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## Showing up, sustainably

Boeing’s newest and largest members of its 737 MAX and 777X airplane families flew to the 2022 Farnborough International Airshow on sustainable aviation fuel blended with conventional jet fuel at a 30/70 ratio, using the same SAF blend for their daily flying displays. The 737 MAX family leverages advanced aerodynamic design and highly efficient engines to reduce fuel use and emissions 20%, and the noise footprint is 50% less than the airplanes they replaced. The 777-9 will deliver 10% better fuel use, emissions and operating costs.

Videos:

- 777-9: [Watch it fly.](#)
- 737-10: [See efficient flight.](#)



Arriving at EAA AirVenture in Oshkosh, Wisconsin, on a 30/70 blend of SAF, the 2022 Boeing ecoDemonstrator provided tours to more than 5,000 show visitors and served as a beautiful backdrop for attendees celebrating WomenVenture day. Boeing sponsored EAA WomenVenture as it celebrated its 15th year of programming designed to encourage and support women in aviation. (Boeing photo)

Video: [Watch AirVenture in Oshkosh.](#)

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# Operational Efficiency

Safe, sustainable skies are the priority. Boeing continues to invest to ensure our aircraft have the latest equipment and services to support advanced procedures, and we also work with airlines, government customers, air navigation service providers and airports on efficiency improvements. These include procedures such as continuous descent approaches and equipment upgrades such as GPS-based navigation for more direct routings. We develop services to leverage data for fuel and flight efficiency, help customers optimize flight planning and provide pilots with real-time weather and traffic information.

“Boeing has multiple digital solutions available today and even more that are in development to help customers improve their fuel and flight efficiency while reducing carbon emissions.”

Stephanie Pope, president and CEO of Boeing Global Services

## Managing air traffic efficiently

Boeing works with governments, airports, airlines and air navigation service providers around the world on exploring new approaches to air traffic management (ATM).

**Why it matters:** Optimized ATM is a critical component needed to reach the commercial aviation industry’s net-zero ambition — collaboration on how to manage airspace more efficiently can reduce emissions by about 10%, according to EUROCONTROL.

**Around the globe:** ATM solutions designed to address specific, local and regional needs help airports and airlines operate more safely, quietly and sustainably:

- **China:** Boeing is supporting China’s Air Traffic Management Bureau in exploring a new approach to ATM called “EoR” — Established on Required Navigation Performance (RNP). It’s a separation standard for landing aircraft established by the ICAO, which enables safe separation on parallel runways through simultaneous RNP-equipped arrivals, while reducing fuel burn, greenhouse gas emissions and noise.
- **Europe:** Boeing is participating in seven new Single European ATM Research (SESAR) 3 Joint Undertaking research projects, renewing a 20-year-plus commitment to aircraft operational efficiency and air traffic management in Europe and paving the way to a future sustainable sky. The seven projects address critical areas for change, including emissions reduction, automation enabled by artificial intelligence, resilient ATM service provision, as well as the swift uptake of solutions for the integration of drones (U-space), urban air mobility, multimodality and reduced emissions operations. The partnership is a European undertaking between private and public sector partners to accelerate the delivery of the Digital European Sky through



Executive operations support assistant in EUROCONTROL’s Maastricht Upper Area Control Centre, which enables air traffic controllers to provide safe and efficient air traffic services. (EUROCONTROL photo)

research and innovation. To do so, it is harnessing, developing and accelerating the implementation of the most cutting-edge technological solutions to manage conventional aircraft, drones, air taxis and vehicles flying at higher altitudes.

- **India:** Boeing completed the development of a 10-year road map for Communication, Navigation and Surveillance/Air Traffic Management (CNS/ATM) for Airports Authority of India (AAI). Backed by the U.S. Trade and Development Agency, Boeing and AAI conducted an analysis across operational, environmental, regulatory, technological, safety and financial factors. The resulting road map focuses on improving airspace utilization and maintaining safe and efficient aircraft operations — helping to modernize the Indian National Airspace System with domestic traffic expected to double by the end of this decade.

**The bottom line:** Boeing will continue developing local and global partnerships within the aviation ecosystem, enabling exchange of expertise and technology to help build a safer and more sustainable future of flight.



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# Celebrating a decade of paperless flight decks

**The big picture:** In the summer of 2012, Boeing’s Jeppesen FliteDeck Pro launched — the very first electronic flight bag (EFB) application to test what, at the time, felt revolutionary: pilots flying with digital charts and maps, free of paper binders. A decade later, the digital solutions revolution in aerospace continues to enable airlines to make impressive strides in operational efficiency and their sustainability targets.



Kubota Garden. Seattle (Boeing photo)



# Renewable Energy

Renewable energy can help reduce carbon emissions inside our operations and from our products and services. For our products, renewable energy can help reduce the carbon intensity of an energy powering our products, such as Sustainable Aviation Fuel (SAF), green hydrogen and batteries. Boeing believes SAF is a necessary lever to decarbonize aviation. However, it will take a “SAF and” approach and not a “SAF or” approach to support the commercial aviation industry’s ambition for net zero by 2050. As part of the “SAF and” approach, Boeing continues to advance the viability of other renewable energy carriers and their safe use on aircraft.

For additional information on SAF, please reference the [SAF Fact Sheet](#).

## Creating a decarbonized solution in the UAE

When Boeing was invited to analyze a study that looked at developing SAF in the United Arab Emirates (UAE), the decision to participate was easy and will support the growth of SAF production in the region.

The “**Power-to-Liquids Roadmap**” report examines the financial, economic and environmental benefits of decarbonizing the country’s aviation industry with an emerging SAF technology.

