

# Lower emissions at high altitude

Sustainable aviation fuel



This document includes forward looking statements. Actual future conditions and results (including but not limited to energy demand, energy supply, the relative mix of energy across sources, sectors of the economy and geographic regions) could differ materially from the statements provided herein. In addition, the full 2024 Advancing Climate Solutions Report can be found here, including important cautionary statements. Exxon Mobil Corporation has numerous affiliates, many with names that include ExxonMobil, Exxon, Mobil, Esso, and XTO. For convenience and simplicity, those terms and terms such as Corporation, company, our, we, and its are sometimes used as abbreviated references to specific affiliates or affiliate groups. Abbreviated references describing global or regional operational organizations, and global or regional business lines are also sometimes used for convenience and simplicity. Nothing contained herein is intended to override the corporate separateness of affiliated companies. Similarly, ExxonMobil has business relationships with thousands of customers, suppliers, governments, and others. For convenience and simplicity, words like venture, joint venture, partnership, co-venturer, and partner are used to indicate business relationships involving common activities and interests, and those words may not indicate precise legal relationships.

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**“We’ll continue to innovate and provide solutions that meet the growing needs of society, including its net-zero emissions ambitions, by fully leveraging our competitive advantages of scale, integration, technology, functional excellence, and our highly skilled people.”**

**Darren W. Woods**  
ExxonMobil Chairman & CEO

# The energy transition

ExxonMobil's work to drive emission reductions in support of a net-zero future.

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ExxonMobil has been a leader in innovation for more than 130 years, supplying products people need to live healthy, prosperous lives in an ever-changing world. Today, we are working to help society reduce overall greenhouse gas emissions by decreasing our own emissions and by developing and deploying GHG emission-reducing technologies and products.

The aviation industry has set out to meet this important challenge by setting a goal of net-zero carbon emissions from their operations by 2050 for International Air Transportation Association (IATA) member airlines.<sup>1</sup> As a century-long partner, we support this goal to align the aviation industry with the objectives of the Paris Agreement and plan to be part of the solution.

From 2022 through 2027, we are pursuing more than \$20 billion in lower-emission investments. About 50% of our lower-emission investments are targeted at reducing emissions from operated assets, with the balance going toward reducing the emissions of other companies.<sup>2</sup>

Biofuels and biofuel blends, like Sustainable Aviation Fuel (SAF), will play an important role in helping achieve the transition to a net-zero future. We are working on plans to produce and will continue to supply SAF to help meet the industry's demand. Below we outline our position on the aviation industry's path to lower GHG emissions.

# The aviation industry

## A path to lower GHG emissions

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Airline travel remains an essential means of connectivity and commerce, enabling some \$3.5 trillion in global GDP.<sup>3</sup> Demand for passenger flights has almost returned to pre-pandemic levels in many geographies<sup>4</sup>. In fact, demand will only continue to grow. It is projected that demand for passenger flights in 2050 could exceed 10 billion passengers<sup>5</sup> compared to 4.5 billion in 2019. Energy providers are expected to increase their collective output to meet these needs while

