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TECHNOLOGY WORKING GROUPS

Fueling the Future: How Sustainable Aviation Fuel Supports American Prosperity

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Sustainable aviation fuel (SAF) is a non-petroleum jet fuel certified for use in commercial and military aircraft. It can be produced as a synthetic fuel—using hydrogen and carbon dioxide—and as a biofuel from wastes or crops. The cost, emissions profile, and sustainability of any given SAF depends on the feedstocks and production method used. American development of SAF is highly diverse, with companies advancing a range of technologies and feedstocks. Because SAF is mixed with petroleum jet fuel, it can integrate into existing supply chains and help lower the overall carbon intensity of aviation fuel. In addition to reducing emissions from the aviation sector, SAF offers a range of economic and environmental co-benefits.

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HIGHLIGHTS

A major manufacturing and jobs opportunity: Scaling SAF production could create tens of thousands of new U.S. jobs, strengthen domestic manufacturing, and work in tandem with today's petroleum jet fuel industry.

Energy security starts at home: Domestically produced SAF is less vulnerable to global oil market volatility—benefiting commerical aviation and national defense.

Export markets are expanding: As international mandates require cleaner aviation fuel, early U.S. leadership could capture growing markets for both fuel exports and clean-energy intellectual property.

Public health benefits arrive quickly: Cleaner jet fuel can reduce particulate matter and sulfur dioxide near airports, pollutants associated with respiratory and cardiovascular diseases.

Innovation Unlocks Value: Continued federal investment in innovation is essential to unlocking the full potential of SAF and other emerging technologies. Sustained funding for research, development, and demonstration not only accelerates the creation of new SAF approaches with added value but also enhances existing approaches by making them more cost-effective, energy-efficient, and scalable.

Key SAF Feedstocks and Their Associated Co-Benefits

Hydrogen and waste carbon dioxide

A class of liquid fuels known as "power-to-liquid (PtL)" or "e-fuels" is produced using clean hydrogen and carbon dioxide. Domestic production of e-fuels for aviation ensures a reliable, resilient fuel supply that strengthens national security. This technology pathway converts waste gases—such as carbon dioxide emitted from ethanol plants—into ultra-low carbon jet fuel, creating market opportunities using abundant and untapped domestic sources.

Wastes, residues, and by-products

SAF can be derived from an array of secondary products, ranging from animal fats (tallow) and used cooking oil to agricultural and forest residues. The use of these feedstocks transforms secondary products into valuable low-carbon fuel and contributes to a circular economy by keeping materials in use and, in some cases, reducing waste and pollution. For example, forest residues such as logging slash that might otherwise be burned, can instead be used as a feedstock for SAF. The use of such feedstocks for SAF production also avoids diverting resources from existing markets, as these waste materials have few, if any, significant alternative commercial uses.

Purpose-grown crops

A wide range of purpose-grown crops—plants specifically cultivated for non-food applications—can serve as feedstocks for SAF. These crops also provide their own co-benefits. For instance, winter or secondary oilseed crops, like carinata and camelina, have high oil contents and can contribute to improved soil health and reduced fertilizer runoff, while also minimizing pressure for agricultural land expansion. Similar benefits may be realized by growing energy crops like miscanthus on marginal or degraded land. The maturity of traditional biofuel feedstocks like sugarcane and corn provides near-term supply potential, though this must be carefully managed to minimize diversion from existing use cases (e.g., feed markets).

International SAF Demand Takes Off

SAF demand will reach a turning point in 2025, driven by the implementation of blending mandates under the European Union's ReFuelEU Aviation regulation and the United Kingdom's SAF mandate—policies expected to generate over 1 million metric tons of SAF demand in the European Union and the United Kingdom this year alone. While 1 million metric tons of SAF demand remains modest compared to the region's conventional jet fuel demand, it is projected to quadruple to 4 million metric tons by 2030 and continue growing as blending requirements increase. Based on current announcements, SAF production capacity in the European Union and the United Kingdom is forecast to reach 3.8 million metric tons by 2030, falling just 0.2 million metric tons short of anticipated demand. However, only 30 percent of this capacity is currently operational or under construction, and the supply gap could widen if many announced projects fail to complete construction and commissioning in time. This shortfall could increase Europe's reliance on imports.

Sources: SkyNRG and ICF, *2025 SAF Market Outlook* (Amsterdam, The Netherlands: SkyNRG, 2025), https://skynrg.com/wp-content/uploads/2025/06/SAF-Market-Outlook-2025.pdf; see also Camille Mutrelle et al., *The e-SAF market: Europe's head start and the road ahead* (Brussels, Belgium: T&E, 2025), https://www.transportenvironment.org/articles/europe-risks-losing-its-early-e-fuels-lead-for-aviation-study-warns.

The Value of SAF

Export Potential

The global surge in SAF demand presents the United States with a strategic opportunity to become a key exporter. Foreign SAF mandate programs—like in the United Kingdom or European Union—will require e-fuels and advanced biofuels for compliance, which could be supplied by producers in the United States capable of meeting those programs' strict sustainability criteria.

