Rhodium Group

Growing Global Demand for Sustainable Aviation Fuels

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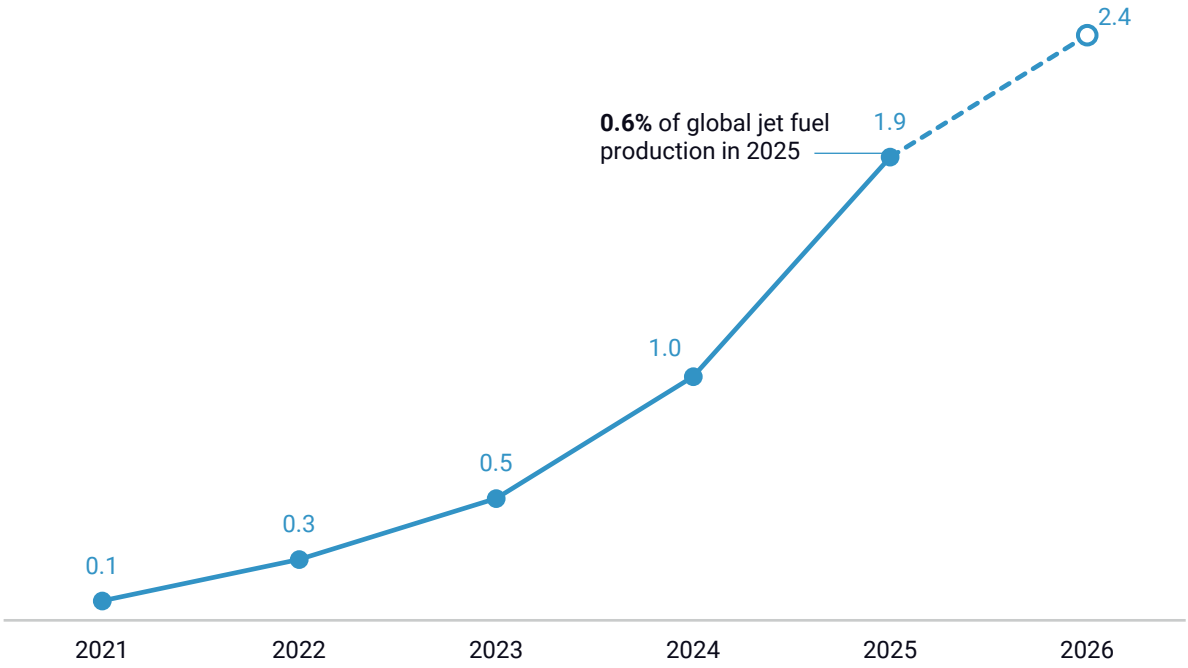
Disruptions to oil shipments and refining in the Middle East have pushed up jet fuel prices and have renewed interest in alternatives, particularly sustainable aviation fuels (SAF)—a non-petroleum-based alternative to conventional jet fuel made from renewable waste and feedstocks. Scaling SAF to levels that could cushion the industry against further geopolitical shocks and significantly reduce emissions from global aviation may take decades, however. While SAF production has risen significantly in the past few years, it contributed less than 1% of global jet fuel consumption in 2025. In this note, we assess the investment pipeline for global and regional SAF production and the potential for SAF production capacity to scale in the coming decade.

Governments are mandating SAF

While until 2021 SAF production was negligible, in 2025 the industry took its first step towards a compliance-driven market, as the European Union, the United Kingdom and other countries advanced major policy frameworks. The same year, SAF supplied 0.6% of global aviation fuel demand, up from 0.1% in 2021 (Figure 1). The International Air Transport Association (IATA) projects that SAF will continue to grow in 2026, reaching 2.4 million tons of production, roughly 0.8% of global jet fuel production. Because policies favor renewable diesel at flexible plants, IATA's production estimate assumes SAF production represents about a third of total production capacity. Government mandates and voluntary commitments drive almost all this growth in demand, as SAF prices are two to five times more than conventional jet fuel in 2026.

