and long-term opportunity, particularly for deployment within alcohol-to-jet (ATJ) conversion pathways.



Municipal Solid Waste (MSW): This serves as a potential feedstock for gasification/ Fischer-Tropsch (FT) pathways, strictly subject to standardized waste segregation, quality metrics, and sustainability compliance criteria.



Ethanol and Other Alcohols: These are highly relevant to ATJ pathways. However, the actual volumetric requirements remain fundamentally dependent upon processing plant efficiency, specific pathway configurations, and the applicable national blending targets.



4.2 Capacity & Infrastructure

India is progressively transitioning from petroleum-exclusive refining structures to integrated biorefining hubs.

Indian Oil Corporation Limited (IOCL): IndianOil is actively advancing SAF-related initiatives, including co-processing configurations and alcohol-to-jet (ATJ) technology development. It has successfully obtained ISCC CORSIA certification for SAF production at its Panipat refinery. Current project capacities and commissioning schedules are not asserted beyond this verified certification milestone.

Bharat Petroleum Corporation Limited (BPCL): BPCL remains among the principal Indian refiners relevant to the emerging domestic SAF ecosystem. Specific project commissioning timelines, locations, and processing capacities are not asserted within this report absent current corporate disclosures.

Regulatory Framework:

On 17 April 2026, the Government of India amended the ATF Control Order to formally bring SAF-blended aviation fuel within the order's statutory regulatory scope. This amendment legally recognises relevant SAF co-processing methods alongside IS 17081 and IS 1571 blending arrangements. It functions strictly as an enabling measure rather than a fiscal tax waiver or a formally notified SAF blending mandate.

4.3 Capacity Building

Capacity building is critical for scaling SAF because the ecosystem faces multi-dimensional challenges encompassing technical, financial, regulatory, and operational complexities.

To position India as a global SAF leader, diverse stakeholders with varying levels of expertise must be systematically aligned. Recent feasibility studies highlight critical gaps in technical know-how, project development, regulatory comprehension, and financial structuring that collectively impede deployment.

Strengthening these capabilities is essential to mitigate project risks, improve bankability, and ensure effective execution across the value chain. Absent targeted workforce readiness and institutional coordination, strong policy frameworks or abundant feedstock availability will fail to translate into commercial-scale outcomes.

Globally, capacity-building initiatives are already establishing foundational pathways through specialised workshops, training programmes, and technical webinars across Europe, the Asia-Pacific, the Middle East, and Africa. Led by industry associations, regulatory bodies, and advisory frameworks, these efforts convene policymakers, airlines, fuel producers, financiers, and feedstock suppliers. International collaboration and exchange programmes further accelerate learning curves by transferring operational expertise from mature markets to emerging ones, effectively minimising duplication of effort.

To directly address deployment bottlenecks, capacity-building programmes focus on several primary thematic pillars:

- Structured training on SAF production pathways, technology readiness levels (TRL), sustainability certification frameworks, and rigorous carbon accounting methodologies.
- Developing efficient feedstock aggregation networks, localised logistics systems, and integrated supply architectures such as direct supply lines.
- Designing robust policy frameworks, structuring blended finance mechanisms, mitigating investment risks, and securing long-term offtake agreements.

Ultimately, addressing these core themes ensures that capacity building supports both localised technical execution and system-level coordination—both of which remain vital to scaling the SAF ecosystem in India.



Absent targeted workforce readiness and institutional coordination, strong policy frameworks or abundant feedstock availability will fail to translate into commercial-scale outcomes.

SAF ECOSYSTEM & STAKEHOLDER MAPPING

5.1 GOVERNMENT MINISTRIES & ROLES

Ministry of Civil Aviation (MoCA)

- Policy design and implementation for mandatory SAF blending in ATF.
- Airline obligations, airport readiness, and compliance with international standards such as ASTM D7566 and CORSIA-related carbon-accounting.

Ministry of Petroleum and Natural Gas (MoPNG)

- SAF production, refining and blending, working with oil PSUs (e.g., Indian Oil) to set up SAF-ready refineries and scale up production.
- Feedstock-side coordination and certification (e.g., bio-aviation fuel pathways, sustainability-compliant feedstocks)
- Chairs or supports the Bio-Aviation Turbine Fuel Programme Committee that promotes SAF uptake.

Ministry of Environment, Forest and Climate Change (MoEFCC)

- Define the domestic environmental criteria for SAF to qualify as a low-carbon fuel.
- Streamline regulatory approvals for greenfield SAF production plants.

Ministry of Agriculture and Farmers' Welfare (MoAFW) & Ministry of Fisheries, Animal Husbandry & Dairying

- Feedstock-supply value chains
- Align SAF-linked demand with farmers' income and rural-employment schemes.
- Ensure that SAF-relevant biomass-sourcing does not conflict with food-security and land-use priorities.

Ministry of Commerce & Industry

- International trade, logistics, and industrial scaling.
- Trade regulations for SAF feedstocks and finished products.
- Oversee accreditation bodies that verify SAF production processes for international markets.
- Attract FDI.

Ministry of Ports, Shipping and Waterways

- Monitor movement and maritime export/import of SAF components.
- Develop specialised storage and handling facilities for green fuels at major ports.
- Align SAF logistics with the Harit Sagar Green Port Guidelines.