In addition to policies in the E.U. and the UK, similar SAF mandates exist or are advancing in major economies such as China, India, Brazil, Japan, South Korea, Indonesia, and Canada's British Columbia. As global air traffic is projected to double over the next two decades, international demand for SAF is expected to accelerate sharply.[1] The United States is well positioned to capitalize on this growth by leveraging its strengths in agriculture, energy production, advanced technology, and robust trade infrastructure. Early-moving U.S. producers stand to benefit from strong export opportunities, supplying clean fuel to international markets through innovation at home. Beyond fuel exports, the United States also holds a competitive edge in SAF-related intellectual property and services. Between 2000 and 2023, U.S. researchers and inventors maintained a clear lead in SAF-related publications and patents, underscoring America's potential to lead both the physical and knowledge-based dimensions of the global SAF economy.[2]

Air Quality Improvements

One clear co-benefit of SAF is its ability to reduce particulate matter and sulfur dioxide from jet exhaust, pollutants associated with respiratory and cardiovascular diseases.[3] Its use is especially valuable in communities located near airports, where aircraft emissions are concentrated, and where residents often face disproportionate exposure to harmful pollutants. In addition to cutting air pollution during combustion, SAF can also improve air quality further upstream in its supply chain. For example, converting waste materials into SAF helps reduce the burden on traditional waste treatment methods such as incineration, thereby avoiding additional pollution.[4] By reducing emissions both at the source and throughout the supply chain, SAF serves as a critical tool for promoting cleaner air and protecting public health.

Strategic Hubs for America's SAF Future

The Great Lakes and Midwest are already national leaders in biofuel production, with a strong agricultural foundation. In addition to feedstock availability, the region is strategically positioned with access to major transportation corridors—including the St. Lawrence Seaway and the Mississippi River system—which connect biorefineries to Gulf Coast petroleum infrastructure, the Atlantic market, and, via the Panama Canal, key destinations across the Asia-Pacific. Regions of the United States with abundant supplies of clean energy also present valuable opportunities for powering e-fuel production processes.

Source: Lachlan Carey, Aaron Brickman, and Corey Stewart, *Sustainable Aviation Fuel Targeted Opportunity Region – Great Lakes Region* (Boulder, Colorado: Rocky Mountain Institute, 2023), https://rmi.org/sustainable-aviation-fuel-targeted-opportunity-region-great-lakes-region/.

Energy Security

SAF strengthens U.S. energy security by diversifying fuel supply chains and reducing dependence on imported petroleum. Because SAF can be produced domestically from a diverse range of existing feedstocks, it less vulnerable to global oil market volatility. These benefits extend to defense applications, where its potential for point-of-need production offers increased operational flexibility and reduced reliance on extended and vulnerable supply chains.[5]

Domestic Manufacturing and Jobs

SAF production presents a major opportunity to boost domestic manufacturing and job creation across the United States. As SAF production expands to achieve the U.S. targets of 3 billion gallons by 2030 and 35 billion gallons by 2050, the industry is poised to create tens of thousands of jobs.[6] These opportunities span the operation and construction of production facilities, select feedstock supply and collection, and development of supporting energy infrastructure. Notably, this projection excludes additional jobs likely to arise in SAF distribution, blending, and other indirect activities and economic impacts.[7] Importantly, SAF development complements—not replaces—conventional jet fuel infrastructure. Because SAF must be blended with petroleum-based fuel, its production can integrate into existing supply chains while lowering the overall carbon intensity of aviation fuel. With smart investment in technologies, logistics, and infrastructure, the United States can build a more sustainable aviation fuel system that drives domestic manufacturing and creates quality jobs.

> **"To fully realize the benefits of SAF and other emerging technologies, continued federal investment in innovation is essential**

Unlocking Added Value with Innovation

The United States has long stood at the forefront of innovation by pairing public investment in research with the ingenuity and scale of the private sector. This foundation now positions the country to lead in the development and deployment of emerging technologies—including SAF. However, to fully realize the benefits of SAF and other emerging technologies, continued federal investment in innovation is essential. Numerous SAF pathways exist—and many more remain to be discovered—each with the potential to add additional value. Unlocking these opportunities requires sustained funding for scientific research, which can advance new pathways and improve existing ones by making them more cost-effective, energy-efficient, and scalable.

Endnotes

1 "Future of Aviation," International Civil Aviation Organization, accessed July 14, 2025, https://www2023.icao.int/Meetings/FutureOfAviation/Pages/default.aspx.

2 "Emerging technology in detail: sustainable aviation fuel," World Intellectual Property Organization, accessed July 14, 2025, https://www.wipo.int/web-publications/wipo-technology-trends-technical-annex-the-future-of-transportation-in-the-air/en/emerging-technology-in-detail-sustainable-aviation-fuel.html.

3 Alexander Laska & John Hebert, *Clearing the Air: The Public Health Benefits of Meeting the SAF Grand Challenge* (Washington, D.C.: Third Way, 2025), https://www.thirdway.org/memo/clearing-the-air-the-public-health-benefits-of-meeting-the-saf-grand-challenge.

4 Brian Wang, Zhao Jia Ting, and Ming Zhao, "Sustainable aviation fuels: Key opportunities and challenges in lowering carbon emissions for aviation industry," *Carbon Capture Science and Technology* 13 (December 2024), https://doi.org/10.1016/j.ccst.2024.100263.

5 Several types of SAF have been tested and approved under the U.S. military's jet fuel specifications (MIL-DTL-83133) for use by all Departments and Agencies of the Department of Defense.

6 Campbell Howe et al., *Pathways to Commercial Liftoff: Sustainable Aviation Fuel* (Washington, DC: U.S. Department of Energy, 2024), https://yardsale.energy/wp-content/uploads/2025/05/DOE-Liftoff-SAF-2024.pdf.

7 Ibid.