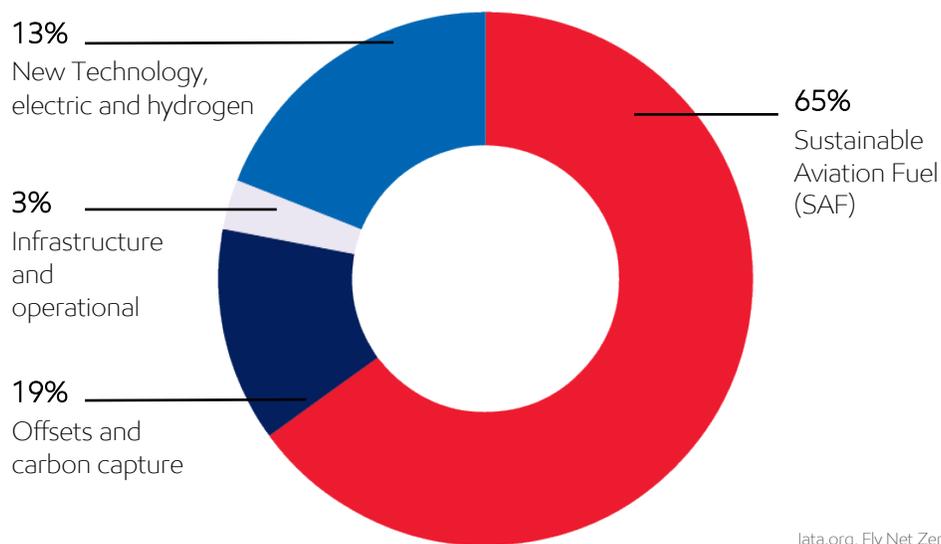
simultaneously providing energy solutions that will help our customers navigate the energy transition. In parallel, the aviation industry is actively working to mitigate the environmental impact of increased travel.

In October 2021, IATA set a goal of reaching net-zero carbon emissions by 2050 for its airline members. Progress toward this goal can be enabled by adopting lower-GHG emission fuels and collaboration by all aviation industry stakeholders.

# Alternative energy solutions

Successfully achieving IATA's net-zero emissions by 2050 will require a multi-faceted approach, including advancements in aircraft-related technology, changes to infrastructure and operations, and increased availability of SAF. SAF represents the most significant opportunity to impact the reduction of GHG emissions in the near term and will play a vital role as the industry transitions to less carbon intense solutions.

Zero-emission pathways including hydrogen and electric aircraft currently require advancements in technology and are maybe decades away from becoming commercially feasible. It is estimated that SAF could contribute up to 65% of the reduction in emissions needed by the aviation industry to reach net-zero by 2050.



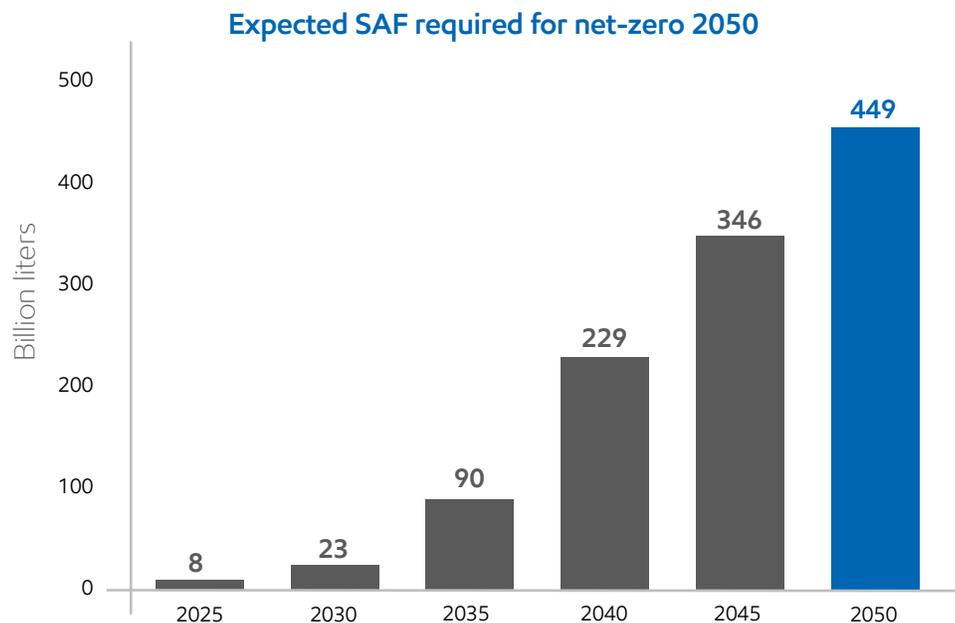
[iata.org](https://www.iata.org), Fly Net Zero

# Supply & demand

## Sustainable aviation fuel

Today, SAF production is approximately 25 million gallons<sup>4</sup> (0.1 billion liters) per year but will need to reach billions of gallons per year in the coming decades. A dramatic increase in SAF supply will be required to achieve the industry's decarbonization goal. However, one of the most important challenges to overcome is the price which is currently higher than traditional jet fuel. This has created a supply and demand dilemma.