Other relevant ministries include

- Ministry of Chemicals and Fertilizers / Ministry of Food Processing Industries
- Ministry of Finance / Department of Expenditure / RBI (indirect role)
- Ministry of Jal Shakti
- Ministry of Communications
- Ministry of Urban Affairs (MoHUA)

5.2 Regulators & Standards Bodies

Regulators and standards bodies certify SAF to guarantee engine safety, compliance with international carbon markets, and formal fuel-grade recognition.

नागर विमानन महानिदेशालय
DIRECTORATE GENERAL OF CIVIL AVIATION

Directorate General of Civil Aviation (DGCA)

- The primary agency for monitoring, reporting, and verifying (MRV) CO2 emissions from the Indian carriers.
- Oversees the implementation of the Carbon Offsetting and Reduction Scheme for international aviation in India.
- Approves the use of specific SAF blends in Indian-registered aircraft.

Bureau of Indian Standards
The National Standards Body of India

Bureau of Indian Standards (BIS)

- Maintains and updates IS 17081, the Indian standard for ATF.
- Ensures that domestic SAF production meets international quality specifications (aligning with ASTM D7566).
- Mandates laboratory testing to certify each SAF batch before airport hydrant entry.

Petroleum & Explosives Safety Organisation (PESO)

- Issues storage, transport, and blending licenses and safety guidelines for refineries and into-wing facilities.

- Regulates the design and operation of SAF pipelines and specialised blending tanks.

Center for High Technology (CHT) under MoPNG

- Assesses the technical readiness of SAF pathways for deployment in Indian public sector refineries.
- Monitors SAF pilot plants, bridging the gap between research labs and commercial production.

Bureau of Energy Efficiency (BEE)

- Administers and supports the Indian Carbon Market framework and related verification infrastructure.
- The current CCTS compliance mechanism applies to specified sectors, including petroleum refineries; it is not treated here as an established SAF-specific credit market for airlines.
- Sets benchmarks for the energy intensity (energy audits) of biofuel production processes.



UCO collection and food-safety controls

- FSSAI and related food-sector systems are relevant to the safe collection and diversion of used cooking oil. The report does not treat RUCO or ISO 22000 as a SAF-specific regulatory system.
- RUCO/UCO systems are treated as feedstock-collection and food-chain safeguardsrather than as dedicated SAF regulation.
- Mandates documented oil collection from large food businesses to provide SAF producers with a verified supply.

ISO standards

ISO 14001 concerns environmental management systems

ISO 14064 covers GHG quantification and reporting.

These standards can support SAF project management and carbon accounting, but they do not themselves certify an aviation fuel as and SAF.

ISO 14064 (Carbon Footprint)- Establishes the global standard for quantifying and reporting greenhouse gas emissions and removals.

ISO 22000 (Food Safety)- Governs the RUCO initiative, tracking diverted feedstock to prevent re-entry into the food chain.

Other relevant departments

NITI Aayog for Inter-Ministerial Coordination .

Indian Computer Emergency Response Team (CERT-In) for cybersecurity

Central Board of Indirect Taxes and Customs (CBIC) for cross-border movement of green fuels.



5.3 Industry Stakeholders

Oil PSUs & refiners:

- Developing commercial-scale biorefineries and co-processing units.
- Certifying that SAF meets applicable fuel-quality and sustainability requirements before distribution.
- Managing SAF storage and blending with conventional ATF.

Airlines:

- Meeting applicable government SAF obligations and reporting requirements.
- Conducting demonstration flights to verify fuel efficiency.
- Offsetting the green premium through corporate programmes or ticket surcharges.

Original Equipment Manufacturers (OEMs):

- Supporting aircraft and engine qualification for approved SAF blends and continuing research toward 100% SAF capability.
- Partnering with refiners to analyse how bio-aromatics affect engine seals and performance.

R & D and Innovation (CSIR IIP, IIT):

- Developing patented pathways
- Testing local residues
- Bridging the gap between lab-scale experiments and industrial production.

Certifications:

- Calculating lifecycle GHG performance using the applicable methodology and documenting sustainability claims.
- Verifying feedstock provenance, sustainability criteria and chain-of-custody requirements.

Feedstock stakeholders:

- Securing a year-round supply of agricultural waste or used cooking oil.
- Consolidating scattered rural waste into centralised processing hubs.

Logistics :

- Preventing SAF contamination during rail, road, or pipeline transport.
- Managing dedicated green tanks at strategic ports and refinery hubs.

Technology Licensors :

- Delivering engineering blueprints for Alcohol-to-Jet or Gas-to-Jet facilities.
- Ensuring refinery output consistently meets chemical specifications.

In addition to this, Industry Associations, Carbon Market Platforms, Legal & Consulting

Firms and Ground Handling & Fuel Hydrant Operators also play key roles.