**Boeing’s role:** The report was developed by the UAE Ministry of Energy and Infrastructure in collaboration with the World Economic Forum’s Clean Skies for Tomorrow Initiative. Boeing participated by offering expertise at the launch event, analyzing the findings and being an active member of the UAE’s SAF task force, which is led by the Ministry of Energy and Infrastructure and provides strategic guidance on a range of fuel options, including Power-to-Liquids (PtL), a type of SAF.

**What is PtL?** SAF requires careful attention to detail. There are several pathways to creating PtL (Power-to-Liquid) including the process where renewable electricity, CO<sub>2</sub> and water are synthesized into a liquid hydrocarbon, including jet fuel.



The Emirates flight test utilized 18 tons of SAF in one engine of a 777-300ER blended from two producers, Neste and Virent. The flight flew over the Dubai coastline for just over an hour. (Emirates photo)

### Here’s how it’s made:

- Electricity is applied to the water (H<sub>2</sub>O). The hydrogen is collected and the oxygen is set aside.
- The hydrogen is mixed with the carbon dioxide in a reactor until it matures.
- The liquid is removed from the reactor, which results in PtL jet fuel.

**Resources needed:** This PtL relies on two things in the UAE: tapping into the UAE’s abundant sources of renewable energy (intense sunshine and sustained winds), as well as its ability to capture carbon dioxide from the air or from point sources such as industrial waste gases.

PtL is considered a significant technology for the UAE to decarbonize aviation. Other

countries are also studying PtL to mature the technology and assess how this pathway may help them decarbonize.

**The upshot:** The UAE report shows that it would be ambitious but feasible for the country to produce as much as 11 million tons of PtL SAF by 2050 — equivalent to approximately 70% of national jet fuel consumption.

**It’s all about partnerships:** “We collaborate with policymakers across six continents to support the SAF value chain, including its supply, use, certification and life cycle,” said Mohammed Al Ghailani, Boeing’s sustainability lead for the Middle East and Africa. “We were thrilled to support the UAE’s ongoing research into developing a renewable fuel that would be suitable to the region.”

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## Feedstocks and forces – Boeing’s work to scale up SAF around the world

**Why it matters:** Today, SAF is made from waste-based agricultural products and used cooking oil and reduces emissions by up to 80% compared to conventional jet fuel. Most is currently blended with fossil fuel. Boeing is working to make SAF more accessible to help deliver on its commitment that commercial airplanes will be compatible to fly on 100% SAF by 2030. SAF development and production deliver economic growth, provide energy security for countries and create jobs across multiple industries.

**SAF sources and building scale:** Boeing is researching, developing and advocating for SAF across the globe, working with the most sustainable feedstocks that are available.

- **Australia and New Zealand:** Boeing is working on a SAF road map, in partnership with the Commonwealth Scientific and Industrial Research Organisation (CSIRO), to help analyze the availability of sustainable feedstocks in the Asia-Pacific region, primarily focusing on Australia and New Zealand.
- **Brazil** is the second-largest biofuel producer globally. Boeing’s focus includes feedstocks that can be sourced sustainably, such as sugar cane, eucalyptus and other residual biomass options.
- **China** is planning to scale up SAF adoption and Boeing has partnered with Peking University to develop fundamental research meant to guide the industry in identifying promising SAF feedstocks and pathways.
- **Ethiopia:** Boeing supports a SAF e-learning and academic program in partnership with Roundtable for Sustainable Biomaterials (RSB). Boeing conducted a feasibility study on Carinata (Ethiopian mustard) as a feedstock for SAF production.

- **Europe:** Boeing’s technology office in Madrid participates in research and development activities with the Horizon Europe program to develop new pathways and to join consortia focused on energy transition for both small and large airports.
- **India:** In collaboration with World Economic Forum’s Clean Skies for Tomorrow initiative, India produced a road map detailing how to scale production and use of SAF, including feedstock analysis, production capacity and technological maturity.
- **Japan:** In August 2022, Boeing announced its new center focusing on sustainability and supporting a newly expanded cooperation agreement with Japan’s Ministry of Economy, Trade and Industry. Read more on our partnerships in Japan on [Page 45](#).
- **Middle East:** Boeing also participated in the Sustainable Bioenergy Research Consortium’s (SBRC) Seawater Energy and Agriculture System (SEAS), which is an integrated system of aquaculture, halo-agriculture and mangrove silviculture to produce SAF and seafood. The first airplane flight fueled with jet fuel produced through SBRC’s SEAS happened in January 2019.
- **Mexico:** Boeing is the only multinational company working with the Biojet Consortium, established in 2016 and is comprised of 14 research centers and companies that are exploring alternative aviation fuel supply chain in Mexico.
- **South Africa:** Since 2014, Boeing has been working with RSB and World Wildlife Fund-South Africa to help small-hold farmers to grow crops that produce SAF. Boeing is partnering with Stellenbosch University to deliver SAF e-learning.

- **UK:** Boeing is focused on supporting the creation of a policy, capital and innovation ecosystem in the UK to enable the Government’s Jet Zero Strategy commitment of having five plants in construction by 2025. Boeing was proud to be the founding partner of the Energy Innovation Centre at the University of Sheffield, which has since been selected as the home of the UK SAF clearing house.
- **U.S.:** Boeing focuses on SAF procurement, research and development, and promoting SAF commercial scale-up in the U.S. and around the globe. Boeing also recently announced the purchase of 5.6 million gallons of SAF for its commercial operations in 2023.



Dr. Alejandro Rios Galvan, director of the Sustainable Bioenergy Research Consortium at Khalifa University in Abu Dhabi, and Boeing’s SAF feedstock expert Onofre Andrade meet as partners at a solar energy plant in Masdar City — where low-carbon energy will be used to produce green hydrogen. (Boeing photo)