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India’s Strategy for SAF Leadership

From policy to implementation

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SAF ASSOCIATION

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FOREWORD
India's SAF Journey: From Policy to Implementation



India stands at a defining moment in the development of Sustainable Aviation Fuel (SAF). As one of the world's fastest-growing aviation markets, India has an opportunity to build not only a cleaner aviation sector, but a new industrial ecosystem spanning agriculture, waste management, energy, refining, technology, finance and aviation.

The timing of this report is particularly significant. With India moving towards the implementation of its SAF roadmap and the 2027 CORSIA compliance phase, the conversation must now progress from policy ambition to practical implementation. India's indicative SAF blending pathway of 1% in 2027, 2% in 2028 and 5% by 2030 for international flights provides an important foundation for this transition.

The question before us is no longer whether India has an SAF opportunity, but how effectively we can convert that opportunity into a scalable, sustainable and globally competitive industry.

India possesses several important advantages: a large and growing aviation market, substantial agricultural and waste resources, an established refining and ethanol ecosystem, expanding renewable energy capabilities and strong scientific, engineering and entrepreneurial capacity. The report highlights the potential to develop a diversified SAF ecosystem—building on HEFA and refinery co-processing in the near term, expanding Alcohol-to-Jet pathways, and progressively developing Fischer-Tropsch and e-SAF opportunities.

However, achieving scale will require coordinated action across the entire value chain. Sustainable feedstock availability and traceability, technology readiness, certification, project financing, infrastructure, airline offtake, market mechanisms and policy certainty will all be critical to translating targets into operating projects and long-term investment.

This is precisely where the SAF Association (SAFA) seeks to contribute.

SAFA was established to bring together policymakers, industry, airlines, refiners, technology providers, investors, researchers, feedstock stakeholders and international partners to accelerate the development of India's SAF ecosystem. Our role is to facilitate dialogue, enable collaboration, connect opportunities with stakeholders and help address the practical challenges that stand between ambition and implementation.

The report, "India's Strategy for SAF Leadership: From Policy to Implementation," jointly developed by S&P Global Energy and the SAF Association, is intended as a contribution to this critical phase of India's SAF journey. It brings together market intelligence, global experience and an assessment of India's technology, feedstock, policy and investment landscape.

We believe India should aspire not merely to meet its SAF requirements, but to develop the capabilities to become an important regional and global SAF hub.

The SAF transition will require partnership, persistence and collective action. SAFA is committed to working with all stakeholders to help build that future.

The journey from policy to implementation has begun. Together, we can make India's SAF opportunity a pathway to leadership.

Rohit Kumar
Secretary General
SAF Association & CMAI

FOREWORD
India's SAF Journey: From Policy to Implementation



India's Sustainable Aviation Fuel (SAF) journey is entering a defining phase. As aviation continues to expand and the transition towards SAF moves from policy intent to implementation, the industry now has an opportunity to build a robust, scalable and globally competitive SAF ecosystem.

SAF must be viewed not as a single technology or feedstock pathway, but as a portfolio of opportunities aligned with India's diverse resources, industrial capabilities and evolving energy landscape. HEFA and refinery co-processing can support near-term deployment, while Alcohol-to-Jet can leverage India's established ethanol ecosystem. Over time, agricultural residues, municipal waste, Fischer-Tropsch pathways and e-SAF can further expand India's production potential as technologies mature and commercial conditions evolve.

For industry, the opportunity is substantial—but so is the responsibility. Building SAF at scale will require dependable feedstock supply chains, technology readiness, competitive production economics, rigorous sustainability standards, certification, infrastructure, financing and long-term offtake commitments. Most importantly, projects must move beyond announcements towards bankable investments and commercial production.

India already possesses several important building blocks: a strong refining and petrochemical sector, a growing ethanol industry, significant agricultural and waste resources, expanding renewable energy capacity and deep technical and engineering capabilities. Bringing these strengths together can create a domestic SAF value chain capable of serving India's growing aviation requirements while positioning Indian producers to participate in emerging international markets.

The global experience also demonstrates that successful SAF markets require collaboration across the value chain. Producers, airlines, refiners, technology providers, feedstock aggregators, financial institutions, researchers and policymakers must work together to address the commercial and technical challenges associated with scaling a new industry.

In this context, the SAF Association has an important role to play as a platform for industry collaboration, knowledge exchange and constructive engagement with policymakers and other stakeholders. Our objective is to help create an ecosystem where technology, capital, feedstock and market demand can come together to accelerate deployment.

The report, "India's Strategy for SAF Leadership: From Policy to Implementation," by S&P Global Energy, provides a timely perspective on India's emerging SAF landscape and the pathways available to industry. It contributes to the understanding required as India moves towards the next stage of SAF development.

The opportunity before Indian industry is clear: to convert India's resource and industrial strengths into sustainable aviation fuel at scale, while creating long-term economic, technological and environmental value.

I am pleased to present this report as a contribution to that journey and look forward to continued collaboration across the industry in advancing India's SAF transition.

Dr. Alok Sharma
Vice President, SAF Association
Former Director, R&D, Indian Oil Corporation Limited (IOCL)

Executive Summary

India' s aviation fuel market is expected to be among the fastest- growing globally, driven by rising passenger traffic, expanding airport infrastructure, and greater international connectivity. This growth creates a substantial opportunity—and necessity—for sustainable aviation fuel (SAF) deployment, positioning aviation decarbonization as both a policy priority and a strategic commercial theme for India.

Global experience from early movers such as the EU, UK, US, Singapore, and Japan shows that secure, long- term mandates are essential to create demand certainty for SAF. However, mandates alone are insufficient: they must be complemented by supply- side support (capital grants, tax credits, revenue- certainty schemes) and offtaker support (ETS- linked subsidies, levies, or cost- sharing mechanisms) to bridge the significant cost premium of SAF over conventional jet fuel. Flexible design elements—adjustable feedstock rules, book- and- claim systems, and phased target ramp- ups—have proven critical in managing feedstock and technology constraints while maintaining investment appetite.

From a technology standpoint, India is well positioned to sequence SAF pathways. In the near term, Hydroprocessed Esters and Fatty Acids (HEFA- SPK) and refinery co- processing are the only fully commercial pathways. India already operates four CORSIA- certified co- processing units, with combined capacity sufficient to meet its initial blending targets for international flights in 2027–2028. Large domestic edible oil consumption suggests significant potential for used cooking oil (UCO), enabling a largely domestic HEFA supply chain and enhancing energy security.

In the medium term, India' s established sugarcane and molasses ethanol industry, together with progress on E 20 gasoline blending, provides a platform for Alcohol- to- Jet (ATJ) projects. Transitioning over time to second-generation, residue- based ethanol will improve lifecycle emissions performance and support eligibility for exports into more stringent markets. Over the longer term, Fischer- Tropsch (FT) pathways based on agricultural residues and municipal solid waste, and Power- to- Liquid (e- SAF) supported by the National Green Hydrogen Mission, offer high- abatement options but face high capital costs, technology risk, and revenue uncertainty, requiring targeted policy and financing support.

India government sets SAF road starting with blending targets of 1% in 2027, 2% in 2028, and 5% in 2030 have been set for international flights from Indian airports. SAF demand under these targets is expected to rise from about 46,000 tonnes in 2027 to roughly 250,000 tonnes by 2030. Near- term obligations can be met by existing domestic co- processing capacity, while announced HEFA and ATJ projects expected between 2028 and 2030 will support the ramp- up to the 5% blend.

India’s UCO and ethanol resource base also create export potential, particularly in Asian markets where SAF mandates are emerging. Access to European markets, however, will require additional sustainability certifications, and sugarcane-based SAF is not currently eligible under EU feedstock rules. Indian ATJ producers targeting Europe will need to pivot to cellulosic ethanol and comply with evolving ReFuelEU requirements and synthetic fuel sub-quotas, reinforcing the importance of feedstock diversification and alignment with international sustainability criteria.

Strategically, India can phase deployment across pathways by leveraging HEFA and co-processing for rapid CORSIA compliance and capability building; scaling ATJ using the existing ethanol infrastructure while transitioning to second-generation feedstocks; and piloting FT and e-SAF in green hydrogen and industrial hubs. A durable yet flexible policy architecture—anchored in clear, gradually tightening blending targets and supported by financial instruments to de-risk early projects—will be critical. Strengthened lifecycle accounting, certification, and traceability aligned with ASTM and international sustainability standards will underpin access to premium export markets and long-term project finance.

Overall, with strong aviation growth, solid feedstock fundamentals, and a CORSIA-aligned starting point, India is well positioned to become both a significant domestic SAF consumer and a strategic regional supplier. Success will depend on how quickly India translates global policy lessons into a cohesive, flexible SAF framework and how effectively it supports the technology transition from HEFA to ATJ, FT, and eventually e-SAF.

Global SAF Policy

Few industries have rallied around a long-term decarbonization goal as visibly as aviation. ICAO has established a global framework for international aviation emissions through CORSIA, while International Air Transport Association (IATA) member airlines have collectively committed to net-zero emissions by 2050. At first glance, the sector can look unusually coordinated. Look more closely, however, and the policy picture for sustainable aviation fuel (SAF) is far more uneven.