5.4 Investors & Financial Institutions

1. *Commercial Banks: Debt financing and project loans*
2. *Institutional Investors: (e.g., Pension Funds, Insurance Companies):*
   i. Long-term capital to SAF infrastructure
   ii. Invest in green bonds issued by airlines and developers.
3. *Venture Capital and Private Equity Firms:*
   a. Early-stage equity to startups
   b. Provide capital to scale small-to-midsize producers from pilot plants to industrial facilities.
4. *Multilateral Development Banks:*
   i. Leverage blended finance to de-risk emerging market investments and attract private capital.
   ii. Offer concessional loans and guarantees to lower the cost of capital for decarbonization infrastructure.
5. *Export Credit Agencies (ECAs):*
   a. Providing government-backed guarantees and insurance to shield private lenders from project defaults.
   b. Funding the export of advanced SAF processing equipment to international buyers.
   c. Securing long-term financing for capital-intensive refinery projects.



6. *Corporate Venture Arms of Airlines:*

Invest directly in fuel producers via equity and offtake agreements

5.5 Research & Academia

- Developing patented, indigenous technologies to convert non-edible oils and UCO into HEFA-based bio-jet fuel.
- Exploring Power-to-Liquid pathways by combining green hydrogen production with carbon capture technologies.
- Creating lifecycle assessment models tailored specifically to Indian feedstock supply chains.
- Training specialised chemical engineers to support industry scaling.
- Partnering with global aerospace OEMs to evaluate the long-term impact of high-blend SAF on materials and seals.
- Researching combustion physics, material impacts, and catalysts to optimize SAF thermal stability, seal integrity, and drop-in performance.
- Researching biochemical and thermochemical pathways to convert agricultural residues, industrial waste, and municipal solid waste into SAF.
- Operating pilot facilities and conducting flight trials with commercial airlines and the IAF to demonstrate commercial and technical readiness.

5.6 Institutions:

CSIR-Indian Institute of Petroleum (CSIR-IIP), Dehradun



Indian Institute of Technology (IIT) Delhi – Centre for Energy Studies

Indian Institute of Science (IISc), Bengaluru – Interdisciplinary Centre for Energy Research

Institute of Chemical Technology (ICT), Mumbai

International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi

Tata Institute of Fundamental Research (TIFR) – Sustainability Science Labs.

5.7 Project Developers & Technology Providers

India's current SAF ecosystem is driven by refiners, technology licensors, engineering firms and startups. The country is looking into blending used cooking oil (UCO) with crude

in existing refinery infrastructure to produce lower-carbon fuel.

The selected Indian and international participants include IndianOil, Praj Industries, LanzaJet/LanzaTech, Honeywell UOP, GPS Renewables, Lummus Technology, HPCL, BPCL, NTPC Green Energy and MRPL. However, their exact project status, capacity and commissioning timelines are not treated as operating capacity unless supported by current corporate disclosures.

For example, IndianOil's Panipat complex is a key reference for SAF production and certification, while Praj Industries, LanzaJet/ LanzaTech, Lummus Technology and Honeywell UOP contribute ethanol-to-jet, alcohol-to-jet, HEFA and digital compliance capabilities. GPS Renewables supports waste-to-fuels and circular-feedstock projects. According to official corporate disclosures, Indian refiners and energy producers are actively deploying SAF technologies across their facilities. Hindustan Petroleum Corporation Limited (HPCL) is co-processing used cooking oil (UCO) at its Visakh Refinery while deploying Trijet technology. Bharat Petroleum Corporation Limited (BPCL) announced plans to establish India's first large-scale SAF plant by late 2026, incorporating Alcohol-to-Jet and HEFA units at its Mumbai, Kochi, and Bina refineries. Additionally, NTPC Green Energy is developing an Ethanol-to-Jet plant in Pudimadaka that integrates carbon capture technology to synthesize ethanol from flue-gas emissions. Meanwhile, public project disclosures from Mangalore Refinery and Petrochemicals Limited (MRPL) confirm the construction of a



According to official corporate disclosures, Indian refiners and energy producers are actively deploying SAF technologies across their facilities.

20-kiloliter-per-day SAF demonstration plant using CSIR-IIP technology to serve captive international flight demand.

Startups are expected to enable scale-up through feedstock aggregation, traceability, compliance tech and modular development, though these are not yet counted as confirmed commercial capacity.

Additionally, we expect more innovation in SAF ecosystems such as logistics & infrastructure, compliance & regulatory tech (RegTech), tamper-proof digital data providers, book-and-claim, & SAF Certificate (SAFc) Platforms etc.

India has significantly accelerated its policy ecosystem for SAF between 2024 and 2026. This framework aims to bridge the green premium (the price gap between conventional ATF and SAF), and establish India as a global SAF production hub.

BUILDING THE FISCAL FRAMEWORK FOR SAF



6.1 Tax and Fiscal Framework — Verified Position

In early 2026, the Indian government restructured its biofuel tax regime under the new GST 2.0 framework to accelerate sector growth. However, the source material reviewed for this report does not establish a blanket 5% GST rate for SAF. Any SAF-specific GST treatment is incorporated exclusively when corroborated by the applicable tariff classification and official notification. Accordingly, prospective tax proposals remain strictly segregated from confirmed fiscal measures.

The 17 April 2026 amendment to the Aviation Turbine Fuel (ATF) (Regulation of Marketing) Order brought SAF-blended aviation fuel within the Order's statutory scope, formally recognising co-processing configurations and standard blending arrangements. This administrative measure did not, by itself, create a blanket SAF tax exemption or a federal excise-duty waiver.

