Jet fuel demand hit by Omicron; recovery delayed until 2023/2024

The aviation sector was optimistic for continued recovery in 2022 following two challenging years battling the Covid-19 pandemic. But flight disruption from Omicron may prevent a recovery to 2019 levels until 2024. By then sustainable aviation fuels (sustainable aviation fuel [SAF]—see survey) and more efficient aircraft may start chipping away at conventional jet fuel growth.

The emergence of the omicron coronavirus variant has led to widespread flight cancellation over the festive period and temporarily set back the prospects of a full recovery in the global jet fuel market—the sector most affected by the pandemic in 2020 and 2021. Airlines removed many millions of seats from their planned capacity for the first quarter of 2022 leading up to Christmas, with further cuts over following weeks—although concern has eased somewhat as January has progressed, given the new variant’s lower severity among the vaccinated.

Before Omicron, the International Air Transport Association (IATA), which represents some 290 airlines comprising 83% of global air traffic, had expressed cautious optimism for domestic aviation sectors in 2022. It predicted domestic activity would reach 93% of 2019 levels, while international routes would trail with levels of just 44%. By the end of the year, projections ranged from a 75% traffic recovery in Europe, to 65% for the North Atlantic and just 11% in Asia.

Given the hit in Asia, Energy Intelligence says overall global jet fuel demand will only reach 6.2 mn bpd in 2022, 20% below its peak in 2019; and just 6.9 mn bpd in 2023. Jet fuel demand uncertainties could weaken global oil demand forecasts—in contrast to 2009 to 2019 when global air traffic growth meant jet fuel was a reliable 4%/yr contributor to overall oil demand growth.

Airlines also face huge operational challenges due to the pandemic, while jet fuel prices are at 7-year highs. There is also increasing pressure from low carbon regulations and costs, as well as from passengers who want to minimize their carbon footprint. IATA says the EU’s Fit for 55 package to reduce emissions could add €39 billion to annual airline expenses by 2035—nearly twice the €22 billion industry-wide profit in 2019. Meeting the net-zero target requires massive outlays for SAF purchases and carbon offsets. What is more, it is steadily rising—voluntary and mandated carbon prices are setting regular price records in the EU and United Kingdom.

The collapse in demand has also affected jet markets directly. Spot barrels in the Singapore jet fuel market fell sharply in December, and prices dipped around the time of the Omicron announcement. However, the relative price weakness did not last long because the market and refineries were able to quickly react and adjust product yields—producing more diesel and gasoline instead.

IATA has called for governments to follow the World Health Organization advice and immediately rescind travel bans that were introduced in response to the virus, but so far, many countries have ignored this—notably, China, which has some of the most draconian international travel restrictions.

1 | DOMESTIC, WESTERN MARKETS STRONGEST

Domestic markets are performing the strongest with a fall of just 20% in jet consumption from 2019 levels in 2021, according to the latest IATA passenger data, while international markets were down 80%. Strong demand for freight has kept the air cargo sector buoyant, with volumes in 2021 up 9% on 2019 levels. Leisure travel is leading the rebound on the passenger side, with business travel still struggling. IATA’s 20-year forecast projects annual passenger traffic growth rates slowing to between 1.5% and 3.8% globally through 2040, from over 4% in the last decade.

Travel barriers have caused wide variations in regional jet demand trends. The United States is leading the global rebound due to its large domestic market, which has lifted jet demand there to 1.4 mn bpd this year (October EIA), after dipping to 597 000 bpd in May 2020. Platts Analytics expects US Q1 2022 jet demand to average about 1.5 mn bpd, but more international flights later this year should boost consumption to 1.6 mn bpd, even with Omicron, and 2023 could see the return of prepandemic levels.1
However, despite no restrictive measures, omicron- and weather-related flight cancellations did hit US demand for jet fuel in December and January. Most observers expect continued improvement and recovery as the year progresses, and as the country shifts to a different phase from a pandemic to an endemic that people learn to live with. Demand remains strong. According to TSA data in early January, 1.7 million travellers checked in on January 9, almost double 2021 levels for the same day, although still below the 1.96 million for the same day in 2019.

In Europe, a variety of domestic and international restrictions has dampened jet demand, but this increasingly looks to be temporary, although full recovery still looks unlikely until at least 2023. Last year saw a sustained partial traffic recovery in European airline traffic, starting at 64% of 2019 levels in January and rising to remain relatively stable at over 70% since the summer, helped by the introduction of vaccination certificates. Airline traffic stood at 22% below 2019 levels in December, according to Eurocontrol on January first.

There is expected to be a 70% to 90% recovery in European airline traffic compared to prepandemic levels in 2022, according to the European Organization for the Safety of Air Navigation, although Omicron may delay this.

Asia-Pacific is lagging behind the rest of the world with international traffic still 95% below 2019 levels through October. Many Asian countries imposed further restrictions and movement checks during the Christmas and New Year holiday season to stem the spread of the omicron variant, including Singapore, Hong Kong, India, and China. Asia could catch up quickly if connectivity is restored, with demand from China and India pushing Asian fuel usage back above 2 mn bpd by 2023—but current attitudes and rising case numbers in China make this unlikely.

In Asia, refiners are likely to keep production levels steady in the near term because yields are already at minimum levels. S&P Platts estimated jet demand in Asia would grow 520 000 bpd in 2022, after a sharp contraction of over 1 mn bpd in 2020 and a modest decline of 30 000 bpd in 2021.

## 2 | INDIA AND RUSSIA

Two of the biggest Asian Markets facing challenges are India and Russia. In India, the suspension of scheduled international commercial passenger traffic to and from the country was extended in early December to January 31, 2022, from December 15, 2021.

A rise in Omicron cases in India has prompted many states and cities to reimpose regional restrictions. West Bengal suspended all direct flights from the United Kingdom and reduced the frequency of domestic flights from Mumbai and Delhi, while Delhi closed public buildings. Other states have added new rules for international arrivals including quarantine requirements and temporary bans for high-risk countries.

India’s kerosene/jet fuel demand is projected to rise by 57 000 bpd in 2022 after a sharp contraction of 104 000 bpd in 2020 and a modest 9000 bpd increase estimated for 2021, according to S&P Platts on January 4. The country’s kerosene/jet fuel demand in 2022 is expected to be 16% lower than in 2019 as international traffic is likely to remain weak, especially in the near term due to omicron.

Indian jet fuel consumption rose to 504 000 mt in November, a 21-month high, the latest preliminary data (early January) from the Petroleum Planning and Analysis Cell showed. The country’s jet fuel production surged 44.8% year on year in November, hitting a 20-month high of 1.06 mn mt.