While CORSIA gives the sector a common methodology for carbon accounting and recognizes emissions reductions from eligible SAF, IATA's net-zero road map sets out a shared industry direction and identifies SAF as the largest contributor to future emissions reductions. However, neither framework obligates governments to adopt blending mandates, production incentives, or other support mechanisms.

Governments have therefore stepped into the space with very different policy choices.

The EU has chosen a regulatory route, using mandatory blending requirements under ReFuelEU Aviation to create demand. The United States has leaned more heavily on tax credits and production-side support. Singapore is in the process of implementing a SAF levy mechanism, while Japan has tended to emphasize industry targets and voluntary commitments, which it has recently tempered. In many emerging economies, the question remains more basic: how SAF fits alongside energy security, affordability, and industrial development priorities.

The result is not a single global market design but a variety of policies seeking to achieve the ultimate goal of decarbonization.

This should not be read simply as policy failure. SAF continues to command a steep premium over jet fuel, is available in limited volumes, and is tied to feedstock markets that vary widely from one region to another. A government with abundant agricultural residues or access to low-carbon-intensity (CI) feedstocks will view the opportunity differently from one that relies heavily on imports or faces intense pressure over affordability.

Global Aviation Decarbonisation Program (CORSIA)

Greenhouse gas emissions from the aviation industry are increasing rapidly; in 2018, the industry emitted 918 million tons of CO2. That is 2.4% of global CO2 emissions and a 32% increase over the past five years. Under a business-as-usual forecast, the United Nations' International Civil Aviation Organization (ICAO) expects aviation emissions to triple by 2050, as over 10 billion passengers are projected to fly. Although the aviation industry is not directly included in the Paris Agreement, meeting the Paris Agreement's ambitious goal will require the aviation sector to play its part in capping its emissions.

In 2010, ICAO established its global aspirational goals for the international aviation sector. The goals aim to improve aviation fuel efficiency by 2% annually toward 2050 and to keep net carbon emissions from 2020 at the same level. However, in 2019, the organization recognized that the aspirational goal of a 2% annual improvement in aviation fuel efficiency is unlikely to reduce aviation's absolute emissions contribution to climate change, and more ambitious goals will be needed to transform aviation into a sustainable industry.

To achieve the aspirational goals and promote sustainable growth of international aviation, ICAO has identified areas that can contribute to the reduction of CO2 emissions. The organization developed a basket of measures: 1) Improving aircraft-related technology and standards, 2) Improving air traffic management and operational improvements, 3) Development and deployment of sustainable alternative fuels (SAF), and 4) Deployment of market-based measures.

The first global market-based measures scheme for any sector was announced at the 39th session of the ICAO Assembly. It is known as the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). CORSIA complements the other measures within the basket by offsetting the CO2 emissions that cannot be reduced through aircraft and operational improvements and the use of SAFs. Offsets can only be achieved by purchasing high-quality emission units on the global carbon market. To achieve carbon-neutral growth between 2021 and 2035, the international aviation sector would need to offset 2.5 billion tons of CO2 emissions.

CORSIA will be implemented in three phases: Pilot Phase (2021-2023), First Phase (2024-2026), and Second Phase (2027-2035). Participation in the first two phases (2021-2026) is voluntary, and as of July 2026, 134 member States of ICAO have announced participation in CORSIA. From 2027 onwards, all States with an individual share of more than

0.5% of 2018 RTKs will be required to participate in CORSIA, targeting coverage of 90% of international aviation activities.

CORSIA is a route-based approach, and, in order to eliminate market distortion, all emissions from airplane operators performing international flights between two participating States (both origin and destination) will be subject to CORSIA offset requirements. On the other hand, international flights between either an origin State or a destination State that has no participation in CORSIA are not required to offset their emissions under the scheme. The approach ensures that all airline operators flying on the same international route are treated equally, regardless of their home State's participation in CORSIA.

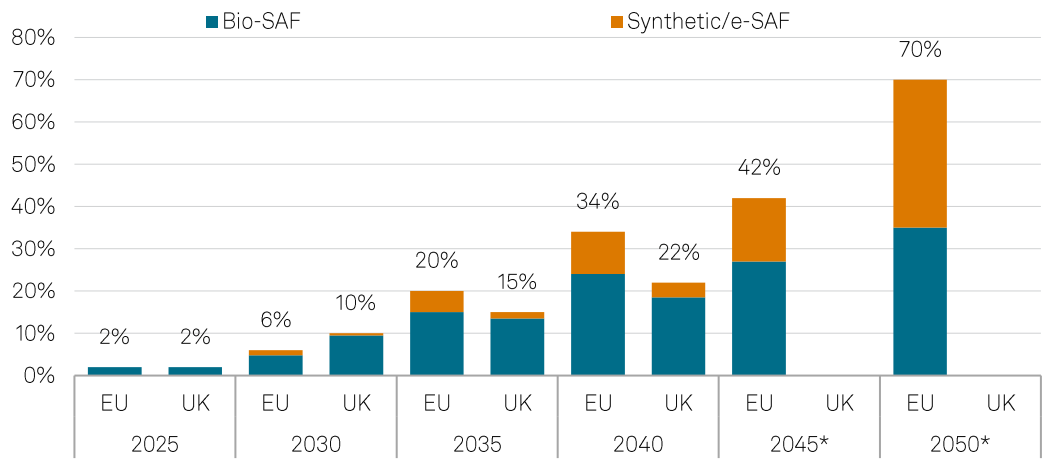
Europe

Europe has the world's most comprehensive SAF policy framework, but implementation has not been smooth sailing. Over the past few years, Europe has advanced a web of interlinked policies to kick-start a regional SAF market. Today, it is the only region with firm, long-term mandates, and these are being supplemented by an array of new SAF-specific emissions trading scheme (ETS) frameworks, grant funding, and revenue certainty mechanisms to drive demand and unlock investment. But building the machine is one thing; getting it to fly is another.

While progress is being made, the regulatory landscape is encountering friction, leading to unintended consequences and teething issues for the nascent market. Such challenges are to be expected when launching the region's first integrated action plan for decarbonizing aviation – particularly when it involves stakeholders across the entire aviation industry, not just those limited to Europe.

The landmark ReFuelEU Regulation took effect in 2025, for the first time setting long-term quotas for SAF blending out to 2050. Aviation fuel suppliers now face a choice – blend physical SAF into their jet fuel supply at EU airports each year, or face a penalty for non-compliance on each ton not supplied and make up the missing amount the following year. Quotas are set at 2% from 2025, increasing stepwise every 5 years to 70% of jet fuel by 2050. From 2030, a synthetic aviation fuel (e-SAF) sub-quota kicks in at 1.2%.

EU ReFuelEU Aviation and UK SAF Mandate quotas, % of jet fuel mix



Data compiled Aug. 17, 2026.
*UK SAF Mandate does not yet SAF targets beyond 2040.
Source: S&P Global Energy.
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Europe takes a strict approach, excluding food/feed crop feedstocks entirely. Meanwhile, strict penalties ensure that dodging the mandate is costly. ReFuelEU sets the minimum penalty each year as twice the average yearly price difference between SAF and fossil jet fuel, with the European Aviation Safety Agency (EASA) establishing these reference prices at the EU level. For 2026, EASA's penalty is $2,980 per ton, which will form the basis of most Member States' penalties, though Member States such as Germany are proposing lower penalties in their national implementation of the Regulation.

To further ease logistics in the early days of the mandate, until 2034, a flexibility mechanism allows suppliers to meet their quota as a weighted average share of SAF supplied at all their airports. The unintended consequence – the largest suppliers are monopolistically concentrating SAF supply at key hubs, enabling them to dictate terms and slap steep SAF surcharges on captive airlines.

Aircraft operators flying within the European Economic Area (EEA) and to the UK and Switzerland have been subject to the EU ETS since 2012. Yet change is on the horizon, with the aviation sector facing a complete phaseout of free allowances by 2026, a measure intended to provide flexibility for aircraft operators. Using SAF is one option to reduce a growing ETS bill, with emissions from the fuel treated as ‘zero’ under the scheme. But SAF on average costs 2.5 to 3 times more than fossil jet fuel, meaning airlines could be trading off one cost for another.

To address this, Brussels introduced the Fuels Eligible for ETS Support (FEETS) scheme in 2024 to support aircraft operators specifically with SAF. From 2024-2030, 20 million free ETS allowances (~€1.7 billion in subsidies) are reserved to bridge a share of the price spread between SAF and fossil jet. The share of the spread covered depends on the SAF feedstock, with e-SAF getting the most support. The aim is simple – fuel suppliers sell SAF at market prices and aircraft operators buy SAF at prices closer to fossil jet. Subsidies are allocated each year proportionately to operators, large and small alike, based on how much SAF they actually uplift.

The legislative landscape continues to evolve, with the Commission recently publishing a proposal for the next phase of the ETS (Phase 5, 2031-2040). On the long list of updates is an additional 110 million free allowances under the FEETS scheme. Together, S&P Energy CERA estimates that the 140 million combined allowances can subsidize part of the price spread for nearly 12 million metric tons (MMt) of SAF in the EU.

