

FUELING SUCCESS: THE SAF ROUTE TO AVIATION SUSTAINABILITY



THE SAF OPPORTUNITY

Aviation accounts for 1.9% of overall greenhouse gas (GHG) emissions, making it an important site of pressure for policymakers and consumers alike in the drive towards decarbonization.[1] While there are many methods available for reducing GHG emissions in aviation, including changes in equipment and operational efficiency measures, a sizable share of the responsibility for delivering sustainable aviation is being laid at the feet of oil and gas organizations.

This is because aviation requires energy-dense, transportable fuels, making air travel difficult to decarbonize. A global challenge, here, also represents a real opportunity for oil and gas organizations pursuing their own decarbonization journeys. The key lies in Sustainable Aviation Fuel (SAF) – a range of jet fuel technologies which can significantly reduce the environmental impact of flight.

As a leader in developing cutting-edge solutions for SAF, Honeywell has extensive expertise in delivering these viable alternatives to fossil fuels. We're committed to transforming the industry for the future. In this guide, you will discover how we are innovating SAF to empower oil and gas companies to meet demand and learn how you can energize a sustainable future.

TARGETING DECARBONIZATION

The decarbonization imperative is only set to intensify as climate action becomes increasingly codified by governmental initiatives and regulations. For example, the European Council released its ReFuelEU Aviation rules as part of the 'Fit for 55' package, aiming to **increase the share of sustainable fuels at EU airports from a minimum of 2% in 2025 to 70% by 2050**, with an additional sub-target for eSAF of 1.2% by 2030 and 35% by 2050.[2] As well as aviation-specific initiatives, the industry must also operate with an awareness of top-line commitments like the European Green Deal and the UAE's 2050 Net Zero pledge, which will require significant progress in the aviation industry. Of course, all of these represent an evolving range of strategies being taken as states seek to meet the goals established in the Paris Agreement: further policies with more granular targets are being developed and ratified year-on-year. Those commitments have stimulated concerted efforts in the international aviation community to formalize and unify the industry's routes to decarbonization. The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), which is part of the United Nations' International Civil Aviation Organization (ICAO) and which sees participation from 126 nation-states, stipulates SAF as one of its eligible measures.[3,4] Following technical analysis of lower-carbon aviation fuels, ICAO has stated that "SAF has the greatest potential to reduce CO_2 emissions from International Aviation".[5]





SOLUTIONS

THE SAF OPPORTUNITY

INVESTING TO HIT THE TARGET

In the task of accelerating the energy transition, though, winning new markets isn't the only reward on the table for oil and gas businesses. Those who commit to net zero carbon emissions can reap benefits from carbon tax incentives and subsidies for the production and use of more sustainable fuels, including the US's Inflation Reduction Act (IRA), which includes the 45Q tax credit. The IRA also provides incentives for the production of clean hydrogen, with tax credits of up to $3 per kg starting in 2023. This reduces the cost of clean hydrogen production by almost half and contributes to almost $369 billion dollars being made available to address energy security.[6]

National and international policies are increasingly naming SAF as part of the future of energy. Echoing the EU's 'Fit for 55' package, the UAE's Minister of Energy and Infrastructure has set a target of producing **700 million liters of SAF annually by 2030**, and sees positive incentives as a critical tactic for achieving that growth.[7] Meanwhile, in 2021, the Biden Administration announced its Sustainable Aviation Fuel Grand Challenge for the U.S. aviation fuel supply sector to **produce at least three billion gallons of SAF per year by 2030 and 35 billion gallons of SAF per year by 2050.[8]** SAF mandates also exist today in Norway, Sweden, France, and numerous other countries across Europe and Asia.

The IRA and similar programs show that an appetite exists for government investment in energy innovation which will enable new value chains like SAF. Honeywell UOP is delivering the technology oil and gas organizations need in order to realize that value.



HONEYWELL SOLUTIONS

HONEYWELL UOP ECOFINING™

The Ecofining process for renewable jet fuel is based on traditional refining hydroprocessing technology. It works by adding hydrogen to remove the oxygen from the feedstock and then further refining this product to meet the required specifications. The process produces a bio-synthetic paraffinic kerosene (bio-SPK) or renewable diesel that is then blended with standard jet fuel for use in flight.

