Sustainable Aviation Fuel: From Pilot Use to Commercial Scale-Up

How SAF is moving from niche deployment to broader airline adoption, with policy targets, blending limits, and early market growth shaping the next decade.

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SAF is no longer a concept fuel; it is already in commercial use, and the numbers show both its promise and its limits. The clearest signal is performance: SAF can cut CO2 life cycle emissions by 80% on average versus regular kerosene, while today's aircraft can use blends of up to 50% pure SAF. That makes it one of the few near-term options for aviation decarbonization that fits into existing aircraft and fuel systems. The market is still early, but policy and industry targets are now concrete. The U.S. Sustainable Aviation Fuel Grand Challenge, announced in 2021, calls for 3 billion gallons of domestic consumption by 2030 and 35 billion gallons by 2050, while aiming for at least a 50% reduction in lifecycle emissions. Real-world usage is also expanding: ICAO reports more than 360,000 commercial flights have used SAF at 46 airports, mostly in the United States and Europe. EPA data show consumption rising from about 5 million gallons in 2021 to 24.5 million gallons in 2023, which points to a market that is still small but clearly moving beyond demonstration scale.

- SAF can reduce CO2 life cycle emissions by 80% on average compared with regular kerosene, which is why airlines see it as the most practical near-term decarbonization option.
- Today's aircraft can use up to 50% SAF blended with regular jet fuel, showing that the fuel already works inside existing aviation systems.
- ICAO says more than 360,000 commercial flights have used SAF at 46 airports, with activity concentrated in the United States and Europe.
- EPA data show U.S. SAF consumption rising from about 5 million gallons in 2021 to 24.5 million gallons in 2023, a sign that the market is moving beyond pilot scale.

KEY INSIGHTS

SAF is described as a jet fuel made from either waste or residue from renewable sources, or by combining carbon dioxide in the atmosphere with renewable hydrogen. The transcript says today's aircraft can use up to 50% pure SAF blended with regular jet fuel, and SAF can reduce CO2 life cycle emissions by 80% on average compared to regular kerosene. Airbus says the aviation industry, alongside SAF producers, consumers, and regulators around the world, is working to boost production and supply. The video also says experts are working to improve SAF so aircraft can eventually fly with up to 100% pure sustainable aviation fuel.

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01 What SAF is and why aviation cares

Sustainable aviation fuel is a liquid jet fuel made from non-petroleum feedstocks, including waste, residues, and renewable hydrogen pathways. It matters because aviation has few near-term decarbonization options that can work with existing aircraft and airport infrastructure. The fuel can be blended with conventional Jet A, which lowers the barrier to adoption compared with technologies that require new aircraft fleets. That compatibility is why SAF has become the main practical decarbonization option for long-haul aviation in the near term.

02 Where the market stands today

The market is still early, but it is no longer theoretical. ICAO says more than 360,000 commercial flights have used SAF at 46 airports, concentrated in the United States and Europe. EPA data show U.S. SAF consumption rising from about 5 million gallons in 2021 to 15.84 million gallons in 2022 and 24.5 million gallons in 2023. That growth is meaningful, but it also shows how small the installed base remains relative to global jet fuel demand.

03 What the next phase is trying to prove

The next phase is about scale, cost, and supply reliability. The U.S. Sustainable Aviation Fuel Grand Challenge, announced in 2021, sets targets of 3 billion gallons in 2030 and 35 billion gallons in 2050, with at least a 50% reduction in lifecycle emissions. Airbus says the industry is working to boost production and supply, and experts are trying to remove the need to blend SAF with fossil fuels at all. The direction is clear: move from limited blends and early plants toward broader commercial availability and, eventually, higher blend limits.

CITATIONS

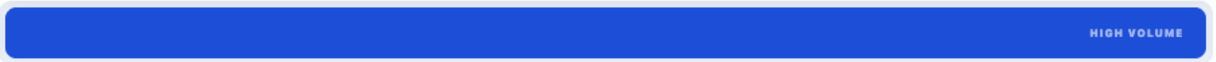
- Sustainable Aviation Fuel - Alternative Fuels Data Center
- Developing Sustainable Aviation Fuel (SAF)
- Sustainable Aviation Fuel | SAF | SkyNRG
- Sustainable aviation fuels: Key opportunities and challenges in lowering carbon emissions for aviation industry - ScienceDirect

KEY DATA BENCHMARKS

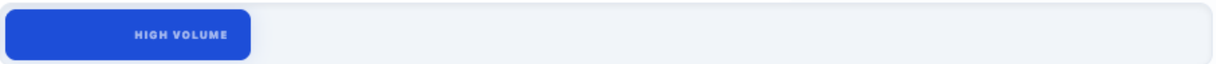
The metrics show a market that is still small in absolute volume but already active in commercial operations. Flight and airport counts point to real deployment, while the consumption figures show rapid growth from 2021 to 2023. The blend and emissions metrics explain why SAF is getting attention: it can work in current aircraft and deliver large carbon reductions.