The inverted-duty refund mechanism is not characterised or treated as a SAF-specific incentive within this analysis unless the corresponding GST notification and precise tariff classification are explicitly cited.

A dedicated, SAF-specific Production Linked Incentive (PLI) scheme is classified strictly as a policy proposal unless established via a formally notified government framework. Existing biofuel, hydrogen, and clean-energy programmes may, however, support SAF-related technology developments indirectly.

Relevant budgetary or structural green-hydrogen support may reduce the procurement cost of renewable hydrogen inputs for future Power-to-Liquid (PtL) or e-SAF infrastructure projects. Notwithstanding this potential, no SAF-specific allocation is assumed or modelled under current parameters.

Supplementary Bioenergy Frameworks:

Domestic waste-to-energy and bioenergy initiatives may provide indirect capital or logistical support for localized feedstock aggregation and conversion infrastructure. However, these allocations are not treated as automatic SAF subsidies. Similarly, domestic-content provisions or specific feedstock-collection incentives are categorised exclusively as policy options unless fully established through a notified legislative scheme.

6.2 SAF Credit Trading System

The Indian Carbon Market, governed under the Carbon Credit Trading Scheme (CCTS), is not currently characterised as a dedicated SAF credit-trading system. The Bureau of Energy Efficiency (BEE) defines a compliance mechanism for designated obligated sectors, including petroleum refineries, alongside an offset mechanism for eligible mitigation projects.



Consequently, SAF-related carbon-credit monetisation represents an emerging policy opportunity that remains strictly subject to eligibility criteria, approved methodologies, independent verification protocols, and anti-double-counting safeguards.

Current CCTS compliance coverage applies strictly to designated sectors, such as petroleum refineries. Aircraft operators are not treated within this report as automatically obligated entities under the CCTS framework solely by virtue of utilizing SAF.

The deployment of SAF does not automatically generate Carbon Credit Certificates. Any future SAF-related credit claim remains contingent upon the development and notification of an applicable baseline methodology, eligibility verification, and rigorous accounting treatments.

No assumption is made within this analysis regarding the immediate fungibility of SAF certificates with CCTS compliance. The

establishment of any future cross-commodity linkage remains entirely dependent upon regulatory notifications.

6.3 Contracts for Difference (CfD)

India has not been shown in the reviewed material to have an operational SAF-specific two-way CfD. The draft policy under consideration proposes price-support and financing mechanisms. Any CfD or floor-price mechanism is therefore treated as a policy option.

Proposed Price Stabilisation: A strike-price or floor-price mechanism could provide revenue certainty to SAF producers, with public support covering an agreed shortfall subject to eligibility and fiscal rules.

Investment De-risking: Long-term revenue certainty could improve bankability and reduce financing risk for capital-intensive SAF projects.

6.4 Open Access SAF Market

Open access to airport ATF infrastructure remains an active enabling-policy focus. Initiatives by the Petroleum and Natural Gas Regulatory Board (PNGRB) regarding common-carrier ATF pipelines and open-access frameworks are expected to support future SAF logistics. However, a dedicated, nationwide SAF open-access market is not currently in force.

Future common-carrier and open-access arrangements may allow multiple suppliers to utilize shared fuel infrastructure, subject to PNGRB regulations and specific airport operator requirements.

Direct injection of certified SAF into shared airport systems could be accommodated where infrastructure capabilities, fuel specifications, metering, and accounting protocols permit. This is an operational possibility rather than an established nationwide right.

6.5 Governance & Regulations

A multi-tier governance framework oversees cross-ministerial coordination across the domestic aviation fuel and carbon ecosystems:

National Steering Committee (NSC-ICM): Governs the broader carbon market and includes representatives from the Ministry of Civil Aviation (MoCA) and the Ministry of Petroleum & Natural Gas (MoPNG).

Bureau of Energy Efficiency (BEE): Administers SAF-specific carbon credits within the overarching trading scheme.

Institutional alignment reflects the proposed draft SAF Policy. MoCA is designated as the lead ministry, supported by MoPNG, MoEFCC, MNRE, DGCA, BIS, BEE, the Ministry of Finance, state governments, and airport operators. The draft framework recommends establishing an Inter-Ministerial SAF Council, a SAF Secretariat, and a National SAF Registry. These components currently represent policy proposals rather than a notified administrative structure.

SAF economics in India remain constrained by capital-intensive production facilities, feedstock supply constraints, high financing costs, infrastructure bottlenecks, and a substantial price premium over conventional ATF. Given that market prices vary significantly by airport and timing, the analysis incorporates current global production and cost metrics alongside explicitly defined India-specific scenarios, rather than asserting a single national SAF price benchmark.

SAF ECONOMICS & COST COMPETITIVENESS

7.1 Current SAF Cost vs ATF (₹/litre comparison)

Conventional ATF Price Variances: Conventional ATF pricing fluctuates based on airport location, local taxation, and market timing. The previously cited figure of ₹207/litre serves strictly as an explicit scenario assumption for the Delhi–London illustrative model and does not represent a universal or current Indian ATF benchmark.