As the first commercial SAF technology licensor, Honeywell UOP yields have been demonstrated at scale, meaning that customers can capture significant profits through efficient SAF production. With incentives available today in the U.S., even marginal improvements in distillate yield provide a substantial economic benefit. At a 10,000 BPD feed rate, for example, **a 1wt% yield advantage is worth approximately $6 million in profits annually.** What's more, our experience with many types of sustainable feedstocks means that we can guarantee catalyst cycle lengths based on actual operating data. The value of avoiding a five-day shutdown for catalyst reload is worth approximately $8 million in revenue for a 10,000 BPD unit.[9]

Single stage Ecofining technology, enabling renewable diesel production, is ideal for refinery retrofits and offers a fast and cost efficient path into renewable fuels. A retrofit initiative typically costs 50–70% less than a greenfield project and can be completed in an average of 12–18 months. Retrofitting for Honeywell UOP Ecofining can work with either one or two hydrotreater or hydrocracker reactors, reusing existing hydro-processing assets such as reactors, strippers, compressors, and fractionators. This sets the stage for a straightforward expansion to two-stage processing for renewable jet fuel, which can be implemented at a later date.[10]





SOLUTIONS

HONEYWELL SOLUTIONS

HONEYWELL ETHANOL TO JET

As part of its renewable fuels portfolio, Honeywell UOP also offers ethanol-to-jet (ETJ) technology. ETJ represents a new revenue stream for ethanol producers looking for diversification to satisfy the needs of the large and growing aviation market. Our innovative ETJ process leverages Honeywell UOP's already commercialized Ecofining technologies and decades of experience in fuel and aviation to enable **high jet fuel yields at a reduced CAPEX and OPEX.**

Like Honeywell UOP's other aviation offerings, our ETJ process has been engineered with GHG emissions reduction in mind, together with a focus on the needs of industry which ensures that customers will have the ability to commercialize ETJ rapidly and at scale.

HONEYWELL UOP EFINING™

Honeywell has also recently introduced Honeywell UOP eFining technology, a commercial solution for producing low-carbon SAF. With the addition of UOP eFining as our latest technology in a growing line of offerings that are driving the decarbonization of the aviation sector, Honeywell UOP now offers multiple routes to market using a variety of feedstocks.

Honeywell UOP eFining is a methanol to jet fuel (MTJ) processing technology that can convert eMethanol to eSAF reliably and at scale. eSAF belongs to a class of fuels called eFuels. eFuels combine renewably-manufactured green hydrogen with carbon dioxide to produce eMethanol, which can then be converted to a wide range of sustainable fuels, including eSAF. This effectively replaces conventionally-produced fossil fuels.

Honeywell UOP eFining technology provides the ability to harness readily abundant CO_2 in the production of SAF. As a highly integrated design that can process flexible feedstocks using commercially proven processes, this new technology is efficient, resulting in reliable, high yield eSAF production at a lower cost and energy intensity relative to comparable technologies. In fact, **Honeywell UOP eFining can reduce greenhouse gas (GHG) emissions by 88% compared to conventional jet fuel.**[11]



CASE STUDIES: SAF IN ACTION

Summit Next Gen will utilize Honeywell's ETJ technology to convert low-carbon ethanol into SAF in a facility located in the U.S. Gulf Coast region that provides access to significant logistics and utility infrastructure.[12] The collaboration is set to mark a new standard for the industry, empowering the forward-thinking ethanol producer to help aviation reduce its carbon footprint.

SOLUTION

The planned capacity is approximately 250 million gallons per year of SAF.

Honeywell UOP is providing related engineering and technical services, equipment, catalysts and adsorbents, and technical support services for start-up and throughout the life of the plant. By leveraging Honeywell's ETJ technology, which can be modularized off-site, Summit Next Gen will also be able to benefit from lower installed costs and faster, less labor-intensive installation compared to job site construction.