In Russia, state oil company Gazprom Neft’s jet fuel subsidiary Gazpromnaft Aero is maintaining its positive forecast for the recovery of Russia’s aviation market amid rising domestic tourism growth. Russia’s jet recovery has been ahead of the global one, according to Gazpromnaft-Aero estimates, despite several waves of coronavirus.

The head of the company expects domestic passenger traffic in 2022 to slightly surpass 2019 levels. Russian domestic demand for jet fuel in the first 9 months of 2021 almost reached the prepandemic level of 2019, totaling 5.5 mn mt, according to the company’s data.

Russia’s Federal Air Transport Agency previously forecast full recovery of the domestic jet market by 2023, a year earlier than the global market. In November, the number of passengers traveling via domestic flights exceeded the volume seen in November 2019 by 10%, according to the agency. However, S&P Global Platts Analytics forecasts Russian jet fuel demand will average 185 000 bpd in 1H 2022 compared to 217 000 bpd in the same period of 2019.

## 3 | FUTURE UPSIDE?

Prices remain well supported despite the fall off in demand. Platts assessed jet CIF NWE at $696/mt on December 24, up 58.5% since the beginning of the year. Now that it appears Omicron is a less severe variant, most airlines are reinstating flights and the spring is expected to rebound in many areas as quarantine and border restrictions are eased further and pent-up demand is released.

In Europe and the United States, there is support from pressure on supply from particularly low stock levels and limited output from refineries. In the US jet inventories are close to seven-year lows, according to US EIA, as refiners continued to blend jet into the diesel...
pool. EIA data showed jet fuel accounted for 6.9% of refinery yields in 2020, and 8.6% in October 2021—down from 10.5% in 2019. And in Europe, Mediterranean stock levels are at extremely low levels, after a recovery in demand last summer and higher than expected levels through the autumn. This had helped support prices despite the downturn in demand.

Supply-side constraints amid elevated demand in some parts of Asia are expected to keep jet fuel prices supported there too. Tight jet fuel availabilities in the Asian spot market owing to curtailed production and lower jet fuel/kerosene yields will likely prompt refiners to maintain steady output levels. China’s decision to cut oil product export quotas for 2022 was also likely to exacerbate the tight supply. China’s Ministry of Commerce has allocated 13 mn mt of oil product export quota in the first round to seven oil companies for 2022, down 55.9% from the same round in 2021.

The demand picture for 2022 remains uncertain, although a drop is expected in January and February as the latest wave of coronavirus keep borders closed and/or costly to cross, before a recovery in the spring—at least away from countries that do not have a zero Covid approach, primarily China. Here it is very unclear when international flight numbers will recover, as the country has had few Covid cases and vaccination levels/effectiveness vary, making it highly exposed to an outbreak of the Omicron variant should international flights resume.

4 | SAF CHALLENGE

Sustainable fuels will represent a growing cost for airlines and passengers in the years to come, as they progressively replace some of the fossil jet fuel with SAF and synthetic aviation fuels. According to Platts data, the ex-works production cost of SAF amounted to around $2698.67/mt in NWE on December 21, up from $1680.71/mt on January 4, 2021, while CIF NWE jet fuel cargoes were assessed at $680.25/mt on December 21, up from $439/mt on January 4. This illustrates a rise in both the underlying jet price and SAF premium over the last year.

According to the European Commission Fit for 55 plan and ReFuelEU Aviation initiative, which aims at making the aviation industry in Europe carbon-neutral by 2050, a target now shared by the International Air Transport Association, the share of SAF in aviation fuel should rise from around 0.05% in 2021 to 2% in 2025, 5% in 2030 and 65% in 2050. The UK government also announced ambitious SAF targets of 10% by 2030 and up to 75% by 2050. Denmark has mandated a 100% SAF target for domestic flights by 2030, and Norway introduced a 5% minimum, and also has a 100% target by 2030.

There is also increased movement on SAF in the United States. In Russia there is not expected to be much adoption until ICAO’s CO2 emissions standards come into force in 2027. However, state Gazpromneft-Aero has already announced plans to produce SAF in test batches at its Omsk and Moscow refineries.

For more on SAF regulation, developments, and challenges, please see Survey.

REFERENCES
1. U.S. Energy Administration (EIA). Short-term energy outlook. https://www.eia.gov/outlooks/steo. Accessed January 20, 2022.
2. S&P Global. Daily Update: January 7, 2022. https://www.spglobal.com/en/research-insights/articles/daily-update-january-7-2022. Accessed January 20, 2022.
3. S&P Global. Platts. Asian jet fuel recovery stays subdued as omicron-related fears persist. https://www.spglobal.com/platts/en/market-insights/latest-news/oil/123121-asian-jet-fuel-recovery-stays-subdued-as-omicron-related-fears-persist. Accessed January 20, 2022.

How to cite this article: Jet fuel demand hit by Omicron; recovery delayed until 2023/2024. Oil and Energy Trends. 2022;47(2):3-5. doi:10.1111/oet.12904

THE MONTH IN BRIEF

Month in brief

Front-month (March) Brent futures started January at $77.85/bbl and climbed steadily through the month to reach 7-year highs. The surge in prices was largely down to fading pandemic concerns combined with supply tightness,
and geopolitical concerns in Libya, Kazakhstan, Ukraine, and the Arabian Peninsula.

Crude futures settled higher on Monday January third after an OPEC-plus advisory committee report suggested the omicron coronavirus variant would have a limited effect on global demand growth. NYMEX February WTI settled up 87 cents at $76.08/bbl, and ICE March Brent closed $1.19 higher at $78.97/bbl. Prices continued to rise until Friday seventh January, boosted by disruption to Libyan exports and unrest in Kazakhstan, both major OPEC-plus exporters. At the end of the week, levels retreated a little on news of a resumption of supply from Libya and rising Covid numbers in China, where international travel restrictions remain tight.

Crude futures fell again on Monday 10th, and then resumed their upward trajectory—with Brent reaching $84.67/bbl on Wednesday 12th January, after the US EIA reported US crude stocks at their lowest level since October 2018. February WTI also rose to $82.64/bbl. US commercial crude oil stocks declined 4.5% to 413.3 mn bbl, leaving them 8.2% behind the 5-year average. The draw exceeded market expectations. Prices then retreated slightly as traders booked profits, but the overall outlook remained bullish.