FIGURE 1
SAF production has risen steadily but contributes less than 1% of global jet fuel
Global sustainable aviation fuel production, million tons



Source: Rhodium Group and Bruegel analysis of IATA

Europe has the most ambitious SAF mandates. The EU's ReFuelEU Aviation regulation, also adopted by Switzerland and Norway, requires fuel suppliers to increase the share of SAF delivered to airports from 2% in 2025 to 6% in 2030 and 70% in 2050, with an electro-SAF (a synthetic jet fuel made from captured carbon dioxide, water, and renewable electricity) sub-target reaching 5% in 2030. The EU exceeded its 2025 target, with 2.8% of jet fuel supply coming from SAF, supported by EU policies allocating emissions trading allowances to airlines to cover part of the price difference between eligible fuels and conventional jet fuel. The UK has a similar mandate, with rising minimum shares, high penalties for non-compliance and price guarantees for domestic production.

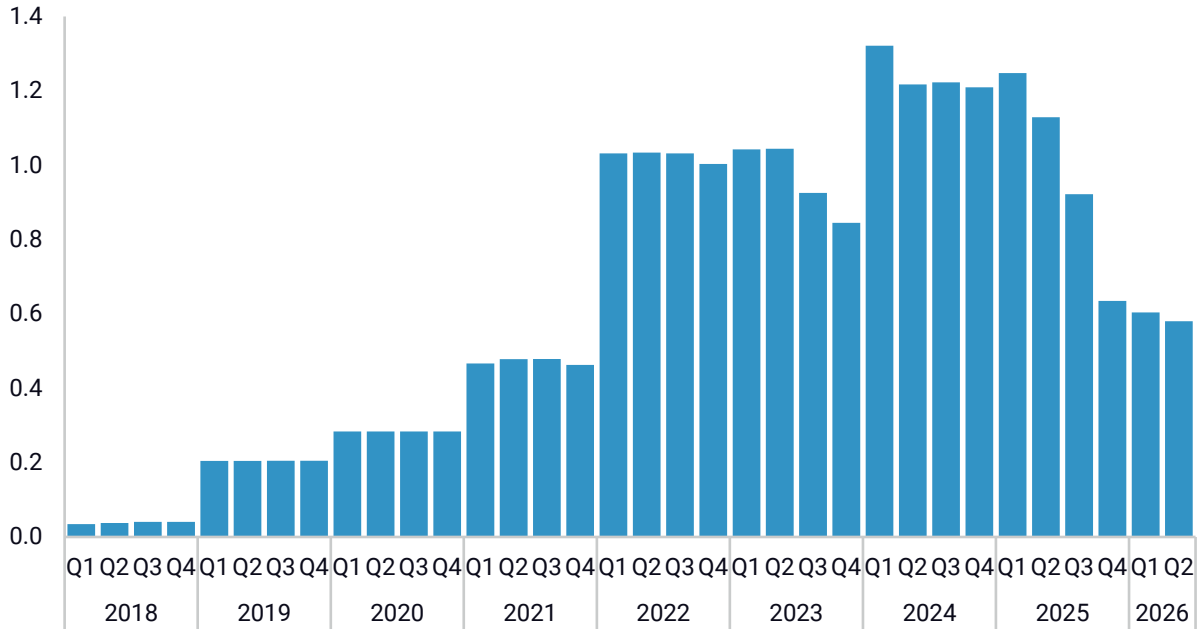
Several other countries plan to introduce SAF requirements. Japan and South Korea target international flights: pending legislation in Japan would require SAF blending with conventional kerosene from 2030, while South Korea mandates 1% from 2027, rising to 7-10% in 2035. Brazil's Fuel of the Future Law instead requires airlines to cut domestic-flight emissions through SAF by 1% in 2027, rising to 10% by 2037. India's target starts in 2027 for international flights. Singapore has taken a different approach. From 2027, a passenger levy in Singapore will fund centralized SAF purchases, targeting a 1% share initially and 3-5% by 2030.

The United States and China have no mandates. Instead, the US supports production through tax credits (the Section 45Z tax credit), which runs until 2029. Since 2026, the maximum credit for SAF has fallen from $1.75 to $1 per gallon. Eligible feedstocks must originate in North America. China is focusing on voluntary adoption and certification, with a 2024 pilot covering over 10 airports.

SAF investment has grown, but technology rollout is still slow

Global SAF investment has grown rapidly since 2018. A total of $23 billion has been invested across 258 projects tracked by the Clean Investment Monitor. We distribute investments over the duration of the facility construction to produce a measure of actual ongoing investment into SAF production (Figure 2). Actual annual investments grew from $150 million in 2018 and peaked at nearly $5 billion in 2024, before slowing in 2025.