The cost will only come down when producers scale up production through economies of scale, but premium prices have kept industry demand low. Sound government policies and positive investment incentives are needed to reach a price point that will make large-scale adoption possible. That's why we are doing our part to advocate for policies that promote cost-effective, market-based solutions.



lata.org, net-zero 2050

# Sustainable aviation fuel

## What is SAF?

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SAF is a lower carbon intensity alternative to traditional jet fuel made from a blend of renewable sources and fossil jet fuel. The renewable component of SAF can reduce GHG emissions by up to 80% on a life-cycle emissions basis.<sup>6</sup> It can be produced from several sources, including bio-derived feedstocks such as fats, oils, greases, sugar, or materials such as municipal solid waste, and recycled

industrial gases, that reduce the need for fuel produced from conventional sources. The renewable component of SAF recycles the CO<sub>2</sub> absorbed by the biomass feedstock during the course of its life. Importantly, it is an engine-ready fuel that works with existing fueling systems and aircraft design and meets the ASTM International standard of performance for jet fuel.



# ExxonMobil aviation

## A partner in energy transition

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At ExxonMobil, we are celebrating 120 years of supplying quality fuel for the aviation industry. We have been a trusted partner and part of many milestones throughout this time, from the Wright Brothers' flight in 1903 through powering space flight. Today, we supply major airport hubs across 13 countries and manufacture aviation fuel in more than 10 refineries around the world. We are committed to providing high quality and reliable fuel and lubricant products to our customers.

To that end, we are working to develop the next generation of energy solutions, including the production and distribution of SAF, made from a blend of renewable sources and fossil jet fuel. SAF can reduce CO<sub>2</sub> emissions by up to 80% compared to traditional jet fuel, according to IATA<sup>4</sup>. We will leverage our leadership in manufacturing, expertise in R&D, and reliable supply chain to develop and deliver product solutions needed to help the aviation industry meet its net-zero ambitions.

Where are we now? ExxonMobil is actively developing plans to supply SAF as part of our 200,000 barrels per day of lower-emissions fuels by 2030 goal. We are already distributing SAF to customers in France, Singapore, and the UK. And we are working with partners to add sources of SAF to meet industry demand.



# Regulatory policy

## Advancing the energy transition

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ExxonMobil advocates for sound government policy to develop and deploy SAF to meet the sector's decarbonization goal. To enable this, policy should include the following attributes:

- Reflect the global nature of the aviation industry and align across countries or regions.
- Encourage commitment from all sector participants, including fuel producers, aircraft manufacturers, airlines, airports, and consumers.
- Have a clear basis grounded in science and employing lifecycle-based approach.
- Encourage multiple solutions to maintain consumer choice and encourage innovation.
- Include flexibilities such as credit trading.
- Provide clarity and certainty to encourage investment.

ExxonMobil is active in industry committees, standards committees, and trade associations and encourages policies and standards to support the production of transport fuels with lower life-cycle greenhouse emissions.



# What's on the horizon?

## Co-processing

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At ExxonMobil we are working to advance lower-GHG emission energy solutions on several fronts. While we move forward with plans to produce SAF through currently approved ASTM pathways, we are also championing the development of new routes for the manufacture of SAF.

Co-processing is the simultaneous processing of renewable feedstocks like vegetable oils or animal fats, with petroleum feedstocks such as crude oil in a refinery to produce fuels that, when used, result in lower lifecycle CO<sub>2</sub> emissions compared to petroleum-based fuels, which can help accelerate the airline industry's energy transition when considering the scale of existing refinery production.