Sure enough, Friday 14th saw another sharp rise led by bullish fundamentals and increasing concerns of a possible Russian invasion of Ukraine—while the market shrugged off temporary concerns about the omicron variant and weaker crude imports into China. The following Monday, more upward pressure on prices came from a Yemeni Houthi rebel attack in the UAE capital of Abu Dhabi, which the emirate said it may respond to. By the close on Tuesday January 18th, crude had reached 7-year highs as fundamental outlooks tightened amid rising geopolitical concerns and post-omicron demand optimism. February WTI settled at $85.43/bbl, and March Brent reached $87.51/bbl. It was the highest front-month settle for both markets since October 13, 2014.

Prices continued to rise the following day after an IEA report raised demand forecasts for both 2021 and 2022 by 200 000 b/d and predicted global oil demand would surpass pre-pandemic levels this year. The next 2 days saw a slight softening of prices as rising US inventories indicated current demand weakness, although the market remained supported by low Saudi stocks and overall tightening fundamental outlooks. US commercial crude stocks climbed 520 000 barrels to 413.81 mn bbl, easing upward pressure on prices, according to the EIA. Prices then fell again on Friday January 21st as stock markets weakened ahead of an anticipated hike in US interest rates.

The upward trajectory resumed the following week, with Brent moving above $90/bbl for the first time since October 2014 on January 26th before easing slightly late in the day. It eased back a little again the following day before breaching the $90/bbl mark once more on Friday 28th January—ending the day at $90.03/bbl. On Monday 31st levels firmed to over $91/bbl, with analysts increasingly suggesting that $100/bbl oil may soon be a possibility.

How to cite this article: Month in brief. Oil and Energy Trends. 2022;47(2):5-6.
doi:10.1111/oet.12905

GAS AND POWER

US tops liquefied natural gas exporter list for first time in December as European prices hit fresh records

The US became the world’s biggest exporter of liquefied natural gas (LNG) in December for the first time ever. The timing was opportune as prices once again reached record highs in Europe, which provided an eager market for the additional volumes.

LNG output from American facilities edged above Qatar in December due largely to a jump in exports from the Sabine Pass liquefaction plant, where Cheniere started a new unit in November, as well as higher throughput from Freeport LNG. However, US exports were only
marginally above those from Qatar and Australia, and any production issues could change the rankings in coming months—the United States still has a smaller export capacity on paper than either Qatar or Australia.

But the United States should edge ahead in capacity terms once Cheniere’s 5 mn t/yr Sabine Pass Train 6 and Venture Global’s 10 mn t/yr Calcasieu Pass projects are brought onstream in coming months, with further additions at the end of the year. Beyond that, Qatar is likely to take back the top spot once its major expansion comes online in the late 2020s, benefiting as it does from plentiful, low-cost gas available from the giant North Dome field—by far the world’s biggest gas-field.

1 | STRONG DEMAND AND SOARING PRICES

Returning to the present, the jump in US LNG exports is helping to ease a global supply crunch. Europe is facing a winter energy crisis as suppliers struggle with record low gas inventories and constraints in Russian supplies—on which Europe relies for over a third of its gas. The European TTF gas hub benchmark price traded at almost $60/mn Btu in late 2021, with similar levels at the UK’s NBP, while LNG prices are regularly trading well above $30/mn Btu—compared to gas prices at around $5/mn Btu on the US Henry Hub benchmark.

These record differentials have meant the incentive to export has never been higher, although with most of the term exports linked to Henry Hub prices, it has also been much lower cost for some buyers. European spot prices have since eased back but remain at remarkably high levels. Consequently, European LNG imports climbed to a record 7 mn t in December. This and exports elsewhere amounted to 13% of US gas production in December—a new record, and up sharply on previous years.

European prices are likely to stay firm, supported by competition for cargoes between Europe and Asia, along with winter weather conditions, and Russia’s unwillingness or inability to send more gas to Europe. Start-up of the 55 bn m³/yr now looks like being delayed until after the winter, which could well mean Russian supplies do not pick up until then either—supplies could be further disrupted if Russia does decide to invade parts of eastern Ukraine.

The tight European market means global spot gas prices are expected to remain firm generally, with Energy Intelligence Group predicting an average of $30/mn Btu in the first quarter, before easing in the spring. Asian spot prices are forecast to average $23 mn Btu in 2022—more than $10/mn Btu higher than oil-linked term prices.

2 | MORE LNG SUPPLY ON HORIZON

Fresh LNG supplies from outside the United States are due onstream at BP’s 3.8 mn t/yr Tangguh Train 3 and Eni’s 3.4 mn t/yr Coral FLNG later in 2022. There may also be relief from the return of supply from liquefaction plants that have been out of action for a variety of reasons (which contributed to the recent tightness), including in Norway, Trinidad and Tobago, Australia, Indonesia, and elsewhere.

Chinese spot demand may also ease off this year, due to weaker growth, but also more term LNG and Russian pipeline supplies, which are due to rise to 15 bn m³ from 10 bn m³ in 2021, as part of a contract that eventually envisages 44 bn m³ of exports.

Further out, a fresh round of term contract interest is boosting the prospects of more planned US LNG liquefaction plants getting the go-ahead, after many were delayed due to the pandemic and low-cost competition from Qatar Energy. For example, CNOOC agreed a 2 mn t/yr long-term deal and a 3-year deal with Venture Global in late 2021. The high demand has driven up pricing formulas to nearly 12% of Brent in new-term contracts, up from low 10s% offered since 2019 until recently.

The boost in term deals and higher prices means Cheniere expects to approve its Corpus Christi Stage 3 project in mid-2022, while the new deal with CNOOC and another with Sinopec mean Venture Global is likely to sanction its Plaquemines project soon. Japan’s Jera has made an equity investment in Freeport LNG, which helps plans for a fourth train there.

How to cite this article: US tops liquefied natural gas exporter list for first time in December as European prices hit fresh records. Oil and Energy Trends. 2022;47(2):6-7. doi:10.1111/oet.12906
Biofuels take off in aviation and marine transport sectors

Total biofuels demand in 2022 is expected to be about 2.8 mn bpd, up 7% on the year and up 2% from prepandemic levels, according to Platts—making it roughly 2.7% the size of the crude oil market. Ethanol demand—mostly in the United States road transport market—is expected to still below 2019 levels in 2022, but the biomass-based diesel market, including biodiesel and sustainable aviation fuel (SAF) is projected to reach a new high of 976 000 mn bpd.