FIGURE 2
Global SAF capacity investment rose rapidly through 2024, but has declined since
Actual global SAF investment, $ billion, 2024 prices



Source: Clean Investment Monitor, Rhodium Group, Bruegel

While actual investment has slowed down from its earlier high, announcements of SAF production facilities have remained relatively steady in the first half of 2026, with new projects representing over 2 million tons of annual SAF capacity announced in Brazil, the US, the UK, Belgium, Denmark and France. Existing production capacity is substantially underutilized, with 1.9 million tons produced in 2025 compared to our 7.3 million tons capacity estimate. This weakens the current investment case for new projects to reach final investment decisions.

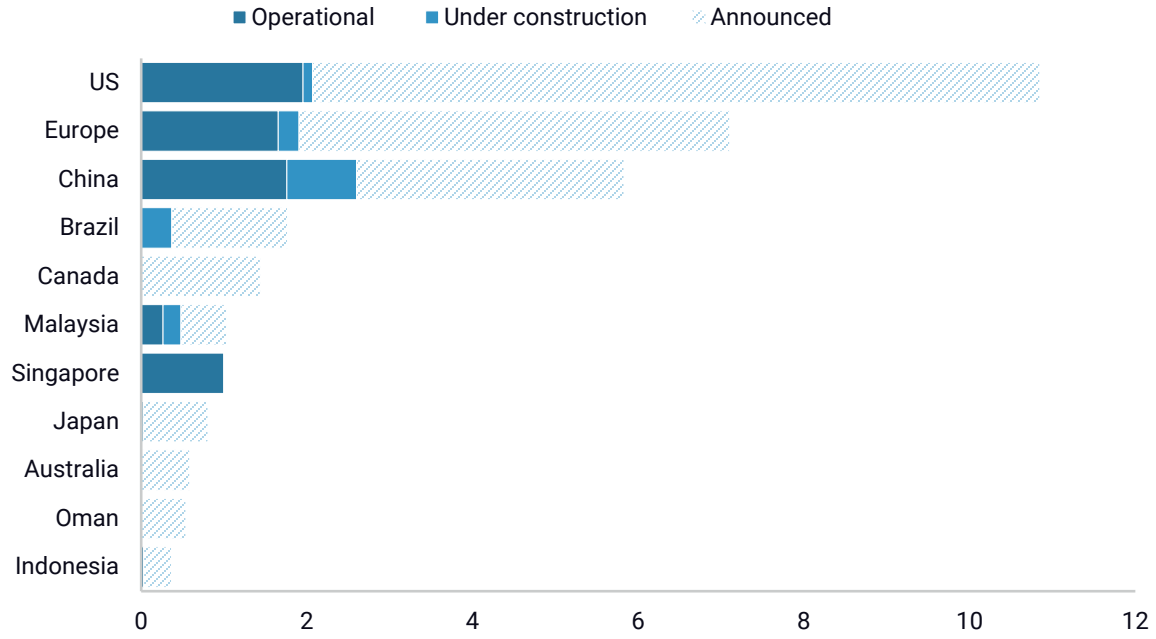
SAF production capacity is geographically diverse

Global SAF production capacity is concentrated in the US, China and Europe, each accounting for about a quarter (1.6-1.9 million tons) of operational global capacity. Most of the remaining capacity is in the rest of Asia. Planned projects could spread production further, particularly to Brazil, Canada, Australia and Oman.

FIGURE 3

US, Europe, and China dominate current production capacity, but announced capacity is more geographically diverse