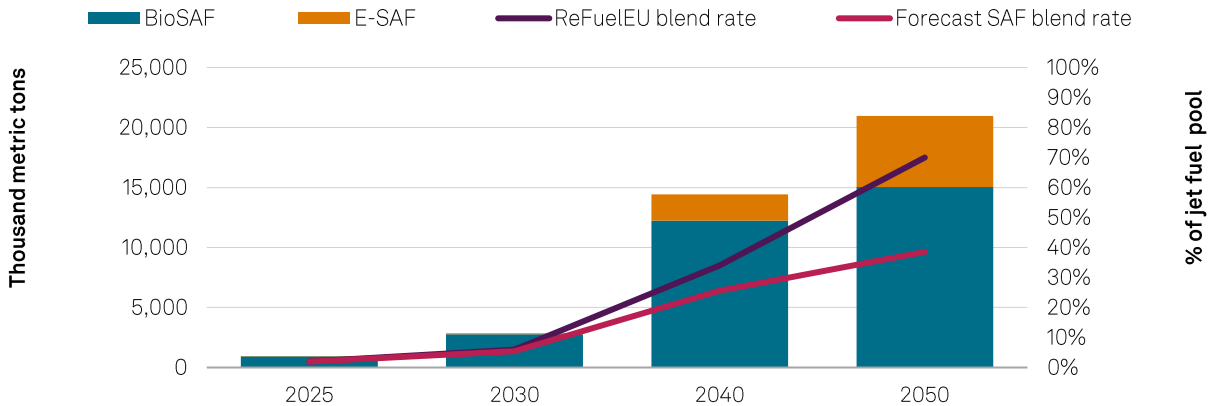
Yet one major catch is proving a headache for airlines. Under the ReFuelEU flexibility mechanism, suppliers can consolidate SAF at specific hubs, limiting the range of airports where it is available. However, to unlock the ETS subsidies, operators must prove physical uplift of the SAF molecules into their aircraft. An EU-wide "Book and Claim" scheme is seen as the solution to this policy conundrum, but implementation has been slow, with the design currently still in the planning phase.

The UK SAF Mandate shares similar traits with ReFuelEU – escalating SAF quotas for fuel suppliers from 2025 to 2040, with sub-targets for e-SAF and advanced non-HEFA SAF, as well as strict feedstock rules. However, the UK system is more flexible. Quotas increase gradually year-by-year, unlike the EU’s five-year step-ups, allowing a more pragmatic strategy of plant development and offtake agreement planning. Instead of relying on rigid physical blending penalties, it also utilizes a market-based, tradable certificate system backed by a fixed buy-out price. Obligated parties can comply by blending physical molecules, purchasing sufficient SAF certificates from suppliers who over-blend, or paying a fixed buy-out.

To solve the supply-side piece of the SAF investment puzzle, the UK continues to implement funding programs, which direct capital grants to novel SAF projects FID. More importantly, a pioneering Revenue Certainty Mechanism is being introduced to provide SAF developers with the revenue security required to unlock bankable project financing. The scheme will operate as a Contract-for-Difference model and is on track to open in 2027-2028 for the first contracts. The combination of demand and supply-side measures means many in the industry view the UK as a more pragmatic blueprint for European SAF policy.

Learnings from Europe’s early-stage SAF market have revealed three key policy ingredients to a successful sector: (1) secure, long-term mandates; (2) grant funding and revenue certainty for plant developers to get to FID; and (3) subsidies for offtakers exposed to high SAF costs. The next few months will see a flurry of industry consultations, legislative proposals and amendments ahead of formal 2027 reviews for both ReFuelEU and the UK SAF Mandate, as well as the final adoption of the revised EU ETS.

EU27 SAF demand and blend rate outlook, Base Case scenario



Data compiled Aug. 17, 2026.
Source: S&P Global Energy.
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S&P Global forecasts European SAF demand to increase from just over 1 MMt in 2025 to 4.5 MMt by 2030, before skyrocketing to nearly 28 MMt by 2050, concentrated in Europe's 'big six' jet markets – the UK, Germany, France, Spain, Italy, and the Netherlands.

Yet despite strong growth, our base case falls short of full compliance with ReFuelEU, reaching a 40% blend rate vs. the mandated 70% by 2050 – the synthetic mandate in particular represents a key challenge. The looming compliance gap results from several headwinds – not just high costs and airlines' limited willingness-to-pay, but also constraints on lipid feedstock availability that limit HEFA production from the mid-term. Newer pathways like Alcohol-to-Jet (AtJ), Gasification + Fischer-Tropsch, and e-SAF could bypass these feedstock constraints but have hurdles over their own: technological challenges, high costs, future price/revenue uncertainty, and project financing difficulties.

Given these realities, the name of the game for policymakers will be flexibility. While the Commission has suggested it will not revise targets down in the first formal review, industry will be watching closely to see if other levers are pulled. Adjustments to feedstock eligibility rules, multipliers, or other flexibility mechanisms could all become crucial tools to manage the compliance gap.

Asia

Singapore

Singapore

Singapore is targeting a 1% SAF blending rate starting in 2027, with the blending target increasing to 3-5% by 2030. To meet this target, Singapore aims to establish a central procurement entity, the Singapore Sustainable Aviation Fuel Company (SAFCo), which will procure the targeted SAF volume through tendering processes. SAF procurement will be funded by the Civil Aviation Authority of Singapore (CAAS) through SAF levies collected when passengers book flights in 2027. The levy rates vary by geographic destination and class of travel.

S&P Global Energy CERA estimates that Singapore's SAF demand from the central procurement to achieve 1% SAF blending in 2027 will be 86,000 metric tons, with demand expected to increase to 370,000 metric tons in 2030.

Geographical Band	Passenger SAF levy (Per passenger charge)		Cargo SAF Levy (per kg charge)
	Economy cabin (Economy + Premium Economy)	Premium cabin (Business + First Class)	
Band I – Southeast Asia	SGD 1.00	SGD 4.00	SGD 0.01
Band II – Northeast Asia, South Asia, Australia, Papua New Guinea	SGD 2.80	SGD 11.20	SGD 0.04
Band III – Africa, Central and West Asia, Europe, Middle East, Pacific Islands, New Zealand	SGD 6.40	SGD 25.60	SGD 0.09
Band IV – Americas	SGD 10.40	SGD 41.60	SGD 0.15

ICAO Code Letter	Wingspan (in m)	Aircraft Examples	Band I	Band II	Band III	Band IV
A	<15	Cessna 404 Titan	SGD 40	SGD 110	SGD 240	SGD 390
B	15-24	Bombardier Challenger 600 / Gulfstream G-IV / Embraer ERJ-135	SGD 100	SGD 280	SGD 640	SGD 1040
C	24-36	Bombardier Global 6000 / Gulfstream G650	SGD 190	SGD 530	SGD 1200	SGD 1950
D	36-52	A310-200 / B767-300	SGD 380	SGD 1050	SGD 2400	SGD 3900
E	52-65	A350-900 / B787-9/10	SGD 570	SGD 1580	SGD 3600	SGD 5850
F	65-80	A380 / B747-8	SGD 630	SGD 1750	SGD 4000	SGD 6500

Japan

Japan has an ambitious plan to incentivize SAF (Sustainable Aviation Fuel) production through a policy package called the Green Transformation (GX) program, from two perspectives: (1) it imposes prices on emissions from supplying and consuming conventional jet fuels to incentivize low- carbon fuel adoption; (2) it creates a dedicated pool of capital to support SAF production.

Overall, the GX program consists of three policy instruments: The GX Economy Transition Bond finances various projects and technologies that support Japan' s energy transition. The GX- ETS regulates companies with annual emissions above 100,000 tCO 2 e/year. The Fossil Fuel Levy charges local producers and importers for the emissions embedded in their fossil fuel supplies. Revenues from both the ETS and the levy will be used to repay the bond.

In addition to the GX policy package, Japan has set mandatory targets for SAF blending and has participated in the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) since 2021. CORSIA will have mandatory status starting in 2027, under which Japan is required to reduce or offset its emissions against its 2019 emission baseline. However, based on existing policy signals, the overall design remains deliberately cautious, which may limit the pace of SAF production and adoption.

Under the GX bond, a dedicated portion of the capital raised will be used to support SAF production. According to the government' s schedule, JPY 20 trillion (122 billion USD) in bonds will be issued over 10 years, from FY 2023 to FY 2032.

By May 2026, about JPY 4.7 trillion (29 billion USD) of bonds had already been issued. Of the capital raised, about JPY 340 billion (2 billion USD) has been earmarked to support SAF production facilities over five years (FY 2024-2028).

In February 2025, four SAF producers, Idemitsu Kosan, ENEOS, Taiyo Oil, and Cosmo Oil, were selected as beneficiaries of subsidies from the GX bond framework, which aims to help lower individual projects' CAPEX. As shown in the table below, under the GX bond framework, Japan is expected to have at least 700, 700,000 metric tons of SAF production capacity by 2030.

TABLE: Details about projects subsidized by the GX Bond

Company	Location	Production Technology	Year of completion	Annual production capacity
Idemitsu Kosan	Tokuyama	HEFA-SPK	2028	200,000 mt
ENEOS	Wakayama	HEFA-SPK	2028	300,000 mt
Taiyo Oil	Okinawa	AtJ-SPK	2030	176,000 mt
Cosmo Oil	Osaka	HEFA-SPK	2026	24,000 mt

However, the ultimate actual supply will also be determined by demand. In addition to the weak signal under the GX carbon pricing regimes, Japan's mandatory blending targets also cannot generate material revenues for these suppliers.