The vast majority of biofuels have so far been used in the road transport sector, where they can help reduce carbon intensity and dependence on imported fossil fuels—although here their long-term role may be limited by the switch to EVs and possibly hydrogen vehicles. More recently, biofuels have been seen as a solution to decarbonize transportation sectors that are more difficult to electrify, including aviation, shipping, rail, and other heavy-duty vehicles.

In particular, sustainable aviation fuels (SAF) and to a lesser extent, marine biofuels, are set to make a significant contribution to decarbonization, with much of their production based on waste and advanced biofuel processing—and little reliance on food crops at this stage. Demand, especially for SAF, which currently faces little low carbon competition in the aviation sector, is already surging as airlines and governments set more ambitious greenhouse gas emissions reductions targets. We look at recent developments and possible obstacles or constraints to their increasingly widespread use.

1 | SUSTAINABLE AVIATION FUEL

SAF is able to cut aviation emissions today, and with few other options available in the near term, it is seen as the best decarbonization hope for the time being in the aviation sector. Progress has been set back slightly by the pandemic, which hit the airline industry—and fuel demand—hard. But demand for SAF is once again emerging as air travel recovers. Current specifications limit SAF content to 50% in a blend with conventional jet fuel, but industry stakeholders are working toward approval for 100% SAF.

According to BP Statistical Review 2021, bio-jet (or SAF) production stood at only about 1000 boe/d in 2020, although this was up 50% on 2019, and future rises are expected to be rapid—Business wire predicts the market will grow from $66 mn in 2020 to $15 bn in 2030, which equates to about 230 000 bpd (see Figure 1).

Looking further ahead, if the aviation industry relies solely on SAF to meet its decarbonization commitments, the Air Transport Action Group’s (ATAG) Waypoint 2050 analysis projects SAF demand of up to 450 million metric tons per year (9.7 mn bpd) by 2050.¹ That falls to 235 million tons/yr (5mn bpd) if new electric, hydrogen, and hybrid electric aircraft succeed in getting off the ground—which is a far more manageable volume, given the limited feedstocks available (see below). These low carbon alternatives would include electric aircraft flying short-haul routes, aircraft powered by green hydrogen for medium-haul journeys and long-haul routes flown using hybrid-electric aircraft. The ATAG analysis is based on 3% average annual growth in air traffic between 2019 and 2050 and the assumption that SAFs will offer an average 90% emissions saving by 2050.

2 | IATA COMMITMENT

The International Air Transport Association (IATA) recently made a commitment for net zero by 2050,² which requires a 1.8 gigatons reduction in carbon emissions by 2050. IATA expects SAF to meet 65% of the airline industry’s total fuel requirement by 2050—449 billion liters (7.7 mn bpd—see Figure 1), with hydrogen and electric aircraft also playing a part in reducing emissions. This equates to a 65% reduction from SAF, 13% from electric and hydrogen aircraft, and 3% from improvements in airspace management. Carbon capture

---

¹ Source: Estimates based on Business Wire, ATAG, IATA, Platts, and others
and storage would also contribute (11%), along with offsets (8%).

IATA sees SAF use rising from 2% or 136,000 bpd in 2025 to 5.2% or 396,000 bpd by 2030—in line with EU targets. From 2030, IATA says SAF use would rise to 1.6 mn bpd (17%) by 2035, alongside a significant contribution from electric and hydrogen aircraft. By 2040 it expects SAF use to reach 4 mn bpd (39%), before accelerating in the 2040s to 6 mn bpd by 2045 and 7.7 mn bpd by 2050. These numbers assume a continued steady advance in both hydrogen and electric.

However, whatever the demand projections, SAF remains an expensive option. Recently it has been trading at about three-to-four times the conventional jet price. For example, according to Platts, Q3 2021 US West Coast price assessments for SAF averaged around $7.50/gal with federal credits and California’s Low Carbon Fuel Standard credits. This compared to $2.15/gal for the quarter for petroleum-based jet. The price of SAF eased to average $6.80/gal in Q4 2021 and is lower still this year—while jet prices have risen, although a significant premium remains.

3 | POLICY SUPPORT

Given the premium of SAF over conventional jet fuel, policy support, as well as strong demand among flyers and airlines, is required. This is happening in both Europe and North America, which should support the research and scaling up of facilities needed to produce the volumes required and bring prices down to competitive levels. Policy can include taxes/penalties, incentives/credits, and mandates.

The EU has adopted particularly stringent rules, having included aviation emissions in the next stage of its emissions trading system (ETS), which currently taxes GHG emissions at about $70/tCO2e. The bloc is also adopting usage mandates. The EU’s Renewable Energy Directive II sets a target to include 14% of renewables in transport fuels and to reduce GHGs by 32% between 2021 and 2030. For SAF specifically, the European Commission had proposed a 2% blending mandate by 2025, with this share growing to 5% by 2030 and 63% by 2050—under a legislative initiative called “Refuel EU Aviation.” Mandating a portion of SAF should help guarantee demand and encourage investment.

Several individual European countries are going further. Norway has already introduced a 5% SAF cut for domestic flights and plans to switch to zero carbon flights by 2030. Denmark also wants fossil-fuel free domestic flights by 2030. The firm regulatory approach has reassured European refiners and given them the confidence to make tough investment decisions to boost SAF production (see below).

Some airlines have criticized the new European rules, coming so soon after the pandemic. They claim they will mean much higher costs for airlines and passengers, which could keep air traffic numbers down.

Across the Atlantic in the United States, there is also support for SAF from the Biden administration, but Democrat defections are making it difficult to get planned reforms and budget allocations through the Senate. The US hopes to use tax credits and other policy levers to drive growth in SAF production. In early September, the Biden administration proposed a $1.50 to $2/gal tax credit for producing SAF, followed by a $1.25/gal tax credit for SAF on September 10th from the Build Back Better Act. There were also positive comments on biofuels from EPA Administrator Michael Regan and an initiative to boost SAF supplies.

In late 2021 the Biden administration launched its Sustainable Aviation Fuel Grand Challenge with the aim of boosting US SAF production from 4.5 mn gallons per year currently to 3 billion gallons/yr by 2030. Up to $4.3 billion will be shared between seven federal departments working on SAF, including the Department of Agriculture providing support to farmers to grow the right biomass feedstocks, and to the Department of Energy (DOE), which will provide up to $3 billion in loan guarantees for new SAF plants.

New SAF plants are being announced all the time by established energy players and new tech start-ups (see below). Blender tax credits should also encourage those US refiners already making renewable diesel like HollyFrontier and Valero, or in the process of converting refineries like Phillips 66 and Marathon, to shift yields toward SAF production. The plan includes a number of incentives to expand SAF production, which could also encourage deep-pocketed oil majors to invest more.