SAF production capacity by geography and project status, million tons SAF

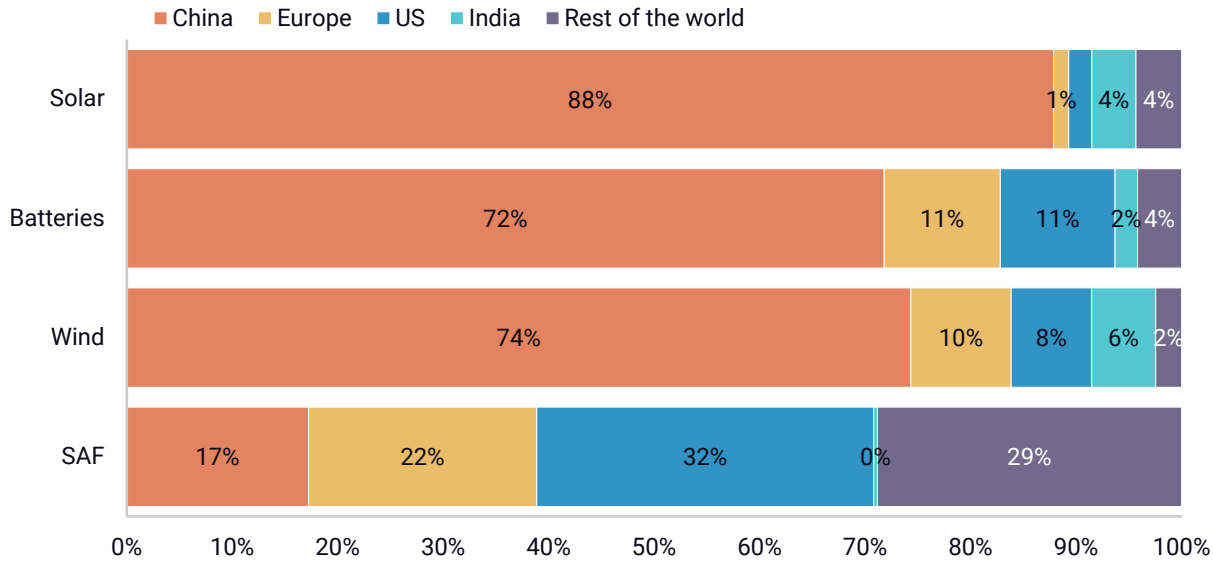


Source: Clean Investment Monitor, Rhodium Group, Bruegel. Note: Assumes 40% production of SAF from flexible HEFA facilities, where the split between SAF and renewable diesel or other clean fuels is not specified. Nameplate capacity, not adjusted for capacity factor or production ramps by year. Excludes speculative/intended facilities, feasibility studies, and facilities that are explicitly canceled.

Additional SAF production capacity totaling about 2.5 million tons is expected from projects that have commenced construction as of the second quarter of 2026. China has the largest share of projects under construction, with about 850,000 tons of capacity, followed by Brazil, with 370,000 tons. Europe has 250,000 tons currently under construction from projects in Germany, Portugal, Romania, and Spain. An additional 115,000 tons are expected from five projects currently under construction in the US.

Based on current plans, the outlook for global SAF production is significantly more geographically diversified than the manufacturing of solar panels, wind turbines, and batteries, where China's share is greater than 70% and as high as 90% (Figure 4). By contrast, China accounts for only 17% of SAF capacity when under construction and announced projects are accounted for. The US and Europe would be home to the largest share of SAF production capacity, at 32% and 22%, respectively.

FIGURE 4
SAF production is regionally diverse compared to other clean energy technologies
Regional distribution of global production capacity



Source: Clean Investment Monitor, Rhodium Group, Bruegel. Note: The figure includes capacities that are operational, under construction, and announced.

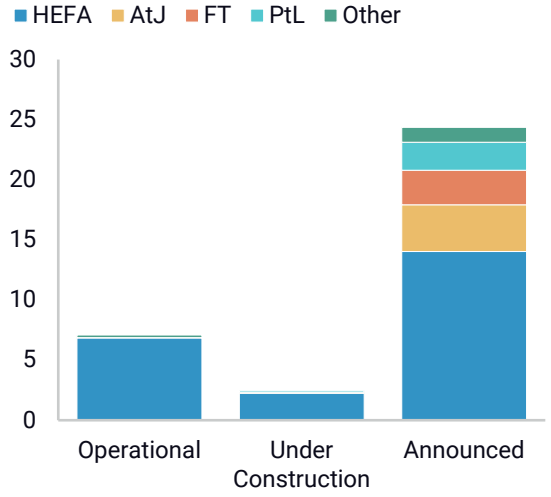
This geographic diversification in SAF production belies underlying dependencies, however. SAF production relies on feedstock supply where concentration risks might still develop. For example, in 2025, 85% of EU SAF feedstocks originated outside the EU, with China accounting for 61% of the total.