In late July 2026, Japan revised its SAF blending target to at least 1% by 2030. The SAF blend rate will be raised to 3% in 2031 and to 5% between fiscal 2032 and 2034. S&P Global Energy estimates that Japan will demand 74,000 metric tons of SAF in 2030, rising to 370,000 metric tons in 2032 based on the proposed blending roadmap. The baseline demand for SAF under the proposed blend rates is relatively low compared to the total expected production capacity subsidized by the GX bond program, which is 700,000 metric tons by 2030. This would require producers to export excess production volumes or risk operating at suboptimal utilization rates.

Under the current proposal, SAF will be required only at seven of Japan's largest airports and only for international flights between 2030 and 34. Only CORSIA-certified SAF will be eligible, and while LCAF would not be initially eligible, there are provisions to review its eligibility at a later date. Furthermore, domestic book and claim is permitted after SAF is delivered into airport storage.

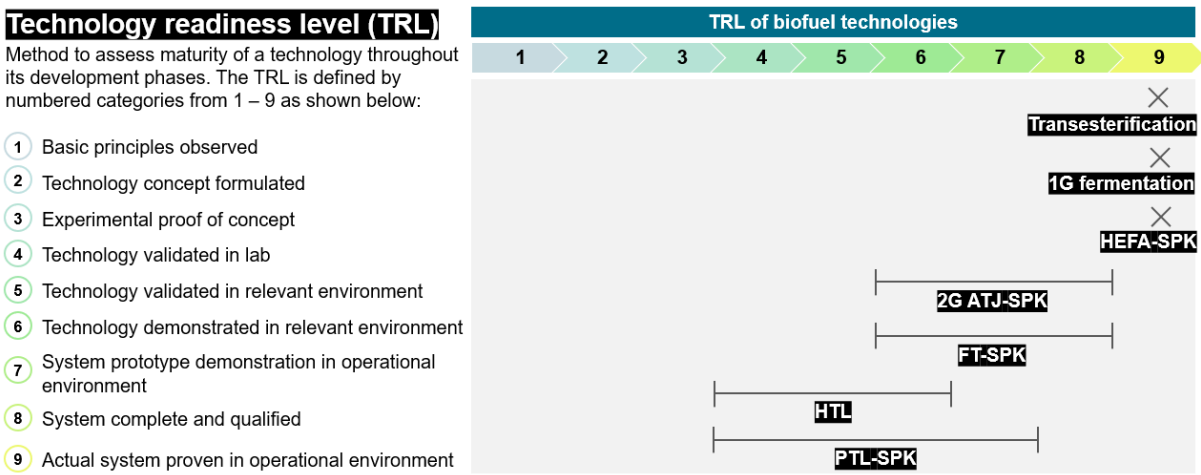
South Korea

South Korea will mandate 1% SAF from 2027, increasing the blend rate to 3% to 5% in 2030 and to 7% to 10% in 2035. At the moment, the suggested penalty for non-compliance is set at 150% of the average transaction price for each non-compliant volume. Acknowledging supply constraints and the early stage of SAF adoption, the Korean government also included a flexibility mechanism to allow deferment of up to 20% of the annual mandated volume and to fulfill the shortfall within the following years.

SAF Technology Maturity

Since ASTM International introduced the D7566 specification for synthesized aviation fuel in 2009, 12 production pathways have been approved, with more under review. The most prominent are Synthesized Paraffinic Kerosene (SPK) pathways. Hydroprocessed Esters and Fatty Acids (HEFA-SPK), Fischer-Tropsch (FT-SPK), and Alcohol-to-Jet (ATJ-SPK) are prioritized for global commercialization. Currently, HEFA is the most commercially mature and carries the lowest technology risk, but its scalability is constrained by inelastic lipid feedstocks. Nascent approved technologies include Catalytic Hydrothermolysis Jet (CHJ) and Synthesized Kerosene with Aromatics (SKA) variants (e.g., ATJ-SKA, FT-SKA). Their chemical complexity requires substantial R&D and entails higher capital costs than standard SPKs. Despite hurdles across pathways, regulatory frameworks continue to evolve rapidly to accommodate advancements, as highlighted by the June 2026 approval of Methanol-to-Jet (MTJ-SPK).

The Technology Readiness Level (TRL) scale assesses technologies from ideation (TRL 1) to full commercialization (TRL 9). Currently, HEFA-SPK and its co-processing pathways are the only ones operating at TRL 9, driven by lower technological complexity and compatibility with existing refinery infrastructure for lipid processing. Other approved pathways vary significantly. Second-generation ATJ-SPK and FT-SPK trail closely at TRL 5–8, advancing through demonstration phases. Emerging technologies, including Hydrothermal Liquefaction (TRL 4–7) and Power-to-Liquid (TRL 4–8), require substantial operational scale-up and economic optimization before achieving widespread commercial deployment.



Hydroprocessed Esters and Fatty Acids (HEFA-SPK) and Co-processing: Establishing near-term supply reliability

The pipeline tracks more than 200 standalone HEFA biorefineries and 70 co-processing refineries, underscoring its commercial scale. Under ICAO's CORSIA framework, using the 89 gCO2e/MJ baseline carbon intensity (CI) for fossil aviation fuel, HEFA-SPK from waste lipids can achieve lifecycle GHG savings exceeding 80%. HEFA's operational maturity, established licensors, and infrastructure compatibility with conventional aviation fuel processes drive near-term commercialization. Retrofitting existing units for co-processing also requires significantly lower capital expenditure (CAPEX) than greenfield projects.

The HEFA pathway's primary limitation is the availability of low-CI feedstocks. Waste-based feedstocks such as used cooking oil (UCO) and tallow offer superior emissions reductions, but their supply is structurally inelastic and constrained by primary consumption rates. As demand drives up waste-lipid values, the risk of feedstock adulteration may intensify, requiring rigorous third-party certification to ensure traceability across the fuel supply chain.

To broaden the feedstock pool, industry and policymakers have increased focus on alternatives such as dedicated energy crops (camelina, carinata, macauba, etc.) and more specialized waste streams, including cashew nut shell liquid (CNSL), spent bleaching earth oil (SBEO), and various industrial residues.

Yet expectations should remain measured. While these feedstocks can add supply at the margins, few are available at the scale required to materially shift global SAF economics. Energy crops are still in the early stages of commercial

development, while many waste-derived feedstocks are geographically concentrated and available only in relatively small volumes.

Alcohol-to-jet (ATJ-SPK): The next bet for SAF, with developments around second-generation ethanol

Following the success of HEFA, the next pathway up for commercialization is ATJ-SPK. It can use first-generation food-crop ethanol and second-generation cellulosic ethanol. Under the ICAO CORSIA life cycle assessment (LCA), first-generation ethanol struggles to deliver deep GHG reductions due to indirect land-use change penalties, prompting facilities to integrate carbon capture and storage (CCS). Conversely, cellulosic ethanol from agricultural residues achieves default GHG savings exceeding 75%.

Currently at TRL 6 to 8, ATJ is moving toward commercial scale. Its strategic advantage lies in accessing massive pools of carbohydrate feedstock, bypassing lipid supply constraints. However, the ATJ pathway faces notable techno-economic barriers. The multi-step chemical conversion of alcohols is highly energy-intensive, driving up operational costs, and scaling pretreatment processes for tough cellulosic biomass demands high CAPEX. ATJ's commercial viability will largely depend on securing abundant, low-cost, sustainable ethanol and optimizing plant-level energy integration.

Fischer-Tropsch (FT-SPK) and Gasification: An opportunity to turn household waste into treasure

Despite being the first ASTM-approved SAF technology, FT-SPK lags in commercial deployment. The synthesis is mature, and the upstream gasification offers unmatched flexibility for converting carbonaceous materials such as municipal solid waste (MSW). Because MSW is a waste stream, it avoids land-use penalties; hence, FT-SPK SAF derived from MSW achieves default GHG savings exceeding 85%.

However, the pathway introduces severe challenges. Currently at TRL 6 to 7, Gas-FT struggles with the variable quality of heterogeneous feedstocks. This variability necessitates extensive sorting, rigorous pretreatment, and intensive syngas cleanup to prevent catalyst poisoning. These requirements demand massive CAPEX and increase operational costs. The extreme gasification temperatures also result in high energy intensity, meaning commercial acceleration depends heavily on overcoming steep economic hurdles in syngas conditioning.

PTL-SPK or e-SAF: Harvesting the power of the sun and the air, the future state of SAF

Using renewable electricity and carbon dioxide to produce e-SAF removes biogenic feedstock constraints entirely. Currently at TRL 5 to 6, Power-to-Liquid (PTL) is considered the ultimate long-term decarbonization solution. e-SAF synthesized from strictly renewable electricity and captured CO2 can achieve near-zero carbon intensity, delivering GHG savings approaching 100%.

However, producing e-SAF is considerably more expensive than mature pathways. The primary techno-economic barriers are extreme CAPEX and high operational energy requirements. The pathway demands dedicated renewable energy buildouts, expensive electrolyzers for green hydrogen, and costly carbon capture infrastructure. Consequently, near-term deployment is driven primarily by regulatory policy, such as EU synthetic fuel mandates, rather than market economics. Widespread adoption hinges entirely on the rapid scaling and drastic cost reduction of global green hydrogen networks.