HEFA Pathway Economics: Hydroprocessed esters and fatty acids (HEFA) represents the most commercially mature SAF technology, yet unit economics remain tied to used cooking oil (UCO) and animal fat feedstock pricing, green hydrogen costs, plant scale, capital expense, and certification mandates. The estimated ₹420–₹550/litre range functions solely as an internal illustrative scenario rather than an active spot market price.

Advanced Pathway Cost Dynamics: Production costs for Alcohol-to-Jet (AtJ), Fischer-Tropsch (FT), and Power-to-Liquid (PtL) vary significantly depending on feedstock procurement, renewable energy tariffs, facility scale, and technology readiness levels. The projected ₹600–₹950/litre range represents an illustrative scenario parameter rather than a quoted market index.

Green Premium Sensitivity: The derived SAF price premium remains highly sensitive to selected production pathways and underlying





Hydroprocessed esters and fatty acids (HEFA) represents the most commercially mature SAF technology, yet unit economics remain tied to used cooking oil (UCO) and animal fat feedstock pricing, green hydrogen costs, plant scale, capital expense, and certification mandates

feedstock variable costs. Consequently, no single national green-premium metric is asserted as an established empirical fact.

Scenario Note: The baseline conventional ATF assumption of ₹207/litre applied in the Delhi–London route calculation reflects a historical modelling input. This parameter should be recalibrated if an alternative airport pair or reference date is selected for final publication.

7.2 Cost Drivers

The premium cost structure of domestic SAF is primarily driven by four core capital and operational variables.

Capital Expenditure & Project Financing: The baseline investment of ₹1,400 crore for an 80-tonne/day processing facility represents a project-specific benchmark rather than a standardised capital expenditure model. Project bankability remains contingent on long-term feedstock availability, binding off-take agreements, competitive financing terms, shared infrastructure, and policy backing.

Feedstock Supply Chain Constraints: Raw material procurement constitutes the primary operating expense. As highlighted in the ICAO ACT-SAF study, fragmented collection networks and supply chain bottlenecks—particularly regarding UCO and agricultural residue streams—remain major commercial constraints.

Green Hydrogen Price Sensitivity: Renewable hydrogen inputs dictate the underlying economics for Power-to-Liquid (PtL) and e-SAF production pathways. Given market volatility, unit cost estimates ($/kg) are treated as context-specific scenario inputs rather than a fixed future price forecast.

Logistical & Infrastructure Integration: Operational priorities focus on refinery-level co-blending, dedicated airport storage, shared ATF distribution networks, digital traceability, and CORSIA-aligned Monitoring, Reporting, and Verification (MRV) systems. The under consideration draft policy framework emphasises on establishing centralised hub infrastructure alongside a unified digital registry to support end-to-end compliance.

COST CURVES AND GAP ANALYSIS

8.1 Future Cost Curves (Learning & Scale)

Domestic SAF production costs are projected to decline as the domestic industry matures:

Structural Cost-Reduction Drivers: Scaling processing capacity, equipment standardisation, repeated plant deployments, access to lower-cost feedstock streams, optimised financing structures, and operational learning curves are expected to drive down unit production costs over time. Specific percentage reduction metrics are omitted unless tied to directly cited empirical studies.

Economies of Scale: Transitioning to larger, standardised commercial facilities will reduce fixed unit costs. However, the precise trajectory and timing of these cost reductions rema in highly pathway- and project-specific.

Price Gap Analysis

The green-premium analysis maintains a strict distinction between observed market conditions and illustrative modelling scenarios. Ultimate SAF pricing relies on a complex interplay of production pathways, feedstock availability, energy input costs, project financing structures, compliance certification, and overarching policy support mechanisms.



8.2 The Baseline: Price Comparison (May 2026)

No universal, India-wide SAF price for May 2026 is asserted in the source material. Investment decisions should therefore be anchored to dated, airport-specific ATF prices and project-level techno-economic estimates for SAF.

Fuel / metric	Current evidence	Use in report	Status
Conventional ATF	Airport- and date-specific market price	Use dated PPAC/OMC price for any financial model	Market price varies

SAF premium	IATA: roughly 2× fossil jet fuel and up to 5× in mandated markets	Use as global benchmark, not an India-wide price	Illustrative benchmark
India SAF cost	Pathway- and project-specific techno-economic assessment required	Use project-level assumptions for HEFA/ATJ/FT/Pt L	Not a single national price

8.3 Real-Life Scenario: Delhi to London (Boeing 787-9)

Economic Impact of India's 2027 SAF Mandate	
Assumptions: 65,000 litres total fuel	Baseline Cost (100% ATF): ₹1.34 crore
1% SAF = 650 litres	Cost with 1% SAF Blend (2027 Mandate): 64,350L ATF: ₹1.33 crore
64,350 litres ATF	650L SAF (Avg ₹670/L): ₹4.35 lakh
ATF ₹207/litre	Total New Cost: ₹1.37 crore
SAF ₹670/litre	Net Impact: ~₹3 lakh increase per flight

****This is an illustrative calculation, not evidence of the actual cost of India's 2027 policy.*

8.4 Price Gap Mitigation: Viability Gap Funding (VGF)

To mitigate the substantial cost premium and insulate airlines from operational financial strain, government and industry stakeholders are evaluating a combination of public-private financing, market-based mechanisms, and targeted consumer surcharges:

- **Viability Gap Funding (VGF):** VGF serves as a crucial de-risking instrument for capital-intensive infrastructure; however, current policy documentation does not establish a universal 40% VGF allocation for SAF projects. Capital support remains strictly subject to specific scheme guidelines, project eligibility, and regulatory approvals.
- **Consumer Levy Benchmark:** As an illustrative international model, Singapore's SAF levy takes effect for flights departing from 1 January 2027, with ticket surcharges applying to sales from 1 October 2026. The fee structure is tiered by distance and cabin class, ranging from S$1.00 to S$10.40 for economy passengers and up to S$41.60 for premium cabins.
- **Taxation & Fiscal Policy:** SAF-specific excise duties or tax concessions are recognised only where formally notified by statutory authorities. Sectoral advocacy, industry representations, and proposed tax relaxations are explicitly distinguished from enacted fiscal policy.
- **Carbon Market Cross-Subsidization:** Integrating SAF into carbon trading systems represents a potential future revenue-offset mechanism rather than an established cash flow stream. Monetisation remains contingent on the prior formulation of clear eligibility, accounting, and double-counting prevention frameworks.

8.5 Future Outlook: The Learning Curve

By 2030, the SAF price premium is projected to narrow significantly through two primary operational levers:

Production & Supply Chain Optimization: Scaling facility capacity, technology learning curves, streamlined feedstock logistics, declining renewable power tariffs, and innovative financing structures will progressively reduce the SAF–ATF cost differential. Specific percentage reductions, such as a fixed 18% per-litre cost drop, are treated as variable scenario outcomes rather than baseline assumptions.

Carbon Market Integration: Monetising SAF-related carbon credits offers a material financial offset, contingent on defining clear eligibility criteria and baseline methodologies. It will also depend on implementing robust verification, and enforcing stringent anti-double-counting safeguards.

8.6 SAF Cost-Sharing Matrix

The financial burden of the SAF transition is split across three pillars:

Fuel is a major airline cost component, but the report does not assign a universal 55–60% share without a specific airline/year source.

Ticket-price effects are analysed through sensitivity scenarios using fuel burn, SAF premium, passenger load and cost-sharing assumptions. Historical export-duty figures are not treated as current permanent policy rates.

RISKS, BARRIERS & MITIGATION

9.1 Policy and Regulatory Gaps



Policy status: The 17 April, 2026, ATF Control Order amendment is confirmed, while India's SAF blending targets remain indicative. On 29 July, 2026, the Ministry of Civil Aviation reviewed preparedness for SAF adoption and CORSIA implementation, including production, blending, carbon accounting and implementation readiness.

Certification is a scaling and harmonisation challenge rather than an absence-of-framework challenge. ICAO-recognised sustainability certification schemes include ISCC and RSB, and the India ACT-SAF work records the NABCB–ISCC pathway. IndianOil's Panipat refinery has obtained ISCC CORSIA certification. Priorities therefore include accredited capacity, harmonised MRV, digital chain-of-custody evidence and lower certification costs.

9.2 Feedstock Competition (Food vs. Fuel)



Food-versus-fuel risk is managed through feedstock prioritisation. India should favour waste, residues and other low-ILUC-risk feedstocks where sustainable, while protecting food security and monitoring land-use impacts.

The 2G pivot: Second-generation pathways based on agricultural residues and waste can reduce direct competition with food crops and should be developed alongside other qualified SAF pathways.

9.3 Infrastructure and Technology Lock-in



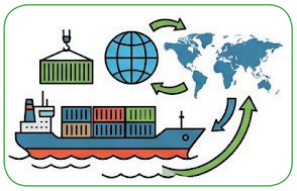
The HEFA pathway is currently the most commercially mature SAF route, but its dependence on UCO, fats and other lipids creates feedstock constraints. Over-concentration on one pathway can create technology and feedstock lock-in. India should build a diversified portfolio spanning HEFA, ATJ, FT and longer-term PtL/e-SAF options.

9.4 Financial Viability and Consumer Impact



Ticket-price impacts are analysed through sensitivity scenarios rather than a single 3–7% forecast. The $1.5 billion cumulative CORSIA-liability estimate through 2035 is not retained because it is scenario-dependent and could not be independently verified from the reviewed authoritative sources.

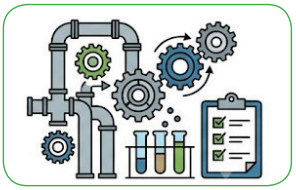
9.5 Feedstock Leakage to Global Markets



As global SAF mandates drive demand for UCO and agricultural residues, feedstock leakage risks require active policy oversight. India should strengthen digital traceability across waste-to-fuel supply chains and conduct comprehensive market assessments.

Any potential export restrictions must be evaluated through transparent frameworks that account for domestic availability, international trade commitments, economic impacts on primary suppliers, and downstream processing stability. A blanket right-of-first-refusal on domestic feedstocks is not assumed to be an existing policy.

9.6 Technical and Compliance Bottlenecks



Commercial aviation currently utilises drop-in SAF blends compliant with established fuel specifications. While several certified production pathways permit blend ratios of up to 50%, specific limits vary by technical pathway. Unblended 100% SAF capability remains subject to ongoing technical trials and engine validation.