SAF feedstocks will need to outgrow used oils and fats

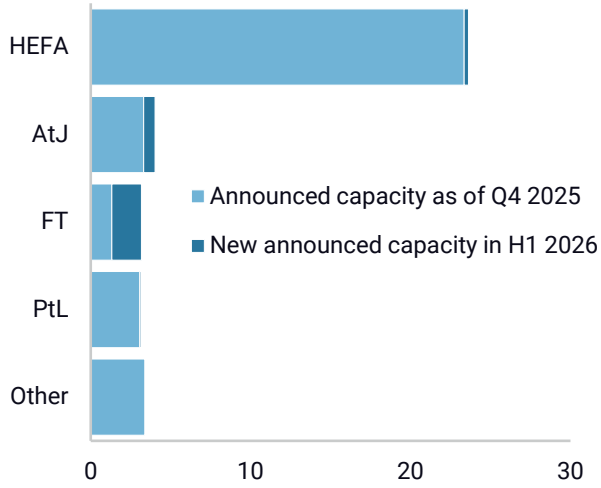
While SAF production is geographically diverse, it is technologically concentrated. Almost all (95%) of operational and under construction global SAF capacity uses the hydroprocessed esters and fatty acids (HEFA) route, which converts oils and fats, mainly used cooking oil and animal fats, into jet fuel (Figure 5).

FIGURE 5
SAF remains technologically concentrated

Global SAF production by pathway and status
Million tons



Announced SAF capacity before and after end-2025 by pathways
Million tons



Source: Clean Investment Monitor, Rhodium Group, Bruegel. Note: The figure includes capacities that are operational, under construction and announced.

HEFA production can grow further, but ultimately the supply of used oils and fats is limited. Projections suggest that meeting global SAF targets for 2030 would require at least twice as much used cooking oil as can be collected in the US, Europe, and China combined. In Europe, planned HEFA and co-processing SAF capacity of 3.9 million tons by 2035 is roughly twice what estimated regional feedstock could supply. Better collection can widen waste supply but will still reach limits.

For SAF to grow further, pathways that use other feedstocks will need to develop. Alcohol-to-jet (AtJ) converts alcohols such as ethanol into jet fuel. A first commercial-scale plant in the United States began production in 2025. Ethanol supply chains are already well established, as they have served biofuel production for road transport. A second fuel type, biomass Fischer-Tropsch (FT), can convert agricultural and forestry residues or parts of municipal waste into jet fuel.

Biomass-based SAF (including from waste) can reduce lifecycle greenhouse gas emissions because the carbon released during combustion was previously absorbed by plants. These lifecycle savings depend upon what would otherwise happen to the feedstock and land used to grow it. Certain animal fats and other biomass already serve other markets, meaning diverting them to produce SAF can increase demand for substitutes and cause indirect land-use change and greenhouse gas emissions.

Substantial potential nevertheless remains in “low risk” wastes and residues that can be collected sustainably, with limited competition from other uses. Taken together, all the biomass resources available for HEFA, alcohol-to-jet and biomass-FT increase feedstock availability substantially. For example, domestic “low risk” feedstocks in the EU could support SAF production to meet 26% of the region’s jet fuel demand by 2035.

These risks make robust sustainability rules and their enforcement essential as SAF production expands. ReFuelEU, for example, excludes food- and feed-crop fuels from its blending targets and requires eligible biofuels to meet sustainability and lifecycle emissions-saving criteria. Reliable checks on feedstock origin can prevent virgin vegetable oils from being passed off as used cooking oil.

Finally, power-to-liquid (PtL), or e-SAF, combines hydrogen with captured carbon dioxide. This avoids biomass constraints but remains very expensive (about eight times conventional jet fuel prices). Its production depends on hydrogen produced from clean electricity, which makes up two-thirds or more of its cost, and carbon dioxide from direct air capture or biogenic sources, which require large volumes of low-carbon electricity. Operating and under-construction capacity covers 0.02 million tons of the 0.6 million tons that EU and UK mandates require by 2030, and no large-scale EU plant has reached a final investment decision.

Across all pathways, plants also produce valuable co-products including diesel, naphtha and liquefied petroleum gases. Sales of these products improve the economics of SAF production.

Conclusion

Global investment in sustainable aviation fuels has grown rapidly, driven largely by government mandates to reduce emissions. The conflict in the Middle East has strengthened the case for SAF to reduce dependence on fossil jet fuel, although current supply at 1% of total aviation fuel is not substantial. Production capacity is more geographically diverse than for other clean technologies but remains concentrated in a single technology route, HEFA, which relies on used cooking oils and animal fats whose supply is limited. Future growth depends on bringing alternative production technologies to commercial scale and maintaining government support to bridge the cost gap to fossil jet fuel.

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