

# Lower emissions at high altitude

Sustainable aviation fuel



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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**

Chairman & Chief Executive Officer, ExxonMobil

# The energy transition

ExxonMobil's commitment to driving 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 that people need to live healthy, prosperous lives in an ever-changing world. Today, we are committed to helping society reduce overall greenhouse gas emissions by decreasing our own emissions and by developing and deploying 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.

Over the next six years, we plan to invest more than \$15 billion on initiatives to reduce greenhouse gas emissions, with a significant share focused on scaling up carbon capture and storage, hydrogen, and biofuels. To this end, we plan to provide more than 40,000 barrels per day of lower-emissions fuels by 2025 and we have a further goal of 200,000 barrels per day by 2030<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 will do our part in the production and supply of SAF to meet the industry's demand. Below we outline our position on the aviation industry's path to decarbonization.

# The aviation industry

## A path to decarbonization

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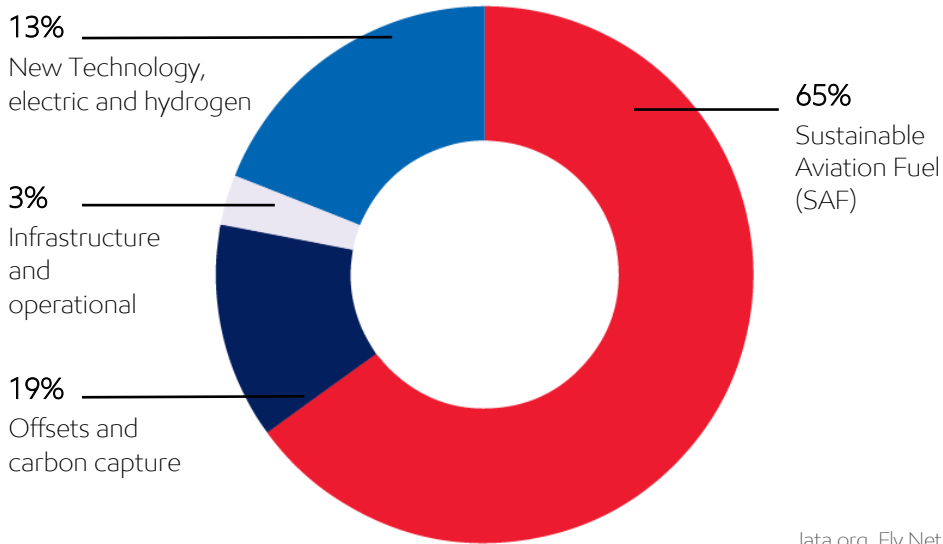
Travel remains an integral part of our society, despite the recent challenges the industry has faced from the global Covid-19 pandemic. It is an essential means of connectivity and commerce, enabling some \$3.5 trillion in global GDP. Demand for passenger flights will only continue to grow. It is projected that demand for passenger flights in 2050 could exceed 10 billion<sup>3</sup> compared to 4.5 billion in 2019. This will produce

double the levels of greenhouse gas emissions if current fuel usage remains unchanged. The aviation industry is actively working on a path to decarbonization that will address this adverse effect. In October 2021, IATA set a goal of reaching net-zero carbon emissions by 2050 for its airline members. Progress towards this goal can be enabled by adopting lower-emission fuels and collaboration by all industry stakeholders.

# Alternative energy solutions

Successfully achieving the IATA's net-zero carbon emissions goal 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 reduce greenhouse gas 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 may be decades away from commercial feasibility. 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.



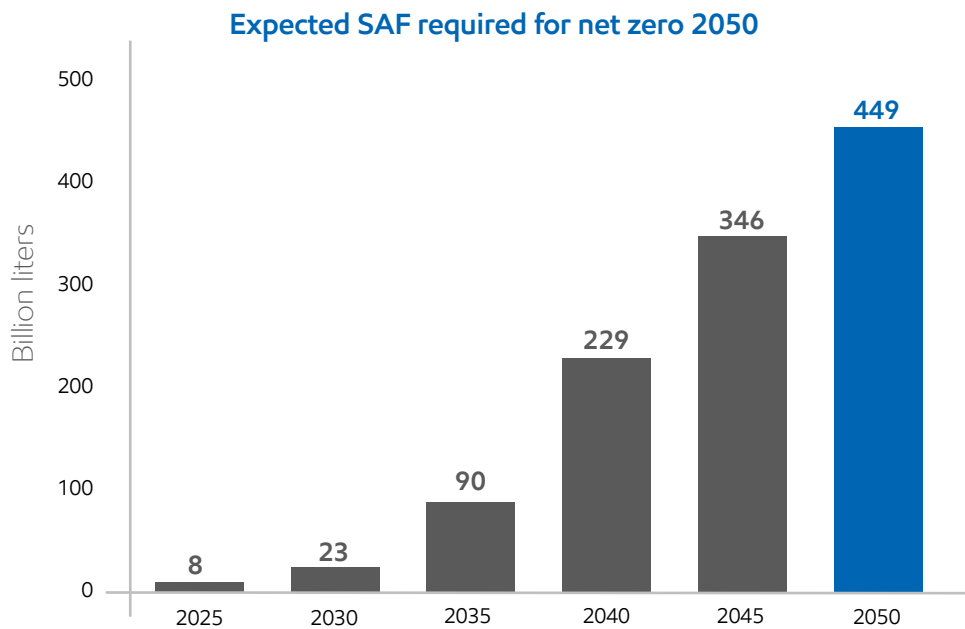
Iata.org, Fly Net Zero

# 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 is expected to 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.