Some US states are going further and faster than the federal government. For example, New York will require biodiesel blending with heating oil, with targets of 5% biodiesel by July 2022, 10% by 2025, and 20% by 2030. Requirements already existed in parts of Long Island and New York City, and the state-wide requirement will cut 1 mn t/yr of CO2 emissions.

4 | CUSTOMER DEMAND

Big aviation fuel consumers, particularly airlines themselves—but also major airline users such as Microsoft (see below)—are demanding that fuel suppliers begin to supply SAF. The Sustainable Aviation Buyers Alliance, which aims to pool the purchasing power of fuel buyers to encourage policy support, opened to new members for
the first time last autumn in the run up to COP26. Over 80 signatories—both airlines and large travel buyers—committed to boosting the use of sustainable aviation fuel to 10% of global jet fuel demand by 2030.

Many individual or corporate passengers appear prepared to pay the additional cost of reducing incurred emissions by using SAF. The alternative of using offsets is less popular as the flight still emits the same level as before. Support among companies is often driven by investors and wider ESG considerations. The recent pledge by the world’s airlines through IATA to reach carbon neutrality by 2050 is also adding to SAF investment momentum.

Most of the demand is still coming from Europe and North America, but there is also demand in parts of Asia. For example, Malaysia Airlines conducted its first flight with a mixture of SAF and regular jet fuel in 2021. The company plans to start using the fuel regularly from 2025 and has lined up supply deals with Neste. Petronas, Malaysia Airlines, and aviation authorities are also exploring potential opportunities to introduce SAF at Kuala Lumpur International Airport.

In Russia, Gazprom Neft and Russia’s state carrier Aeroflot agreed last September to work together on producing Russia’s first low carbon SAF, which it hopes will cut greenhouse gas emissions from air travel by up to 80%. The company plans to conduct its first flight using biofuels by 2024 in cooperation with the green fuel alliance, which includes aviation industry leaders and research institutes and was formed last year.

With investors, policy makers and consumers all demanding lower carbon fuels in aviation, we go on to look at the companies investing in new production facilities, and the deals they are making with feedstock suppliers and airlines.

5 | MAJORS AND REFINERS TAKE LEAD IN SAF PRODUCTION

While they face considerable competition from start-ups, established refiners and major oil and gas companies are investing heavily in SAF and other bio-jet/biodiesel production facilities.

Neste is Europe’s biggest biodiesel producer, much of which is produced from agricultural and forestry waste. The company claims that all its SAF is produced from sustainably sourced waste and residue raw materials such as used cooking oil and animal fat waste. Over the fuel’s life cycle, Neste said its SAF reduces greenhouse gas emissions by up to 80% compared with fossil jet fuel. Neste plans to expand capacity to 1.5 mn tons of SAF annually by the end of 2023. Overall, Neste expects to produce 515mn gallons of SAF per year by 2023, about 15 times more than it currently produces.

Total and Repsol are also big European investors in SAF. Repsol plans to produce 250 kt/yr from its Cartagena refinery from this year from waste materials such as animal fats and cooking oil. Total has already converted its refinery at La Mede and plans to cease crude runs and install a biorefining unit at Grandpuits by 2024. The new unit will be able to process 400 000 tons per year, broken down into 170 000 tons of sustainable aviation fuel, 120 000 tons of renewable diesel, and 50 000 tons of renewable naphtha used to produce bioplastics.

Spanish refiner, Cepsa, also plans to produce SAF from waste and plant-based feedstocks with airline operator Iberia. Iberia has committed to operating a minimum of 10% of their flights with sustainably sourced fuels by 2030. Cepsa has been producing biofuels at its refineries in southern Spain for over 10 years and is investing heavily in advanced processes.

Over in the United States, refiners are also investing. Major US refiner, HollyFrontier, is switching from processing crude to producing 6000 bpd of renewable diesel and SAF at its Cheyenne, Wyoming refining facility. At HollyFrontier’s Artesia refinery, the installation of a pretreatment unit in Q1 2022 will widen the type of feedstock that can be used from just soybean oil—allowing a more profitable mix of feedstocks. The refinery will also complete a 9000 bpd renewable diesel unit in Q2 2022.

HollyFrontier recently purchased Shell’s Washington-based Puget Sound refinery and is waiting for regulatory clearance to complete its purchase of Sinclair Energy, which includes significant renewable diesel capacity.

ExxonMobil is also revamping some of its refineries so they can take waste and agricultural bio feedstocks. For example, Exxon’s Imperial Oil in Canada is keen to build a 20 000 bpd renewable diesel complex at its 200 000 bpd Strathcona refinery in Alberta by 2024.

Other conventional refineries that are being transformed include Newfoundland’s Come By Chance refinery, which will switch to a green diesel plant under a new agreement. The refinery will be rebranded as Braya Renewable Fuels and will make renewable diesel and sustainable aviation fuel, with a production capacity of 14 kbpd. Braya could expand further to reach 35 kbpd in capacity.

6 | ACQUISITIONS, CONVERSIONS, AND PARTNERSHIPS

Some big companies are complimenting their internal efforts by buying into small bio-tech specialists. For example,
ExxonMobil has acquired a 49.9% stake in Biojet, a Norwegian biofuels company that plans to convert forestry and wood-based construction waste into biofuels and biofuel components. The US giant has always been keen to expand into lower-emissions fuels, with an advanced biofuels program in place for many years and a target of producing 40,000 bpd of such low carbon fuels by 2025. Exxon will use Biojet and access to nearby distribution networks to distribute the fuels across Norway and northwest Europe, where demand is expected to be high.

The new Exxon-owned Biojet has plans for five biofuels production plants, which would also be able to produce biofuel components. Biojet said it expects commercial production to begin in 2025 at a manufacturing plant to be built in Follum, Norway. The deal means ExxonMobil can buy up to 3 mn bl/yr of biofuels. Initially this will be used in road transport, and later on expand into marine and air transportation applications. The biofuels will be produced from wood waste, with an anticipate CO₂ reduction of 85% compared to fossil fuels.

While the biofuels program has been going for some time, Exxon only established its Low Carbon Solutions business unit in 2021. That department now includes extensive carbon capture and storage facilities and plans and hydrogen projects, as well as biofuels.