CHJ and HTL: Additional pathway providing operational flexibility with biocrudes

Catalytic hydrothermolysis jet (CHJ) and hydrothermal liquefaction (HTL) are emerging technologies for converting wet biomass and low-quality waste lipids into stable biocrude intermediates. Processing wet waste streams, such as municipal sludge, yields default GHG savings exceeding 75%. Sited between TRL 5 and 7, these technologies have a strategic advantage in handling high-moisture feedstocks. By operating at high heat and pressure in aqueous environments, they eliminate the energy-intensive drying steps required by gasification.

However, barriers are substantial. Conversion requires near-supercritical water and extreme pressures, necessitating specialized, corrosion-resistant metallurgy that drives up initial CAPEX. The raw biocrude contains elevated impurities, requiring extensive downstream hydrotreating to meet aviation specifications. This purification demands significant hydrogen inputs, further increasing operational costs. Commercial success depends on leveraging existing refinery infrastructure to offset these biocrude upgrading expenses.

Global SAF Fundamentals

Europe

Short-term SAF demand in Europe through 2029 will continue to be driven by high penalties and buyouts for non-compliance with ReFuelEU and the UK SAF mandate, together with non-EU countries increasingly aligning with ReFuelEU targets from 2026 and 2027. In the medium term, a step-up in mandates to 6% for the EU and a gradual rise to 10% for the UK could quadruple demand in Europe from 2025 to 2030, reaching 4.5 MMt. Sufficient supply from domestic capacity and imports put the EU on track to meet RFEUA in 2030, though the synthetic aviation sub-target remains at risk. In the longer term, large markets will continue to dominate demand, benefiting from strong existing logistics and supply lines and partnerships between fuel suppliers and flag carriers at key airports, facilitating efficient SAF supply and uplift. However, feedstock and fuel supply constraints and high costs pose challenges for higher mandates.

From a SAF supply perspective, Europe has a strong project pipeline, with nine biorefineries and co-pro projects capable of producing SAF already at FID or under construction as of May 2026. Supply is expected to ramp up to nearly 2.5 MMt by 2030. Post-2030, domestic production will be driven by (a) new or expanded co-pro projects; (b) a switch from modulated biorefineries to maximum jet production; or (c) new SAF projects via refinery conversions or greenfield investments. Developers are increasingly prioritizing a flexible investment and project portfolio across RD, SAF, and renewables production to maximize price arbitrage opportunities under RED III, RFEUA, ETS, and other European policies.

The United States

At the moment, the West Coast of the United States is the largest demand center for SAF, as multiple Low Carbon Fuel Standard (LCFS)-style programs allow SAF to generate supplemental credits. Under the Federal Renewable Fuel Standard (RFS), SAF can also generate D4 Renewable Identification Numbers (RINs). In the longer term, demand for SAF in the Midwest and on the West Coast is expected to grow as more LCFS-style programs are written into legislation.

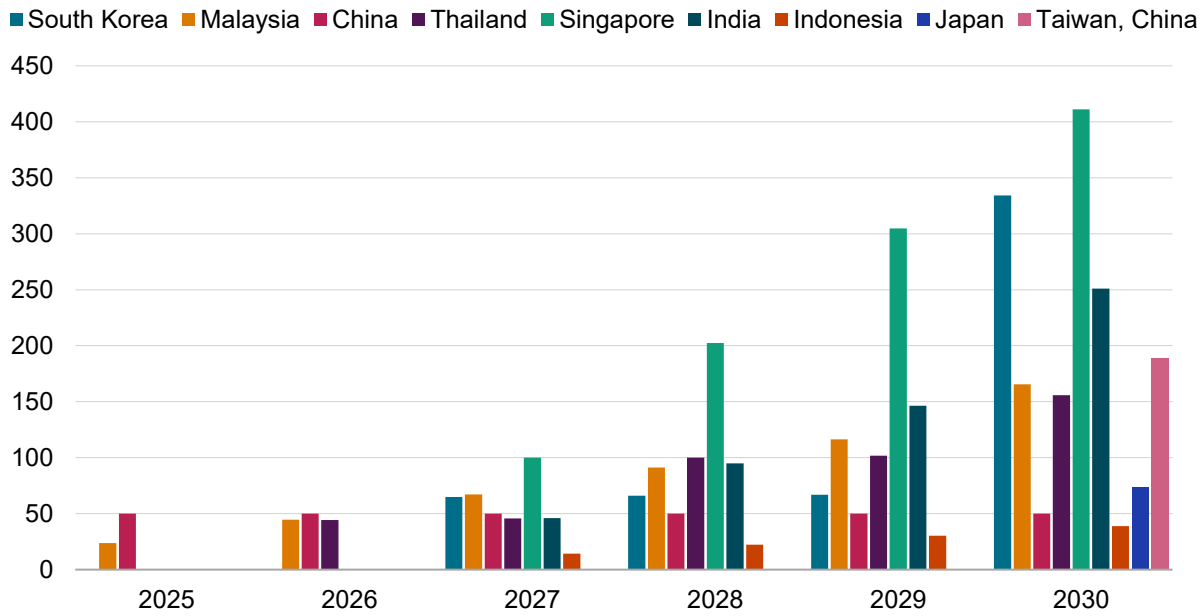
SAF production in the US is expected to be diversified across regions. The Midwest, with significant corn ethanol production, will lead the development of ATJ production capacity in the US. As ethanol blending into gasoline declines, ethanol volumes will be diverted to feedstocks to support higher ATJ-SPK production. As West Coast SAF demand continues to be driven by LCFS-style programs and supply remains limited on the West Coast, Midwest ATJ SAF producers could send SAF to the West Coast region.

Asia

SAF demand in Asia is expected to be driven by policy development. Governments in the region have aligned their SAF policies with ICAO's CORSIA guidance, with countries rolling out SAF blending targets starting in 2027. Asia will begin SAF blending at a relatively low rate of 1% during the 2027–2028 period, with governments expanding the blending roadmap to 5% in 2030. S&P Global Energy estimates that total SAF demand from all announced SAF blending roadmaps in Asia will grow from 390,000 metric tons in 2027 to 1.7 million metric tons in 2030.

From the SAF supply perspective, Asia has been a key SAF supplier to global markets. China released a 1.7 million metric tons SAF export quota in 2026, along with large HEFA-SPK capacities to be commissioned between 2028 and 2030. Total SAF supply in Asia will far exceed the estimated 1.7 million metric tons of demand in 2030. As Asia is also a key feedstock supplier for global HEFA producers, it will continue to target export markets outside the region. In the longer term, S&P Global Energy projects that SAF demand across Asia will surge to 24 million metric tons by 2050, driven by rapid long-term growth in commercial jet fuel consumption and the phased implementation of national biofuel blending mandates across the region.

SAF demand based on legislation, thousand metric ton



Latin America

In the short term, SAF demand in Latin America will be driven by a mandate for domestic flights in Brazil under the Fuel of the Future Law, passed in 2024 and scheduled to take effect in 2027. In addition, regulations, decrees, and directives for international flights will be implemented, including fines for failing to meet CORSIA targets in the Brazilian context. Finally, roadmaps for SAF blend rates and availability—such as those in Chile and Colombia—will also support near-term demand. S&P Global expects Latin America to reach 1,260 thousand metric tons of SAF demand per year in 2035.

In the short term, the development and expansion of SAF supply in Latin America will focus on co-processing SAF via the HEFA pathway, particularly in countries with established biofuel production capabilities for road transportation and access to available feedstocks. In the medium and long term, constraints on lipid feedstocks will drive a transition away from predominantly HEFA-based production toward other pathways—especially ATJ—to achieve the ambitious decarbonization targets set by national and international organizations.

Global Jet Fuel & SAF Pricing

Transparent Jet Fuel Benchmarks Support Efficient Asian Aviation Markets

The Platts price assessment process plays a critical role in the efficient functioning of Asia's jet fuel market. Independent, timely benchmarks support physical trading, procurement, planning, investment, and risk management decisions across the aviation fuel supply chain.