### **Leveraging existing facilities = Increase SAF supply today**

Co-processing is a smart solution that could bring lower GHG emission aviation fuels to the industry more rapidly. For example, a manufacturing facility producing 230k tonnes per year (~5 thousand barrels per day

(KBD)) of SAF could take years to construct and could cost hundreds of millions of dollars. Similarly, co-processing 10% renewable feedstock in an existing 50 KBD refinery unit could be implemented more quickly and efficiently, yielding a similar volume of renewable product in the finished jet fuel. And as feedstock and associated technology solutions become more widely available, the ability to gradually increase the percentage of renewable feedstock becomes a viable option in a large refinery versus having to construct new production units. In addition to the scale and economic benefits, using existing facilities further mitigates the environmental impact and associated GHG emissions related to the construction of new standalone manufacturing facilities. Making co-processing a viable solution requires government policy that supports this technology, encourages investment, and fosters competition. ExxonMobil is a strong advocate for sound market-based government policy that is technology-neutral and encourages investment and adoption of lower GHG-emission fuels at scale.

# Technology spotlight

## Methanol to jet

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ExxonMobil is working to engineer a new, proprietary process technology for the production of synthetic fuels from alternative, more abundant feedstocks including municipal solid waste, forestry and agricultural residues, biogenic CO<sub>2</sub>, and even atmospheric CO<sub>2</sub>. After first converting these feedstocks into methanol using commercially available technology, the new ExxonMobil Methanol to Jet (MTJ) process converts this methanol with high selectivity into a synthetic jet fuel blending component.

To date, we have produced test batches of this new synthetic jet fuel component at our Machelen research facility in Belgium and have submitted these samples for evaluation according to ASTM criteria.

What does this ultimately mean for the aviation industry? Qualifying MTJ as a new synthetic jet fuel manufacturing pathway could help grow the much-needed supply of SAF. It opens the door to alternative

fuel feedstocks that are difficult to access with today's technology. As such, it presents an alternative to the existing Fischer-Tropsch process, providing more options to a growing industry. Finally, pursuit of synthetic fuels from alternative feedstocks can help the aviation industry transition to fuels having lower carbon intensity and strive toward its net-zero ambitions.



# Industry collaboration

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ExxonMobil is an active participant in the World Economic Forum's Airports of Tomorrow initiative and was a signatory to the World Economic Forum's Clean Skies for Tomorrow ambition statement, which seeks net-zero emission by 2050 for the global aviation sector.

The producers, airlines, and airports that have signed the ambition statement support the near-term goal for sustainable aviation fuel (SAF) technologies to reach 10% of global jet aviation fuel supply by 2030.

Founded in 2023, Airports of Tomorrow consolidates the aviation decarbonization work previously done by the Forum through its Clean Skies for Tomorrow and Target True Zero initiatives under one umbrella.<sup>7</sup>

Airports of Tomorrow takes a holistic view of the requirements for aviation's energy transition, including hydrogen and battery electric propulsion, the electrification of airport services, the scale-up of biofuel and synthetic SAFs, and new innovations in urban and advanced air mobility. All these developments will require technical expertise and roadmaps on new infrastructure, analysis on feedstock sustainability and viability for SAF, and conversations on mobilizing finance.<sup>7</sup>

Through Airports for Tomorrow, we look forward to working alongside the broad coalition of stakeholders helping to put the global aviation sector on a path toward net-zero emissions by 2050.

**“Reaching the aviation industry’s goal of net-zero carbon emissions by 2050 while expanding the economic and social benefits of air travel will require innovative solutions and supportive technology-neutral policies that include incentives for producing SAF. At ExxonMobil, we are working on solutions to help make this a reality.”**

Steven Plas

Lower-emissions Fuels Director Product Solutions, ExxonMobil

Learn more about our commitment to climate solutions in the ExxonMobil Advancing Climate Solution Progress Report and Aviation Fuels site on [www.exxonmobil.com](http://www.exxonmobil.com).