Other producers involve partnerships or consortia of established energy and industrial company investors. The prime example is LanzaJet, which now counts Shell and Microsoft among its backers. Suncor Energy and Mitsui & Co. invested $15 and $10 million, respectively, to establish LanzaJet. Recently, Microsoft (through its Microsoft Climate Innovation fund) joined Shell, BA, All Nippon Airways, and Suncor Energy, in investing in LanzaJet.

More specifically, Microsoft is investing $50 million in a LanzaJet facility in Georgia that will produce jet fuel from sustainable waste-based ethanol and other wastes next year. It will be the largest SAF project in the United States. Known as the Freedom Pines Fuels plant, it should be able to produce 10 million gallons per year of SAF and renewable diesel by 2023.

The investment helps LanzaJet realize its goal of producing 1 billion gallons of SAF in the United States by 2030, from ethanol derived from waste sources using its alcohol-to-jet (ATJ) process, although half of that could be outside of the United States. The 1 bn gallon goal would be a third of the Biden administration’s target set in September 2021 to produce 3 billion gallons of SAF per year. It also helps Microsoft meet its climate goals which include becoming carbon negative by 2030 and advancing a net-zero economy.

LanzaJet is also planning other facilities to supply its various backers.

7 | SPECIALIST COMPANIES INVESTING TOO

In addition to the energy giants, there are a number of small, specialized companies with patented processing technologies that are also investing heavily in the sector. For example, California-based, Indaba Renewable Fuels, which is building renewable diesel and SAF plants across the United States.

Projects include two state-of-the-art 6500 bpd greenfield renewable refineries that will produce ultra-low sulfur “drop in” renewable diesel and jet fuel in California and Missouri. All feedstocks and marketing will be sourced and sold in the local markets. The plants will use Topsoe’s HydroFlex technology and are expected to begin production in 2024. They will also use Topsoe technology that enables fossil fuels used in processing to be replaced with renewable liquids, which lowers the carbon intensity of the products.

Other smaller players include Aemetis, which has a renewable diesel and SAF facility under development. It includes CCS in the production process—potentially making it carbon negative. The 90 million gal/year Aemetis Carbon Zero plant is under development in California and is “designed to produce below zero carbon intensity renewable fuels by utilizing cellulosic hydrogen from waste forest and orchard wood along with on-site CO₂ carbon sequestration capacity.” The plant is powered by 100% renewable electricity, using low carbon cellulosic hydrogen to hydrotreat the renewable oil feedstock to make low carbon intensity biodiesel and SAF, and further reducing carbon intensity by injecting CO₂ from the production process into a sequestration well at the plant to permanently capture 200 000mt/yr of CO₂.

Many other plants are also being developed by new fuel firms with no oil background. According to Energy Intelligence Group, these include World Energy, which is on track for 150 million gallons/yr by 2024 from fats, oils, and greases via hydro processing, while Gevo is projecting 45 million gallons/yr by 2025 from crop residues to ethanol via ATJ technology with at least two more identical net-zero plants promised by the end of the decade. Fulcrum is planning for 33 million gallons/yr by 2023 from municipal solid waste using the Fischer-Tropsch (FT) process, while UK-based Velocys is planning a 33 mn gallon/yr US plant using waste woody biomass, it said.

8 | DEALS GETTING DONE

Producers are already signing up big customers. Neste has supply deals with a number of airlines in bother the
United States and Europe, including Delta and American Airlines. In Asia, Neste is in the process of expanding its Singapore facility. Cepsa signed the Iberia deal in January.

Smaller producers are also signing deals. For example, Aemetis signed a deal to supply Delta Airlines with 250 million gallons of SAF, which also helps the airline offset renewable fuel compliance costs. These have risen due to the escalating cost of renewable credits. The contract was signed in October, starts in 2024 and lasts for 10 years.

Delta Airlines, which has said it is working toward replacing 10% of its conventional jet fuel consumption with SAF by the end of 2030, used 690 million gallons of fuel during Q2 2021 at a total cost of almost $1.5 billion. The Aemetis-Delta deal is thought to be worth more than $1 billion, including all credits and subsidies.

Other deals include Phillips 66 partnering with British Airways to supply renewable jet fuel produced by Phillips 66 in the United Kingdom. Currently, its renewable fuel refinery produces 132 000 gal of product per day. British Airways says using the biofuel will enable it to reduce its carbon footprint beginning this year.

And in September, JetBlue signed a new 670mn gallon per year offtake agreement with SG Preston for SAF in the United States. Starting in 2023, the 10-year contract will supply blended SAF to JetBlue for use at the three New York-area airports: JFK; La Guardia; and Newark. The deal will reduce JetBlue’s CO₂ emissions by about 1.5 mn t and covers nearly 8% of JetBlue’s total fuel use (JetBlue has a goal of 10% by 2030). The contract is estimated to be worth about $1 billion.

JetBlue has also purchased large volumes of SAF on the US west coast. Here, in July, JetBlue agreed to buy 1.5 mn gal/year of SAF from World Energy to be supplied to Los Angeles Airport. Neste also sells SAF to JetBlue through a term contract that began in 2020.

Deals are also being done at the upstream end of the process, between feedstock producers and SAF producers. In October, US agricultural giant Archer Daniels Midland and biofuel producer Gevo signed a memorandum of understanding to support production of SAF. The MOU calls for about 900 mn gallons of ethanol produced by ADM to be processed into about 500 million gallons of SAF by Gevo from 2025 to 2026, which is partnering with biofuel engineering firm Axens in the use of their ethanol-to-jet technology in the United States. ADM also has access to CCS, which could turn mean the biofuels produced are carbon negative.

9 | SAF CHALLENGES

The expansion of SAF supply presents several challenges. It will take time to get production up from the current very low numbers. While several refiners and smaller producers are currently investing considerable sums in new refining units and have already pledged to supply airlines with SAF from 2022, many of these early bio-refineries will not begin to expand output for several years yet—for example, Grandpuits near Paris will not be ready until 2024.

Another challenge is the availability of feedstock.5 For the moment, SAF producers use mainly used cooking oil as feedstock in Europe, and because local supply is insufficient, some of it has to be imported from less reliable sources. Feedstock and supply are problems for SAF because currently it is the only way aviation can decarbonize long-haul flights and feedstock supplies are finite.

The current lack of a spot market for SAF could also be a problem. Since there are only very few suppliers of the sustainable fuel, most of which has already been snapped up under-term deals, there is not yet enough liquidity for spot trade. With limited choice, some airlines had little choice but to pay very high prices given the nascent state of the market and blending mandates.