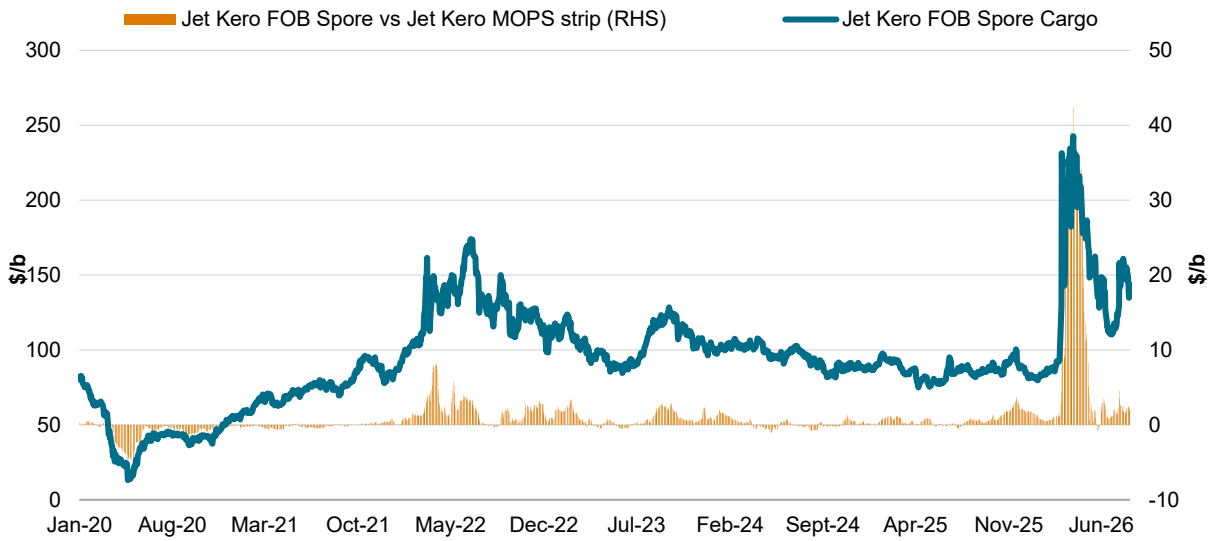
The Mean of Platts Singapore (MOPS) Jet Fuel/Kerosene assessment and the Mean of Platts Arab Gulf (MOPAG) Jet Fuel/Kerosene assessment are among the most widely referenced benchmarks in the region. MOPS jet fuel/kerosene assessments reflect verified tradable market value across Asia's key demand centers, including China, Japan, South Korea, and Singapore, while MOPAG reflects value at one of the world's most important jet fuel export hubs in the Gulf CC countries, comprising Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE. Together, these assessments provide a transparent pricing framework linking producers, traders, airlines, fuel suppliers, and end-users across Asia-Pacific and the Middle East.

The value of transparent pricing has been demonstrated during several major market disruptions over the past decade. During the COVID-19 pandemic in 2020, international travel restrictions caused an unprecedented collapse in aviation demand. Jet fuel consumption and refinery margins fell sharply as the market moved into oversupply.

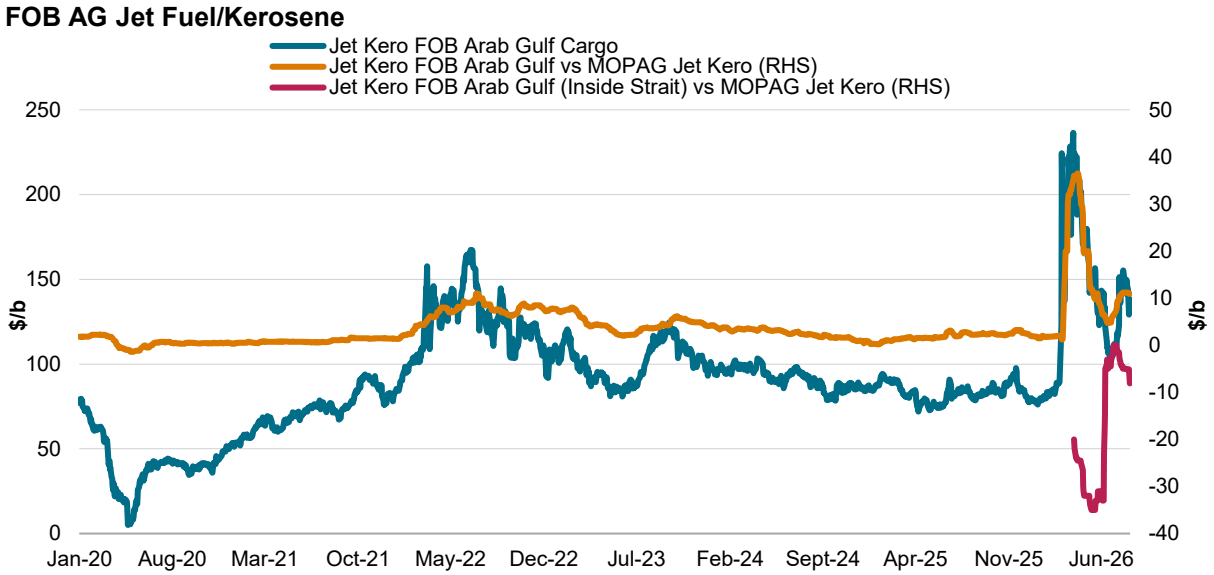
MOPS and MOPAG jet fuel assessments reflected this rapid deterioration in fundamentals, giving market participants an objective measure of weakening demand and shifting supply conditions. As travel restrictions were gradually lifted and aviation activity recovered around early 2022, these benchmarks also provided transparent signals of improving market conditions. This helped participants track the pace of recovery and adjust procurement, trading, and risk management strategies accordingly.

Following Russia's invasion of Ukraine in 2022, global energy markets experienced another period of exceptional volatility. Sanctions, trade disruptions, and shifting product flows altered established supply chains, while jet fuel prices rose sharply as global middle distillate markets tightened. Transparent benchmark assessments allowed airlines, refiners, traders, and policymakers to assess changing market conditions, evaluate procurement costs, and manage exposure in a rapidly evolving price environment.

FOB Singapore Jet Fuel/Kerosene



More recently, heightened geopolitical tensions in the Middle East and concerns about the Strait of Hormuz have underscored the strategic importance of transparent benchmark pricing. The Strait of Hormuz is a critical artery for global energy trade, and the Gulf region remains one of the largest suppliers of jet fuel and refining feedstocks to Asia. The GCC countries, comprising Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE, are home to some of the world's largest refining and export-oriented energy industries and play a critical role in supplying jet fuel and other petroleum products to Asia and global markets. Threats to production, exports, or shipping logistics have, as we have seen, the potential to affect jet fuel availability and pricing across the globe.



During periods of uncertainty, MOPAG and MOPS jet fuel assessments provide market participants with transparent insights into evolving supply-demand balances, freight economics, and risk premiums. In response to market upheaval and potential disruptions to flows through the Strait of Hormuz, Platts introduced refined oil product assessments, including FOB Arab Gulf “Inside Straits,” in April 2026. These assessments reflect spot values for cargoes loading in the Arabian Gulf, helping maintain price transparency when physical movements through the Strait are restricted or disrupted.

Even in the absence of major physical disruptions, benchmark assessments allow the market to incorporate geopolitical risk into tradable values while distinguishing underlying fundamentals from speculation. This transparency supports liquidity, facilitates efficient price formation, and strengthens confidence throughout the aviation fuel supply chain.

Global SAF prices remain supported by compliance demand and geopolitical uncertainty

Global sustainable aviation fuel (SAF) prices have remained at historically high levels throughout 2026, supported by geopolitical uncertainty, expanding regulatory requirements, and evolving global supply dynamics.

Although SAF prices have largely tracked broader gains across aviation fuel markets, price trends have been shaped by a distinct set of market fundamentals. Unlike conventional jet fuel, SAF pricing is increasingly influenced by blending mandates, certification criteria, feedstock availability, and production economics. As Europe's compliance-driven market continues to develop and Asia strengthens its position as a major export supplier, regional developments are exerting a growing influence on global SAF price discovery.

Geopolitical tensions boost aviation fuel values

Aviation fuel markets strengthened in the first half of 2026 amid escalating tensions in the Middle East and renewed concerns about global energy security.

Heightened volatility linked to the Strait of Hormuz supported the refining sector, with jet fuel markets reacting strongly to fears of potential supply disruptions. SAF prices also rose over the period, though gains were generally more muted than those in conventional aviation fuels. By the end of the first half of 2026, Platts assessed FOB Straits SAF outright values at $2,435/mt, while FOB China SAF outright prices stood at $2,410/mt.

Market participants noted that SAF continued to trade on a differentiated set of fundamentals. While geopolitical developments and crude oil movements offered support, pricing remained heavily influenced by feedstock costs, renewable fuel economics, and compliance-related demand.

The contrasting performance highlights the increasingly complex nature of SAF markets. Conventional jet fuel remains closely linked to geopolitical shocks and crude oil price movements, whereas SAF values are also determined by certification requirements, renewable feedstock availability, and the pace of regulatory-driven demand growth.

Consequently, geopolitical uncertainty has provided an important layer of support to SAF markets while reinforcing the value of diversified supply chains and regional production capacity.

Europe's compliance market sustains demand

Europe remains the world's largest demand hub for sustainable aviation fuel, supported by the rollout of the ReFuelEU Aviation framework and growing pressure on airlines and fuel suppliers to secure compliant volumes.

The European Union's SAF mandate took effect in 2025, requiring aviation fuel suppliers to blend sustainable aviation fuel into conventional jet fuel supplied at EU airports. The mandate steadily increases blending requirements through 2050, creating a long-term demand foundation for producers worldwide.

Market reactions to the recent rally in aviation fuel markets have varied. Some buyers accelerated procurement as rising jet fuel prices reduced the relative premium of SAF, while others adopted a more cautious stance, prioritizing management of conventional fuel exposure amid broader market uncertainty. Despite these differing approaches, market participants widely expect a significant volume of compliance-related purchases later in the year.

Supply conditions have also tightened more than anticipated. European participants reported lower-than-expected SAF arrivals from China at times, restricting prompt availability despite expectations of growing export volumes from Asia. Recent expansions to China's SAF export whitelist are expected to support higher shipments in the second half of 2026, although market participants continue to watch closely how quickly those additional volumes reach global markets.