Certification presents an operational scaling challenge rather than a structural framework deficit. Strategic priorities centre on expanding accredited auditing capacity, standardising Monitoring, Reporting, and Verification (MRV) protocols, implementing digital chain-of-custody verification, and mitigating transaction overheads.



STAKEHOLDER-WISE INSIGHTS (ROUNDTABLE OUTCOMES)



10.1 Airlines

- Expand SAF availability across more airports, not just major hubs.
- Sign long-term offtake agreements to give producers demand certainty.
- Disclose the SAF cost component transparently on ticket pricing rather than absorbing it silently.
- Integrate SAF procurement into corporate ESG and purchasing programmes.

10.2 Aircraft Manufacturers

- Accelerate fleet renewal, which independently delivers 20–30% fuel savings.
- Deepen co-investment with domestic energy majors (e.g., Boeing–HPCL) to localise SAF production.
- Set firm SAF-compatibility milestones (e.g., 2030) to align with regulatory timelines.
- Continue parallel R&D in carbon removal technology.

10.3 Fuel Producers, Refineries & Energy Companies

- Scale co-processing (viable to ~2% blend); build the case for higher-blend technology separately, as costs rise sharply beyond that threshold.
- Push for activation of incentives. The gap is implementation, not design.



- Secure the three investment preconditions: feedstock certainty, renewable energy supply, and EPR enforcement.
- Advance 2G ethanol-to-jet as a priority technology track.
- Explore UCO imports, paired with stricter enforcement against domestic UCO diversion to non-fuel uses.

10.4 Technology & Innovation

- Prioritise Alcohol-to-Jet and 2G biomass-to-ethanol-to-jet pathways.
- Anchor targets to carbon intensity, not volume — favour pathways supporting negative carbon density.
- **Diversify pathways:** MSW, biogas, and CO2 capture from industrial sources converted to syngas — ideally via decentralised production.
- **Phase market entry:** build initial demand in premium/luxury travel, then scale to mass market as unit economics improve.
- Build domestic testing/certification capacity and invest in CCUS and e-SAF as longer-horizon bets.
- Tap India's ~35 million hectares of unutilised land as a biomass feedstock asset.

10.5 Airport & Aviation Infrastructure

- Treat refinery-based blending as the preferred model; airport-level blending is not currently operationally feasible.
- Where refinery blending isn't available, permit intermediary/platform blending near airports (as in parts of Asia and Europe), contingent on full compliance.
- Clarify how intermediary blending is treated in carbon accounting to remove investment ambiguity.

10.6 Feedstock & Supply Chain

- Reduce long-term dependence on UCO by expanding into non-edible energy crops and clean waste streams.
- Support farmer participation with enabling cultivation policy and MSP-style price assurance for alternative crops.
- Build an integrated collection strategy spanning UCO, crops, and waste — including reverse logistics and decentralised aggregation — rather than managing each stream separately.
- Extend incentives to smaller supply-chain actors, including kitchen/food-service UCO sources.

10.7 Finance & Market Mechanisms

- Bring SAF/ATF formally under India's green taxonomy to unlock access to green bonds and ESG capital.
- Enable airline-issued bonds and carbon-revenue-linked instruments to fund SAF procurement and technology investment.
- Expand access to institutional green financing (SIDBI, NABARD) and build certification/audit capacity to support investor confidence.
- Position India as a first-mover benchmark in SAF finance globally.

10.8 Policy & Ecosystem Development

- Consolidate a single national roadmap covering financing, targets, and implementation — the current landscape is fragmented.
- Resolve multi-ministerial coordination gaps, given SAF spans energy, agriculture, and aviation portfolios.
- Standardise GHG and ESG measurement protocols, and align carbon revenue generation with credible international standards.
- Draw on international models (e.g., Singapore's household-level UCO collection) and global consortium funding structures to strengthen India's own framework.
- Pursue recognised sustainability certifications (RSB and equivalent) to improve project bankability.
- Build out "book and claim" mechanisms and present a unified, internationally aligned vision — from feedstock to end use — to attract global capital and end-user commitment.



SCENARIO ANALYSIS

The Ministry of Civil Aviation convened a comprehensive review to assess domestic preparedness for SAF adoption and CORSIA implementation. The dedicated SAF policy remains under active development and has not yet been formally notified. Consequently, current policy directives represent proposed framework guidelines rather than enacted statutory regulations.

Dimension	With Robust Policy	Without Policy Support
Production Scale-up	Indicative targets and demand certainty support investment; scale-up depends on incentives, feedstock, offtake, certification and infrastructure.	Supply growth may remain slow and investment may be delayed.
Cost Reduction	Scale, learning and financing can narrow the premium over time; the magnitude is pathway-specific.	High production costs and limited scale could keep the SAF premium elevated.
Industry Participation	Long-term offtake, partnerships and clear policy can improve participation.	Fragmented investment and weak demand certainty can delay projects.
Finance & Funding	Green finance, blended finance and eligible carbon-market instruments could improve bankability.	High financing costs and limited risk-sharing can constrain investment.
Price Bearing	Cost-sharing through levies, differential pricing or other mechanisms can distribute the green premium.	Full cost pass-through could increase fares if no cost-sharing mechanism exists.
Biofuel Production	Diversified waste, residue and other qualified feedstocks can support a more resilient supply chain.	Over-reliance on one feedstock or pathway increases supply and sustainability risk.