10 | OUTPUT CONSTRAINTS

By far the most critical of these challenges is potential output constraints caused by limited feedstock availability. A lack of alternatives to SAF to meet the aviation industry’s carbon reduction goals could mean over-reliance on the fuel—which could keep prices prohibitively high. Fossil jet fuel may become the default backup if SAF supplies are not scaled up fast enough to meet the ambitious 5 to 10 mn bpd targets that are forecast for 2050 (see above).

The solution, according to senior industry figures, is to widen the range of waste feedstocks, which can be done by extending the types of processes that are used to refine them. One leading European refiner said most refiners are currently using the more easily processed types of feedstocks, such as used cooking oils and animal fats—which are easily transformed by hydrogenation. But refiners can also use gasification, pyrolysis, and fermentation—with each suitable for diverse types of urban, agricultural and forest residues. A study by Imperial College London Consultants, “Sustainable biomass availability in the EU, to 2050,”6 commissioned by Concawe, the refining industry’s scientific and technical body, claims there is enough waste material in Europe to produce 160 mn t/yr of advanced biofuels by 2050.

The new Fuelling Net Zero 2021 report7 produced by strategic consultancy, ICF, quantifies the number of new SAF production facilities that would be required. It estimates 5000 to 7000 new SAF production facilities would
goals. 2022 and will help Marathon meet its sustainability
f u e l  biorefinery. The plant is scheduled to start-up in
2021. The company is also converting its con-
dition that came online in late 2020 at Fort Dickson in North
Dakota and reached full capacity of about 184 million
gallons per year renewable SAF/diesel plant.

Marathon is involved in another renewable fuel facil-
ity that came online in late 2020 at Fort Dickson in North
Dakota and reached full capacity of about 184 million
gallons per year renewable and sustainable aviation
fuel biorefinery. The plant is scheduled to start-up in
2022 and will help Marathon meet its sustainability
goals. Biofuels' main role has been to reduce emissions among
road vehicles that use liquid fuels, although the main motive
in the United States used to be energy self-sufficiency (they
were first set up as a means of reducing reliance on interna-
tional oil markets after the second oil shock in the late
1970s). Today its main advocates are farmers, as well as
some environmentalists. In the United States, renewable fuel
mandates were delayed in 2021, after 2020 levels were set at
20.09 billion gallons. Advanced biofuel was set at 5.09 billion
gallons, including 590 million gallons of cellulosic biofuel,
and 2.43 billion gallons for biodiesel. Some of these biofuels
could be reprocessed and switched for use in the SAF
market. Clean Fuels Alliance America is being established
this year to convey the industry's evolution to include
renewable diesel and sustainable aviation fuels as well.
The group is optimistic about demand prospects for its
fuels and pointed to ongoing work to help decarbonize the
Northeast's 4 billion gallon/year market for home
heating oil as well as increased interest for biodiesel from
the rail and marine transportation sectors.

11 | MARINE BIOFUELS

Maritime shipping is the most efficient and least
emission-intensive mode of transporting goods over large
distances, with 2021 shipping fuel combustion emissions
accounting for just 2.8% of global CO₂ combustion emis-
sions, according to Platts, despite being responsible for
85% of international transport. However, further deca-
arbonization is tricky. For large vessels, which account for
the majority of international shipping, electrification is
not currently feasible because of the scale of battery
required.

Instead, it is likely that major shippers and the Inter-
national Maritime Organization (IMO) will require low
carbon liquid fuels to meet their carbon reduction goals,
and today this is mostly biofuels—although in future
there may be competition from ammonia and hydrogen.

The IMO wants to reduce the carbon intensity of the
shipping sector by 40% by 2030 (compared with 2008
levels). It then targets a 50% cut in greenhouse gas emis-
sions by 2050, although there are widespread calls from
the more ESG-focused companies in the sector to make
this a 100% cut by 2050. Carbon intensity must improve
by 1.5% per year up to 2030 for the target to be met. Much
of this is currently being done by more efficient opera-
tions and new LNG vessels, although about 30 biofuel
vessels are expected to be in operation by 2025, and many
more beyond that.

Biofuel producers are attempting to meet the antici-
pated marine fuel demand. For example, in late October,
Renewable Energy Group (REG) and Netherlands-based
GoodFuels signed a long-term deal to produce and supply
sustainable marine biofuel to the shipping industry. REG
is among the world's largest producers of biofuels, with
total Q2 2021 output of 132 mn gallons across in Europe
and the United States. GoodFuels already supplies green
marine fuels and plans an increased role for advanced
marine biofuels created by sustainable feedstocks.

Some ambitious shippers are also keen to secure sup-
ply. Container giant AP Moller-Maersk (APMM) is plan-
ing to move faster than the IMO on decarbonization,
with a 60% cut in emissions -planned by 2030 and a net-
zero CO₂ emissions target by 2050. APMM is one of the
world's biggest consumers of bunker fuel, with demand
at 10.37 mn mt in 2020, according to the Maersk Sustain-
ability Report 2020. The report expects several fuel types
to exist alongside each other in the future and has identi-
fied four potential fuel pathways to decarbonization: bio-
diesel, alcohols, ammonia, and lignin-enhanced alcohols.
However, longer term the company has said methanol
and ammonia are the most feasible future marine fuels.

In mid-October Maersk said that it was investing in
Vertoro, a Dutch start-up developing liquid lignin technol-
ogy that can be used as a marine fuel, made from sustain-
ably sourced forestry and agricultural residue feedstock.
The money will be used to build a demonstration plant
showcasing Vertoro's patented liquid lignin technology,
which it plans to develop and commercialize. Lignin is a
complex organic polymer that makes up important structural materials in the support tissues of most plants. It can be blended with methanol, giving it a much higher energy density, and so reducing the size of required tanks or refueling, and bringing down costs.

In September, Maersk also invested in WasteFuel, which turns waste into SAF, sustainable bio-methanol and renewable natural gas using patented processes. Shortly after that it also invested in start-up, Prometheus, which is developing a direct air capture-technology to enable cost efficient, carbon neutral electro fuels.

Maersk is also looking at other biofuels and vessel adaptation. This includes trials that BP and Maersk Tankers have completed using 30% biofuel. The trials saw vessels sail from Rotterdam to West Africa, each supplied with BP Marine B30 biofuel, consisting of 30% fatty acid methyl esters (FAME) blended with low sulfur fuel oil. Feedstocks used to make FAME include used cooking and other renewable oils, and they must be certified to internationally recognized standards.