Iata.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 greenhouse gas emissions by up to 80% on a life-cycle emissions basis<sup>4</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 the energy transition

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ExxonMobil has been a trusted partner to the aviation industry for over 100 years. We have been part of many milestones throughout this time, from the Wright Brothers' flight through powering space flight. Today, we supply around 30 airports across 13 countries and manufacture aviation fuel in more than 10 refineries around the world. We are committed to providing our customers high quality and reliable fuel and lubricant products.

To that end, we are working to develop the next generation of energy solutions, including the production and distribution of SAF. 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 produce 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:

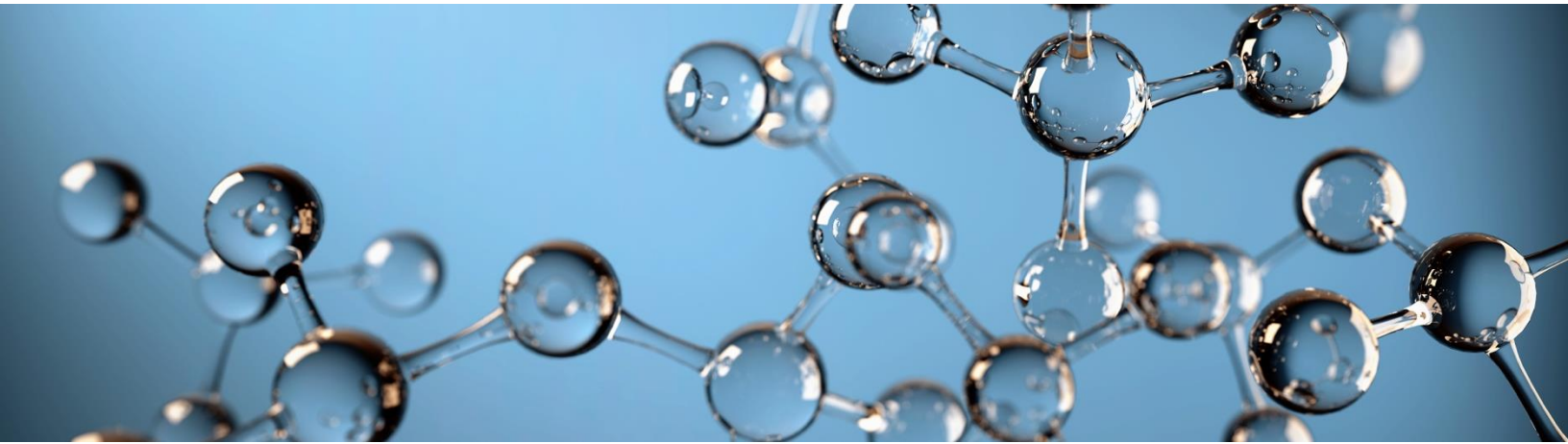
- Reflect the global nature of the aviation industry and align across countries or regions.
- Encourage commitment from all sector participants, including fuel producers, aircraft manufacturers, airlines, airports and consumers.
- Have a clear basis grounded in science and employing lifecycle-based approach.
- 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.



# eFuels

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eFuels are sustainable engine-ready fuels produced from hydrogen and captured carbon dioxide. They are a potentially attractive long-term solution to reduce the aviation industry's greenhouse gas emissions and will be an important addition to the mix of pathways required to meet this goal. While early pilots of eFuels technology have been directed to ground transportation, these fuels are considered particularly suited for hard to decarbonize sectors.

ExxonMobil is in the early stages of testing the viability of eFuels through a collaboration with Porsche. The eFuel for this project was produced using proprietary technology that converts methanol

to gasoline, which results in lower-carbon fuel. When blended to current market fuel standards for today's passenger vehicles, eFuels could reduce up to 85% of greenhouse gas emissions<sup>5</sup>.

Our collaboration with industry partners affirms our commitment to develop and deploy lower-emission energy solutions, including high-efficiency fuels and lubricants that can be leveraged across transportation sectors. While the value of this technology is important, industry adoption of eFuels will require government policies to encourage investment and adoption at scale.

# What's on the horizon?

## Camelina

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This year, ExxonMobil agreed to invest \$125 million into Global Clean Energy (GCE), a California renewable fuels company specializing in nonfood-based feedstocks used to produce advanced biofuels and biomaterials. This investment allows us to secure access to highly advantaged camelina feedstock to produce renewable diesel and investigate camelina for future use in other products solutions like SAF.

Based on California Air Resources Board data analysis, renewable diesel from various non-petroleum feedstocks can reduce life-cycle greenhouse gas emissions by approximately 40% to 80% compared to petroleum-based diesel used in engines on the road today<sup>6</sup>.

The Bakersfield, California refinery will produce more than

4 million barrels a year of engine-ready renewable diesel. This diesel can be substituted for traditional fuels without additional infrastructure or engine modifications. Production is expected to begin in 2022, initially utilizing soybean oil as a feedstock, then gradually switching to camelina oil, improving renewable diesel carbon intensity by 50%<sup>7</sup>. Camelina is a fast-growing, nonfood oilseed cover crop with high oil content.

Advancements in the commercialization of biofuels like camelina are an integral part of our plans to develop a robust portfolio of energy solutions that will help our customers across all sectors transition to a lower-emissions future.

**“ExxonMobil is doing exciting work in lower-emissions fuels to create products that will directly advance our customer’s transition to a net-zero future.”**

**Russ Green** Low Emissions Fuels Venture Executive, ExxonMobil

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