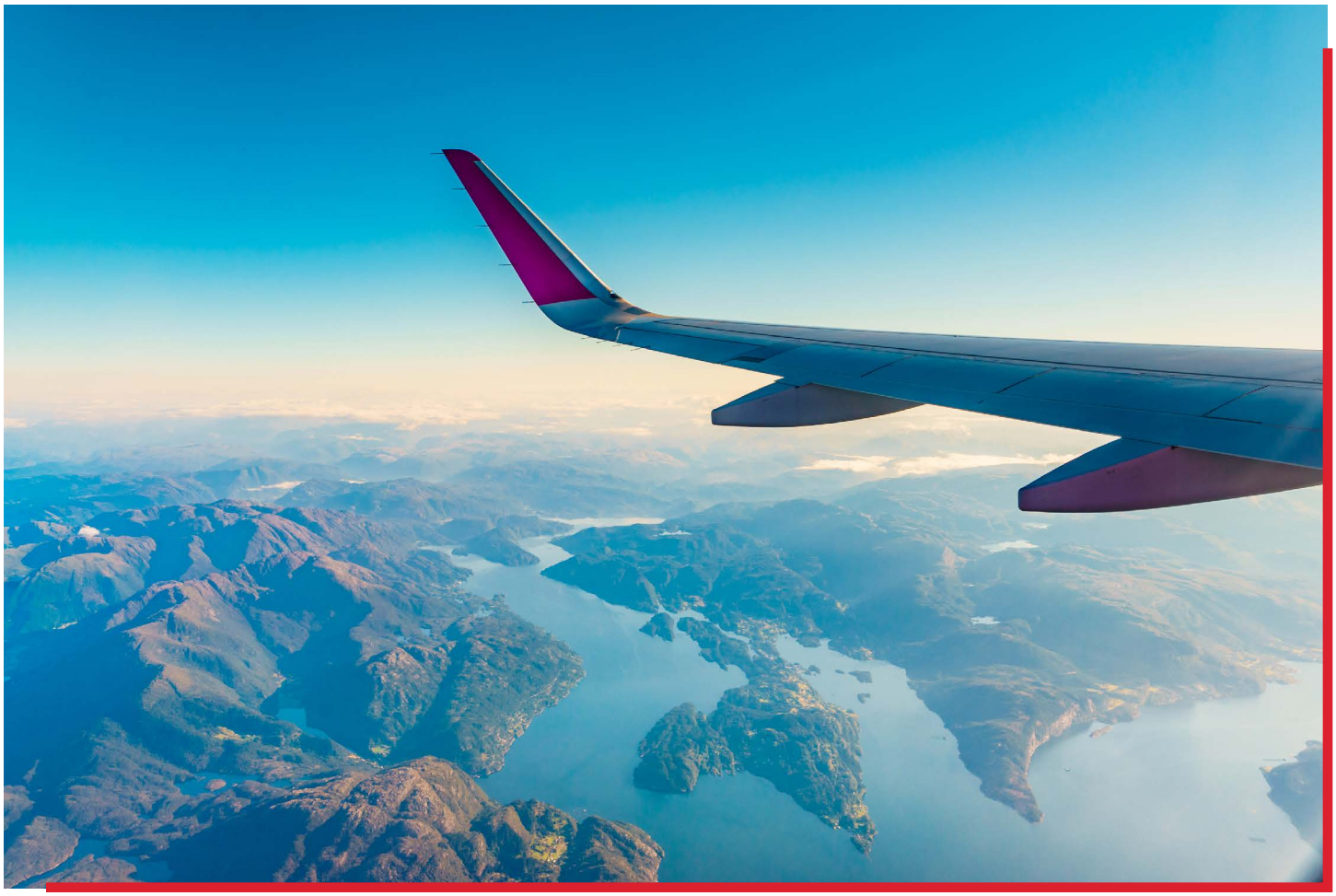


CASE STUDIES: SAF IN ACTION

HIF Global, the world's leading eFuels company, is deploying the latest Honeywell UOP eFining technology to produce eSAF at its second U.S. eFuels facility. The project is expected to be the world's largest eSAF facility, recycling approximately 2 million tons of captured CO_2 to make approximately 11,000 barrels per day of eSAF by 2030.

SOLUTION

Together, Honeywell and HIF Global will transform recycled CO_2 into a useful feedstock to replace fossil fuels in the aviation sector. The HIF Global facility deploying the Honeywell UOP eFining technology has the potential capacity to decarbonize 12 billion air passenger miles per year.[14] The ability to use readily abundant CO_2 to produce SAF is a transformational opportunity for HIF Global and the market. Honeywell's technology is efficient, resulting in high-yield eSAF production at a lower cost relative to comparable technologies.



THE HONEYWELL ADVANTAGE

FIRST MOVER IN SAF INNOVATION

Today, as a recognized leader in refining technologies for over a century and the first licensor to commercialize the production of SAF, Honeywell UOP is innovating the way for cleaner skies.

Honeywell UOP SAF meets the ASTM D7566 specification for Aviation Fuel – and we in fact led the ASTM certification process for renewable jet fuel in 2011. Since then, millions of gallons of SAF have been produced using Honeywell UOP technology, including the fuel used for the world's first transatlantic flight powered entirely by SAF.[15]

Honeywell UOP offers technology to produce SAF from a variety of sustainable feedstocks, including vegetable oils, animal fats, non-food-based fats, second-generation feedstocks such as camelina, jatropha and algae, and low-carbonintensity alcohols. This empowers fuel producers with the flexibility to choose the bio feedstock that best suits their locations and operating goals.

From a position of global technological leadership and deep industrial credibility, Honeywell UOP is applying its experience in SAF to help address the world's energy challenges. We work with airlines and governments to innovate and introduce SAF to a broader share of the industry while driving down costs for organizations.





ADVANTAGE

THE HONEYWELL ADVANTAGE

PROVEN RESULTS FOR A PROMISING FUTURE

When blended up to 50% with petroleum-based jet fuel, SAF offers significant advantages over traditional fuel. Most importantly, it has the ability to **reduce greenhouse gas emissions by 60-80%** compared with petroleum-based fuels, while its higher energy density in flight allows aircraft to fly farther on less fuel. SAF meets or exceeds critical jet fuel specifications, such as flash point, freeze point, stability, and heat of combustion. That means that it offers a drop-in replacement fuel that requires no changes to aircraft technology or fuel infrastructure.[16]

As governments and airlines around the world are recognizing, SAF offers an indispensable route towards reducing the emissions associated with aviation while supporting continued international trade and mobility.

To start shaping a more sustainable, more successful future together, contact a Honeywell expert today.



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