COMPARATIVE GALLONS

U.S. SAF Consumption — **24.5 million**



U.S. SAF Consumption — **5.0 million**



FLIGHTS METRIC

360,000+

Commercial Flights Using SAF

AIRPORTS METRIC

46

Airports With SAF Use

TREND ANALYSIS

Sustainable Aviation Fuel Adoption Is Moving From Pilots to Scale

EXECUTIVE SUMMARY

The market is moving from proof-of-concept to industrial scale. Grand View Research estimates the global sustainable aviation fuel market at USD 1.04 billion in 2024, rising to USD 15.85 billion by 2030, while another market model projects USD 53.63 billion by 2032 from USD 1.43 billion in 2024. That gap reflects how fast the sector is being repriced as airlines, fuel producers, and governments push multiple technology routes at once rather than waiting for a single winner. FT-SPK still leads the technology mix with more than 44% revenue share in 2024, but the pipeline is broadening: HEFA remains the most commercial route, while ATJ-SPK, power-to-liquid, gas-to-liquid, and co-processing are moving through pilots and early deployments. The policy side is also getting more specific. In the U.S., the USDA-backed SAF Grand Challenge targets 3 billion gallons per year by 2030, which gives suppliers a clearer demand signal and helps justify new plant investment. Airbus' process map shows why feedstock choice matters: used cooking oil, agricultural residue, and captured CO2 all require different conversion steps, hydrogen inputs, and certification checks before blending into jet fuel. The next phase will be decided less by chemistry alone and more by feedstock access, hydrogen availability, and how quickly producers can move from demonstration batches to repeatable output.

STRATEGIC PERFORMANCE DASHBOARD

USD
$1.04B
Global SAF Market Size (2024)

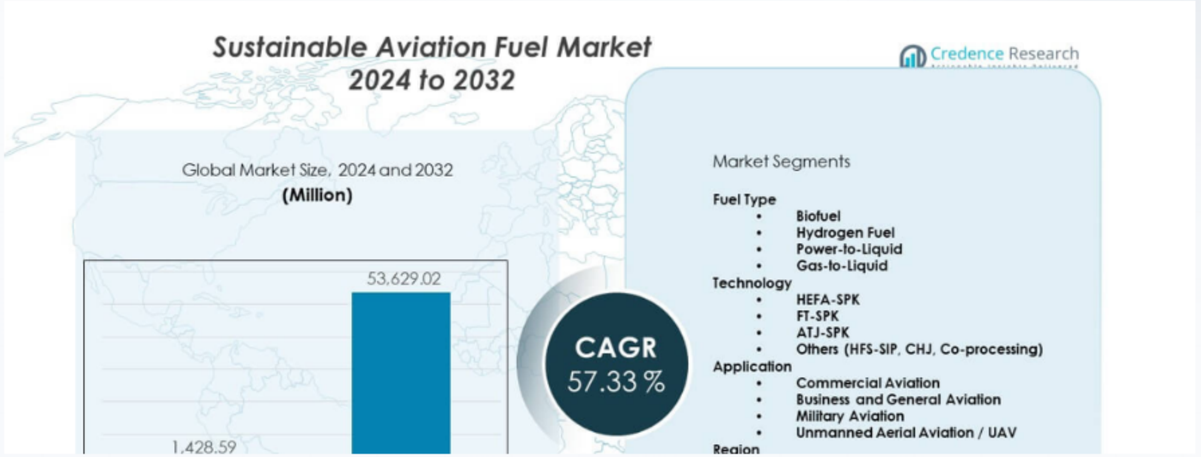
USD
$15.85B
Global SAF Market Forecast (2030)

%
57.5%
Global SAF CAGR (2025-2030)

%
46.44%
North America Revenue Share (2024)

%
44.0%
FT-SPK Technology Share (2024)

GALLONS
3B gallons
U.S. SAF Grand Challenge Target (2030)



The sustainable aviation fuel market is projected to expand from 1,428.59 million in 2024 to 53,629.02 million by 2032, implying an exceptional 57.33% CAGR and signaling a rapid commercialization phase rather than incremental growth. Strategic momentum is being driven by multiple fuel pathways—biofuel, hydrogen fuel, power-to-liquid, and gas-to-liquid—alongside technology platforms such as HEFA-SPK, FT-SPK, ATJ-SPK, and other co-processing routes. Demand is broad-based across commercial, business, military, and UAV aviation, with regional competition likely intensifying across North America, Asia Pacific, Europe, the Middle East and Africa, and South America.

KEY INSIGHTS

- FT-SPK led the technology segment with over 44.0% revenue share in 2024, while HEFA remains the most established route and newer pathways are still moving through pilot and early commercial stages.
- North America captured 46.44% of global SAF revenue in 2024, and the U.S. SAF Grand Challenge targets 3 billion gallons per year by 2030, giving suppliers a clear policy-backed demand signal.
- Airbus describes SAF production from used cooking oil, agricultural residue, and captured CO2, with renewable hydrogen and renewable electricity becoming central inputs for the newer power-to-liquid route.
- NLR's Aviation Energy Futures work on SAF pathways, production scale-up, and end-to-end fuel analysis shows that R&D is now focused on moving from bench-scale chemistry to repeatable industrial output.