Logistical disruptions have added another challenge. Persistently low water levels along the Rhine River have affected inland transportation routes in Germany, prompting some market participants to seek alternative delivery routes and contributing to localized supply concerns.

Asia strengthens its role in global SAF supply

Few developments have influenced SAF market sentiment more in 2026 than Asia's expanding contribution to global supply.

Growing production capacity across the Straits region, coupled with rising exports from China, has significantly increased the region's importance in international SAF balances. What was once viewed primarily as a future demand center is increasingly emerging as a key supply source for mandate-driven markets overseas.

According to customs data, China exported nearly 418,000 mt of SAF in the first half of 2026. The vast majority of these volumes were shipped to Europe, including Belgium, the Netherlands, Spain, the UK, and France. Belgium alone accounted for approximately two-thirds of all Chinese SAF exports during the period.

China's role has become particularly significant for market participants assessing future supply balances. Developments related to the country's SAF export framework are closely monitored, as even incremental increases in export availability can materially influence regional fundamentals. European buyers have increasingly turned to Asian suppliers to supplement domestic supply, making Chinese export policy an important factor in international price formation.

Meanwhile, policy support for SAF consumption is also gathering momentum across Asia. Governments throughout the region are advancing aviation decarbonization efforts through blending mandates and targeted policy initiatives. Singapore plans to introduce a 1% SAF blending requirement from 2027, increasing to between 3% and 5% by 2030. Japan is targeting a 1% SAF blend by 2030 across seven airports. Similar measures are being explored elsewhere in the region as governments pursue emissions reductions while strengthening long-term energy security.

Together, these developments are fostering a more interconnected global SAF marketplace, where policy decisions in Asia increasingly affect global pricing expectations and supply availability.

SAF market enters a new phase of price discovery

Despite growing investment and supportive policy frameworks, global SAF production remains well below the levels needed to achieve long-term aviation decarbonization goals.

The International Air Transport Association estimates that SAF production will reach about 2.4 million mt in 2026, representing just 0.8% of total aviation fuel consumption.

This limited supply base continues to support SAF values as compliance requirements expand. Unlike conventional aviation fuels, SAF pricing is influenced by energy market fundamentals, feedstock economics, government mandates, and certification systems. These factors have created a market that is increasingly global in scope.

As European compliance demand continues to grow and Asian production capacity expands, SAF benchmarks are becoming increasingly important for airlines, producers, and traders seeking greater transparency in an evolving marketplace. For market participants, monitoring regional supply developments and policy changes may become as critical as tracking movements in conventional jet fuel markets.

China and Malaysia remained among the largest exporters in the Asian used cooking oil (UCO) market in 2026, according to S&P Global Market Intelligence's Global Trade Analytics Suite (GTA).

Global UCO Pricing

China exported about 2.23 million mt of UCO and food waste oil (FWO) as of July 2026, with the Netherlands, the United States, and Singapore ranking as its three largest export destinations, according to GTA data. The export flows underscore the continued importance of international demand for Asia's UCO market, particularly from the US and Europe.

Policy-driven demand supported the market in the first half

US and European policy developments were key drivers of demand for Asian-origin UCO in the first half of 2026. The Asian market entered the second quarter on firmer footing after the US Environmental Protection Agency finalized its Renewable Volume Obligations (RVOs) and Canada updated its Clean Fuel Regulations. These developments coincided with increased buying inquiries from North American buyers for Asian-origin UCO in May and June.

The increase in US renewable fuel obligations also raised expectations of a potential feedstock supply gap in the domestic market. Market participants indicated that higher blending requirements could increase the need for imported feedstocks, supporting demand for UCO from overseas suppliers, Platts reported earlier.

The strengthening demand environment was reflected in Asian UCO prices. Platts assessed standard UCO FOB North China at $1,140/mt on April 2, the highest level since Oct. 22, 2025, when the assessment stood at $1,143/mt.

European policy developments provided another source of support. Renewed optimism surrounding Germany's approval of the Renewable Energy Directive III (RED III) increased market expectations for waste-based feedstock demand, adding to positive sentiment for Asian UCO exports.

India’s medium-term jet fuel outlook

India's aviation sector is expected to remain one of the fastest-growing sources of refined product demand through 2060, providing a strong foundation for developing a domestic Sustainable Aviation Fuel (SAF) market. Jet fuel demand is forecast to rise from about 192 kb/d in 2024 to 277 kb/d by 2031, a cumulative increase of about 45%. This expansion is driven by rising middle-class mobility, continued growth in domestic and international air travel, airport infrastructure development, and ongoing airline fleet additions.

While some short-term weakness emerged in 2026, particularly in the international segment, the underlying demand trajectory remains firmly positive. India's aviation fuel consumption softened in mid-2026, with July demand falling to about 180 kb/d, reflecting weaker flight activity, higher operating costs, and supply-side disruptions. However, first-half 2026 jet fuel consumption still increased by nearly 2% year over year, suggesting the recent slowdown is temporary rather than structural and does not alter the longer-term growth outlook.

The demand outlook is further supported by rising passenger traffic, the continued expansion of low-cost aviation, and increasing international connectivity. New infrastructure, including Navi Mumbai International Airport and Jewar Airport in Noida, is expected to ease capacity constraints and support additional growth in flight activity. International aviation is likely to remain an important demand driver, with international seat capacity expanding faster than domestic capacity in 2026 despite higher ticket costs.

Policy support is also expected to play an important role in sustaining aviation growth. A key structural driver is the government's continued focus on expanding air connectivity through the UDAN (Ude Desh Ka Aam Nagrik) Regional Connectivity Scheme. Since its launch in 2016, UDAN has significantly expanded access to air travel across Tier-2 and Tier-3 cities by making air travel more affordable and encouraging airlines to serve previously underserved routes. By mid-2026, the program had operationalized more than 679 routes across 95 airports, heliports, and water aerodromes, serving over 16.8 million passengers. The revamped UDAN program, launched in 2026 with a long-term outlay of approximately INR 28,840 crore, aims to further expand regional connectivity and aviation infrastructure, broadening the passenger base and generating additional aviation fuel demand.

The government has also introduced an aviation turbine fuel (ATF) pricing stabilization mechanism, including a fixed ATF price in Delhi and a dedicated stabilization fund. While not a direct subsidy, the mechanism reduces fuel price volatility and improves cost visibility for airlines. Greater pricing stability can support airline profitability, encourage capacity expansion, and indirectly strengthen long-term jet fuel demand growth.

India SAF development

India has been identified as a key member state to participate in ICAO' s CORSIA program. According to the ICAO 2018 revenue tonne-kilometers (RTK) ranking, India ranked 20th, with international airlines operating under India's flag accounting for 1.35% of global aviation activity. Although India has not participated in CORSIA before 2027, it has participated in CORSIA's Emission Monitoring, Reporting and Verification (MRV) process and has been assigned a baseline of 10 MMt of CO2 emissions for the CORSIA program.

The Indian government has announced SAF blending roadmap starting with 1% blending in 2027 and increasing to 2% in 2028 and 5% in 2030 to decarbonize its aviation industry. S&P Global Energy estimates that India will demand 46,000 metric tons of SAF in 2027 and expects this to grow to 250,000 metric tons in 2030 to achieve these targets. Currently, India has 4 ISCC-CORSIA certified co-processing SAF facilities:

Production Facility	Co-processing capacity	Date of ISCC certification
BPCL – Mumbai Refinery	61,000 metric tons	11th May 2026
HPCL – Visakh Refinery	10,000 metric tons	30th June 2026
IOCL – Panipat Refinery	30,000 metric tons	Renewed on 31st July 2026
MRPL – Katipalla Refinery	5,500 metric tons	24th April 2026

The total co-processing SAF production capacity is 106,500 metric tons, enabling India to fulfill its 2027 and 2028 blending targets through domestic co-processing production. In addition to existing production capacities, India has a few announced SAF projects, a combination of both HEFA and ATJ pathways, which will be commissioned between 2028 and 2030 and will support the increase in demand for SAF in 2030. However, if these announced SAF production plants fail to come online, India will not be able to achieve its 5% blending targets based on existing co-processing capacities. Hence, a degree of investor confidence is required to push these planned projects forward. Using ICAO's default GHG value for low-carbon fuel, the estimated GHG reduction from achieving the 1% SAF blending target in 2027 is 119,000 metric tons and could grow to 665,000 metric tons in 2030.

India has an untapped advantage in the SAF production value chain: domestic feedstock availability. India's edible oil consumption is estimated at 29–30 million metric tons annually, potentially generating 1.8–2.6 million metric tons of UCO in the market. However, only a small proportion enters authorized collection and processing channels. And through various steps of the collection and verification process, not all UCO generated will automatically become SAF feedstock. Traceability and rigorous verification processes are key to ensuring non-fraudulent activities within the UCO supply chain and achieving confidence in SAF adoption.

The ability to integrate the entire HEFA- SAF production supply chain domestically allows India to avoid exposure to global trade volatility, thereby diversifying its energy expansion portfolio and enhancing energy security. In addition to the HEFA- SAF pathway, India also has a key advantage in the ATJ production pathway. Under ICAO' s default value for low-carbon fuel, ATJ produced from sugarcane- based ethanol can achieve a 73% GHG reduction compared to fossil Jet-A1. India has successfully implemented its E20 gasohol blending mandate. Alongside this achievement, India' s domestic sugarcane ethanol has grown to 1.5 billion liters of supply, which can potentially be used to support its ATJ production.

