Sustainable Aviation Fuel (SAF)

Pathway to Commercial Liftoff

Sustainable Aviation Fuel (SAF) is a direct alternative to conventional jet fuel because it can be transported, stored, and combusted in a nearly identical manner. SAF is produced from a range of renewable and synthetic feedstocks through a variety of chemical pathways. When mixed with traditional jet fuel according to regulatory specifications, SAF blends serve as a lower-carbon drop-in jet fuel replacement.

Currently announced domestic projects represent over 3 billion gallons of annual SAF production capacity – correlating with $44 billion of announced investment – by 2030. Realized U.S. production volume will depend on factors including federal and state policy decisions, the development of existing and proposed foreign mandates, airline commitments, and demand for alternative low-carbon fuels (like renewable diesel) that use the same or similar feedstocks and infrastructure.

SAF produced via the Hydroprocessed Esters and Fatty Acids (HEFA) pathway is the only technology proven at commercial scale today and could represent up to 70% of total domestic SAF production by 2030. The HEFA pathway primarily uses fats, oils, and greases – many of which are readily available today – as its feedstock. As HEFA production scales, feedstock supply may become constrained without interventions such as the development of purpose-grown crops that do not also compromise food security. Newer technology pathways with fewer feedstock limitations – like alcohol-to-jet (AtJ) and Fischer-Tropsch with gasification (FT) technology using biomass and waste-based feedstocks, and power-to-liquid (PtL) technology using captured carbon dioxide – will need to mature.

The biggest challenge to achieving liftoff is SAF's cost – currently 2-10x higher – relative to fossil-based alternatives. Innovation has driven down cost already and deploying at scale can capture further cost reductions, making SAF more economical for commercial airlines than it is today. Many offtake agreements currently utilize SAF credits (SAFc) through a book-and-claim system that separates the environmental attribute of SAF (i.e., its carbon abatement potential) from the fuel itself. In other words, airlines can procure the fuel at or near price parity with fossil jet fuel, while third-party offtakers buy and retire the SAFc to offset their emissions elsewhere in the world. Today, most third-party offtakers purchase SAFc on the spot market in 1 or 2-year increments. Normalized 10-year+ offtake agreements are necessary to establish the demand certainty needed both to improve financing terms for developers and encourage greater investment across the SAF value chain, supporting supply.

Market Status

Metric	Value	2030 Target
Total Domestic SAF Nameplate Production Capacity Source: BNEF 2024, DOE 2024	64 million gallons/year[1]	3,000 million gallons/year[2]
Number of Domestic Commercial-Scale SAF Production Facilities[3] Source: BNEF 2024, DOE 2024	0[1]	8 - 12
Cost of SAF Relative to Fossil Jet Fuel Source: DOE 2024, NREL 2024, Stakeholder Interviews	2 - 10x[4]	< 2x

1. BloombergNEF Global Renewable Fuels Project Tracker v. 1.2.6 as of August 2024 and DOE input 2. U.S. SAF Grand Challenge Target. Analysis for pathway to commercial liftoff yields a target of 800-1,200 million gallons/year 3. Commercial defined as ≥ 100 million gallons of annual capacity 4. Depending on the technology and pathway. Compilation of estimates from Reuters, NREL, IATA and industry input

Possible Near-term Actions

1. Project developers could pursue co-processing operations at existing refineries, implement a hubs-based approach, and commit to early and regular engagement with communities to streamline project development
2. All stakeholders could collectively support an internationally approved book-and-claim system to encourage SAF offtake, as well as an industry-market maker to pool SAF demand
3. Producers, airlines, and third-party offtakers could explore different offtake structures to decrease SAF pricing risk
4. SAF incentives could expand private sector follow-on investment
5. Create conditions that encourage investments in innovative agricultural practices for oilseed and starch crops and expand SAF feedstock production by promoting the cultivation of intermediate oilseed crops and dedicated energy crops on marginal land
6. Increase investment in R&D for newer technologies (FT, PtL) that are less feedstock-constrained to diversify production and to meet future demand

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U.S. DEPARTMENT of ENERGY

For questions or more information, contact liftoff@hq.doe.gov