However, marine biofuel remains an expensive option - biodiesel is about twice the price of VLSFO, according to Platts, and the premium is growing due to rising feedstock costs and rising demand as increasing European blending mandates stimulate buying interest. By December 16th, the FAME FOB ARA premium to 0.5% fuel oil had risen by almost three quarters over 2021, according to S&P Global Platts, to almost double fuel oil's $550/mt level.

REFERENCES
1. Aviation: Benefits Beyond Borders. Waypoint 2050. https://aviationbenefits.org/environmental-efficiency/climate-action/waypoint-2050/. Accessed February 1, 2022.
2. International Air Transport Association (IATA). Net-Zero Carbon Emissions by 2050. https://www.iata.org/en/pressroom/2021-releases/2021-10-04-03/. Accessed February 1, 2022.
3. Inspectioneering. Total to Convert its Grandpuits Refinery into a Zero-Crude Platform for Biofuels and Bioplastics. https://inspectioneering.com/news/2020-09-25/9371/total-to-convert-its-grandpuits-refinery-into-a-zero-crude-platform-for-biofuels. Accessed February 1, 2022.
4. S&P Global. Platts. ExxonMobil buys 49.9% stake in Norwegian biofuels producer Biojet, https://www.spglobal.com/platts/en/market-insights/latest-news/agriculture/011122-exxonmobil-buys-499-stake-in-norwegian-biofuels-producer-biojet. Accessed February 1, 2022.
5. FuelsEurope. Sustainable biomass availability in the EU, to 2050. https://www.fuelesurope.eu/publication/sustainable-biomass-availability-in-the-eu-to-2050/. Accessed February 1, 2022.
6. Maersk Drilling. Sustainability Report 2020. https://cdn.maerskdrilling.com/media/2054/sustainability-report-2020.pdf. Accessed February 1, 2022.
7. ICF. https://www.icf.com/insights/transportation/deploying-sustainable-aviation-fuel-to-meet-climate-ambition. Accessed February 1, 2022.
8. Marathon. Sustainability. https://www.marathonpetroleum.com/Sustainability/. Accessed February 1, 2022.
9. Maersk. Maersk invests in Vertoro to develop green lignin marine fuels. https://www.maersk.com/news/articles/2021/10/14/maersk-invests-in-vertoro-to-develop-green-lignin-marine-fuels. Accessed February 1, 2022.

LOOKING AHEAD

Supply outlook: Exploration collapse in 2021, but capex recovery to boost output

Record low exploration success could threaten supply longer term if oil demand does not pull back due to decarbonization. But, in the short to medium term, rising capex and steady growth among key OPEC producers and in US shale output, should keep the market well supplied.

Reduced budgets and disruption from the Covid pandemic meant oil and gas exploration worldwide saw its worst year since 1946 in 2021, according to data from Rystad Energy. The reduction came as a result of reduced budgets due to both low oil and gas prices and a strategic switch away from growth in fossil output as part of net zero
plans. There has also been more of a focus on short-cycle (shale) production, leaving little left for the type of prospective acreage exploration seen commonly in the past.

Reserve replacement ratios relied on successful exploration to replenish the asset base, and this used to be a key metric used to determine bonuses and oil and gas company value. This has become more or less redundant now most companies have net-zero targets and has largely been replaced with cash-flow targets—which goes to fund low carbon programs, dividends, and share buybacks.

Similarly, the amount of oil and gas found each year used to add to the number of years’ the resource in various countries and globally could satisfy demand. With net-zero targets proliferating it is becoming increasingly clear that it is unlikely that all the oil that has already been found will be extracted—so any new volumes are no longer of much importance.

Much of the remaining conventional oil and gas is located in the Middle East, central Asia, and Russia, where investment is difficult to access, which does leave the door open to higher spending elsewhere to find new reserves with lower above ground risk. But it also means the world could become more reliant on OPEC-plus for oil as it transitions to a zero-carbon energy system.

Timing is crucial. The slump in exploration success is adding to concerns over a lack of upstream investment generally that some observers, including the IEA, have warned will lead to shortages in the medium-to-long term.

1 | HIGHER PRICES AND CAPEX TO EXPAND OUTPUT

However, the recent rally in oil and gas prices may mean enough investment is made now to avoid shortages, as least for a while, although most major upcoming projects were planned before the pandemic. Energy Intelligence Group expects upstream spending to rise to $420 billion in 2022 and $444 billion in 2023—although this is significantly below where it would have been without the pandemic.

While considerable expansion is planned within OPEC-plus, countries outside this block will also add significant barrels, delaying any gain in the block’s market power. Most of this will come from the United States, Brazil, Norway, Canada, and Guyana (see below). Total non-OPEC-plus liquids output is forecast to grow by over 2 mn bpd this year and almost 1.5 mn bpd in 2023.

Current high prices mean US shale producers are once again cash rich, and are beginning to invest in expansion again, especially in the Permian Basin. Preliminary estimates see the Permian adding almost 500 000 bpd crude in 2022 and another 325 000 bpd in 2023. Natural gas liquids (NGLs) from shale production are also expected to grow strongly (adding over 500 000 bpd in 2022-2023), as they have on a regular basis over recent years.

The US Gulf of Mexico is also expected to expand, with a number of deepwater plays in development this year, including 240 000 bpd from BP’s Mad Dog Phase 2 and Shell’s Vito project.

Brazil is expected to see growth in deepwater production from the Mero fields in the Libra Block, as well as expansion at Buzios and a revamp at Marlin—all operated by Petrobras—and at Equinor’s shallow-water Peregino field. In total, over 300 000 bpd more is expected to flow in 2022 and another 150 000 bpd in 2023. There will be further major additions of almost 1 mn bpd in 2025 and 500 000 bpd in 2026.

Elsewhere, ExxonMobil is increasing output at Guyana’s Liza Phase 2 by over 200 000 bpd in 2022 and 2023. And Norway has two big new additions coming onstream soon—Johan Sverdrup is adding 220 000 bpd in capacity in 2022 and the new Johan Castberg fields comes onstream in 2023 with 200 000 bpd. In Canada, a new oil sands project will boost output, along with smaller increases at a number of projects, which should lift output by over 150 000 bpd in 2022 and almost 100 000 bpd in 2023.

The new non-OPEC additions should help meet demand over coming years and avoid overly heavy reliance on OPEC-plus for supply. But the lack of new discoveries means this may not be so easy beyond 2030 to 2035.

How to cite this article: Supply outlook: Exploration collapse in 2021, but capex recovery to boost output. Oil and Energy Trends. 2022;47(2):14-15. doi:10.1111/oet.12908