From a feedstock perspective, India has several advantages in achieving its 2030 SAF blending target of 5%, beyond domestic consumption; export potential to support other regional demand centers could be unlocked by realizing its full UCO collection potential of 1.8-2.6 million metric tons. However, at the moment, the co-processing plants are CORSIA-certified and can only target CORSIA markets, as exports to the European region will require additional EU sustainability certifications. Additionally, sugarcane-based SAF is not eligible for European exports, as ReFuelEU does not allow the use of food crops as feedstock; hence, India's ATJ SAF producers will have to expand their feedstock portfolio to include cellulosic ethanol to target the export market as well.

India’s transition toward SAF requires a phased deployment strategy that balances commercial availability with long-term scalability. The near-term priority lies in HEFA biorefineries and refinery co-processing; given the pathway's commercial maturity, it is positioned as the optimal solution for early deployment. However, success depends on navigating waste-lipid constraints by strengthening certified collection networks and ensuring rigorous traceability for international compliance.

In the medium term, Alcohol-to-Jet (ATJ) leverages India’s established sugar and molasses ethanol base. Expanding into second-generation agricultural residue-to-ethanol supply chains unlocks significant volumes. However, scaling ATJ requires public support to mitigate first-of-a-kind engineering and offtake risks, ensuring these projects remain financeable despite intense feedstock competition across adjacent sectors.

For the long term, India must build optionality in Fischer-Tropsch (FT) pathways and, depending on the pace of domestic SAF market expansion, strategically evaluate Power-to-Liquids (PtL) technologies. FT offers a route to monetize agricultural residues and municipal waste, demanding robust biomass aggregation, preprocessing, and financial support to overcome commissioning risks. Simultaneously, PtL capitalizes on India’s renewable power and green hydrogen hubs. Though early compliance is unlikely due to prohibitive costs, establishing demonstration clusters and biogenic CO2 frameworks could position India competitively for synthetic fuel demand.

Across all pathways, structural market risks persist. The cost gap between SAF and conventional jet fuel necessitates robust policy durability, including stable blending targets and financial mechanisms, to bridge the green premium. Stringent lifecycle accounting and ASTM certifications are critical; without policy clarity and traceability, emerging facilities will struggle to secure debt and performance guarantees for commercialization.

India e-SAF development

E-SAF is one of the more novel items on the low-carbon fuels menu. Produced from water, renewable electricity (which in turn produces green hydrogen), and captured carbon dioxide, it is of growing interest because it has fewer physical

feedstock constraints than bio-SAF and delivers high greenhouse gas savings (over 90% vs. fossil fuels in some cases). The catch is that e-SAF faces similar headwinds to advanced non-HEFA projects, and production costs are currently at least 6x the price of fossil jet fuel.

Yet policy, at least in Europe, envisages a strong long-term role for e-SAF, with ReFuelEU sub-quotas rising to an ambitious 35% by 2050. Outside of Europe, development is characterized by non-binding, high-level national targets and early-stage consortia and research projects involving developers, airlines, and governments. Taken together, S & P Global forecasts global e-SAF demand to reach nearly 11 MMt per year by 2050, 2.4% of the jet fuel pool, with Europe accounting for 70% of this.

While demand will remain concentrated in Europe, supply is a tale of the short-, mid-, and long-term. Today, two-thirds of the ~100 e-SAF projects announced globally are positioned at the heart of future compliance markets in Europe, where stronger funding or revenue certainty is available. Longer term, as technologies are derisked and supply scales, cost competitiveness and feedstock availability will increasingly dictate the supply spread. Renewable electricity for hydrogen production alone accounts for 25-40% of e- SAF production costs, making parts of southern Europe, the Middle East and North Africa, the US Gulf Coast, and Mainland China among the most competitive regions in the long term.

Like most regions, e-SAF developments in India have been limited, with no formal policy or national targets announced. There have been a couple of early- stage e- fuel feasibility studies and pilots near major industrial port hubs by the likes of NTPC Renewable Energy Ltd – but no steel is in the ground on any major project. Yet the country is well-positioned to leverage solar and wind resources, plus biogenic CO2 from large domestic agricultural and ethanol industries. The government's National Green Hydrogen Mission, which sets production and cost targets, could be a key enabler for e-SAF in the longer term. For India and other potential exporters, the key to understanding the market opportunity for e-SAF will be how mandates and other policy measures evolve in Europe.

Conclusion

The current stage of SAF development remains largely driven by government policies and blending targets rather than economic advantage. Various policy approaches have been observed worldwide. The European region mandates 2% SAF blending, with penalty structures for noncompliance by obligated parties, and the South Korean government is expected to establish a system similar to the EU's ReFuelEU policy. In Singapore, the government establishes a central procurement body to purchase SAF through the SAF levy collected from passengers. This system introduces flexibility, whereby the blending target is not a hard requirement, and the organization will purchase SAF based on the total levy collected. The Japanese and US governments provide incentives for SAF supply development to reduce production costs and enable wider adoption.

India's success in SAF will depend on well-calibrated policy design that creates a stable, long-term demand environment. By combining targeted subsidies to reduce production costs with carefully structured demand-side obligations and penalties, policymakers can stimulate SAF uptake without causing undue market distortions. Equally important is a fair allocation of costs across the supply chain, rather than fully passing them on to consumers, to maintain public acceptance and airline competitiveness. Such a framework can strengthen investor confidence, support final investment decisions, and catalyze investments in used cooking oil (UCO) collection systems, helping unlock India's estimated 1.8–2.6 million metric tons of UCO feedstock potential. Achieving early and credible progress on the 1%–2% SAF blending mandates in 2027–2028 will be critical to signal policy reliability and mobilize the additional capital needed to scale production capacity toward the 5% SAF blending target by 2030, positioning India as an emerging SAF hub in the region.

Powering the SAF Transition

The SAF Association (SAFA) is an industry-led, not-for-profit organisation committed to advancing the development of a credible, scalable and globally competitive Sustainable Aviation Fuel ecosystem.

As India enters a decisive phase in its SAF journey, the opportunity extends far beyond fuel production. It encompasses feedstocks, technology, infrastructure, certification, capital, policy, market creation and international collaboration. SAFA brings these dimensions together—connecting policy with industry, innovation with investment, and opportunity with execution.

Shaping the Ecosystem. Enabling the Transition.

SAFA serves as a strategic platform for stakeholders across the SAF value chain, with a focus on six interconnected priorities:

Policy & Regulatory Leadership

Working with policymakers, regulators and industry to translate market requirements into practical policy frameworks, standards and mechanisms that support long-term SAF development.

Market Intelligence & Strategic Insights

Bringing together industry knowledge, market intelligence, global developments and India-specific perspectives to support informed business, policy and investment decisions.

Technology, Innovation & Capacity Building

Supporting technology development, research, knowledge exchange and capability building across emerging and established SAF pathways—from bio-based SAF to e-SAF and future fuels.

Investment & Project Facilitation

Helping connect projects, capital, technology and strategic partners to accelerate the transition from opportunity and feasibility to investment and commercial deployment.

Industry Collaboration & Partnerships

Creating platforms for meaningful engagement among producers, airlines, airports, refiners, technology companies, feedstock stakeholders, investors, research institutions and global partners.

Global & Regional Cooperation

Connecting India with the international SAF ecosystem, enabling knowledge exchange, strategic partnerships and opportunities across emerging SAF markets.

A Platform Built for Action

The SAF transition requires an ecosystem—not isolated initiatives.

SAFA works to create the connections and platforms through which policymakers can engage with industry, investors can identify opportunities, technology providers can find partners, producers can access markets, airlines can engage with the emerging supply base, and global stakeholders can connect with India.

Supported by experienced leaders and experts across aviation, energy, refining, renewable energy, technology, policy, finance, carbon markets and sustainability, SAFA brings together diverse perspectives through dedicated industry and technical forums covering policy, production, investment, technology, feedstocks, finance, aviation, airports, supply chains, e-SAF and future fuels.

From Ambition to Implementation

India's SAF opportunity is significant. Realising it will require more than mandates and targets. It will require investment confidence, sustainable feedstock systems, technology deployment, bankable projects, credible certification, market development and sustained collaboration across the value chain.

SAFA's role is to help enable that transition.

Our ambition is to support the emergence of an Indian SAF ecosystem that is commercially viable, environmentally credible, innovation-led and globally connected—while creating new opportunities across the country's industrial and economic landscape.

As India moves from policy ambition towards implementation, SAFA is committed to working with stakeholders across India and the world to shape the market, strengthen the ecosystem and accelerate deployment.

The opportunity is before us.

The ecosystem is coming together.

The time for implementation is now.

SAF ASSOCIATION

SAF Association
Powering the SAF Transition

Policy & Regulatory Leadership | Market Intelligence | Technology & Innovation | Investment & Project Facilitation | Industry Collaboration | Global Partnerships

SAF ASSOCIATION

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We thank the following team members and contributors from SAF Association for their valuable support and insights in developing this report.



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