SAF SCALING POLICY GUIDANCE

1. Institutionalise a national SAF roadmap with clear, time-bound blending targets, giving industry the certainty needed to commit capital.

2. Activate appropriately targeted biofuel and clean-energy incentives to attract investment, subject to notified scheme rules.

3. Assess inclusion of SAF and enabling infrastructure in India's green-finance taxonomy and facilitate access to green bonds, ESG capital and blended institutional finance.

4. Share the cost burden through transparent levies, government-backed differential pricing or other cost-sharing mechanisms, subject to affordability and competitiveness analysis.

5. Diversify feedstock beyond UCO to reduce long-term supply risk while protecting food security and biodiversity.

6. Support technology innovation, including 2G ethanol-to-jet, advanced waste/residue pathways and longer-term e-SAF/PtL.

7. Secure long-term offtake agreements between airlines, fuel suppliers and producers to improve bankability.

8. Resolve multi-ministerial coordination gaps through a clear lead ministry, an implementation secretariat and defined institutional responsibilities.

9. Standardise lifecycle GHG, ESG, MRV and sustainability certification requirements and enable credible book-and-claim mechanisms with strong anti-double-counting controls.

10. Position India as a credible SAF hub through transparent policy, diversified feedstocks, competitive production, international certification and global partnerships.

Abbreviations:

1. **SAF:** Sustainable Aviation Fuel
2. **CO2 emissions:** Carbon emissions
3. **ICAO:** International Civil Aviation Organization
4. **IATA:** International Air Transport Association
5. **CORSIA:** Carbon Offsetting and Reduction Scheme for International Aviation
6. **MoCA:** Ministry of Civil Aviation
7. **BEE:** Bureau of Energy Efficiency
8. **ATF:** Aviation turbine fuel
9. **LCAF:** Lower Carbon Aviation Fuel
10. **CO_2e:** Carbon di-oxide equivalent
11. **ILUC:** Indirect land-use change
12. **UCO:** Used cooking oil
13. **MSW:** Municipal solid waste
14. **PtL:** Power-to-Liquid
15. **HEFA:** Hydro-processed Esters and Fatty Acids
16. **FT:** Fischer–Tropsch Synthesis
17. **ATJ:** Alcohol-to-Jet
18. **EU ETS:** European Union Emissions Trading System
19. **GHG emissions:** Greenhouse gas emission
20. **BPCL:** Bharat Petroleum Corporation Limited
21. **IOCL:** Indian Oil Corporation Limited
22. **TRL:** Technology readiness levels
23. **MoPNG:** Ministry of Petroleum and Natural Gas
24. **MoEFCC:** Ministry of Environment, Forest and Climate Change
25. **MoAFW:** Ministry of Agriculture and Farmers' Welfare
26. **MoFAHD:** Ministry of Fisheries, Animal Husbandry & Dairying
27. **DGCA:** Directorate General of Civil Aviation
28. **MRV:** monitoring, reporting, and verifying
29. **BIS:** Bureau of Indian Standards
30. **PESO:** Petroleum and Explosives Safety Organisation
31. **CHT:** Center for High Technology
32. **CCTS:** Carbon credit trading scheme
33. **FSSAI:** Food Safety and Standards Authority of India
34. **RUCO:** Repurpose used cooking oil
35. **OISD:** Oil Industry Safety Directorate
36. **QCI:** Quality Council of India
37. **CERT-In:** Indian Computer Emergency Response Team
38. **NCIIPC:** National Critical Information Infrastructure Protection Center
39. **CBIC:** Central Board of Indirect Taxes and Customs
40. **OEMS:** Original Equipment Manufacturers
41. **CSIR IIP, IIT:** Indian Institute of Technology
42. **ECAs:** Export Credit Agencies
43. **CSIR IIP:** Indian Institute of Petroleum (CSIR-IIP), Dehradun
44. **IIT Delhi:** Indian Institute of Technology (IIT) Delhi – Centre for Energy Studies
45. **IISc:** Indian Institute of Science
46. **ICER:** Interdisciplinary Centre for Energy Research
47. **ICT:** Institute of Chemical Technology

48. **ICGEB:** International Centre for Genetic Engineering and Biotechnology
49. **TIFR:** Tata Institute of Fundamental Research (TIFR) – Sustainability Science Labs.
50. **FPOs:** Farmer Producer Organisation
51. **RegTech:** Regulatory Tech
52. **SAFc:** SAF Certificate
53. **GST:** Goods and Services Tax
54. **CfD:** Contracts for Difference
55. **PNGRB:** Petroleum and Natural Gas Regulatory Board
56. **NSC-ICM:** National Steering Committee
57. **ISCC:** International Sustainability and Carbon Certification
58. **RSB:** Roundtable on Sustainable Biomaterials
59. **NABCB:** National Accreditation Board for Certification Bodies
60. **CCUS:** Carbon Capture, Utilisation, and Storage
61. **MSP:** Minimum Support Price
62. **ESG:** Environment, Social, Governance

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BEE — Indian Carbon Market: https://beeindia.gov.in/

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