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ALTERNATIVE FUELS

# Biden's SAF Challenge Requires Tripling of Planned Capacity

Dutch sustainable aviation fuel (SAF) supplier SkyNRG has published its own analysis of how the US low-carbon fuels industry can hope to meet US President Joe Biden's SAF Grand Challenge by tripling planned capacity. It has also updated its earlier work on Europe to reflect plans for a UK SAF mandate.

The self-proclaimed "SAF major" has promised regular updates on the two main SAF markets every six to 12 months. SkyNRG itself is technology neutral with SAF production facilities planned in both Europe and the US. The firm's first 100,000 ton per year (33 million gallon per year) hydroprocessed esters and fatty acids (HEFA) SAF plant in Delfzijl in the Netherlands is due to start production in 2025, ahead of a 50,000 ton/yr (16.6 million gallon/yr) Synkero power-to-liquids (PTL) SAF plant due to start in nearby Amsterdam in 2027, and a 90,000 ton/yr (30 million gallon/yr) PTL facility in the US Pacific Northwest, also due in 2027.

"After more than a decade of successfully working to create demand for SAF, SkyNRG is now focusing on building up SAF capacity to fuel a new era of progress in aviation,'' said SkyNRG CCO Theye Veen last month. The firm already supplies third-party SAF to more than 40 airlines and aircraft manufacturers worldwide.

## US SAF Potential

In its second-ever *Market Outlook on SAF*, published May 2022, SkyNRG says Biden's SAF Grand Challenge for US SAF production to reach 3 billion gallons/yr (8.6 million metric tons/yr) by 2030 is achievable. But it will require rapid feedstock and technology diversification away from the fats, oils and greases (FOGs) and corn ethanol that currently dominate US SAF plans in order to scale up production. At the time of the report's publication, only 15 SAF plants with capacity of 900 million gallons/yr had been confirmed in the US, barely enough to meet a third of Biden's 2030 target. The SkyNRG analysis focuses on what's technically feasible and shaped by government policy rather than cost constraints.

SkyNRG expects the FOG-fed HEFA pathway to contribute less than 300 million gallons/yr to US SAF production in 2030, given feedstock constraints and competition with renewable diesel production. Instead, first-generation corn-based alcohol-to-jet (ATJ) is set to meet a third of Biden's production target or 1 billion gallons/yr, with second-generation waste-based ATJ and Fischer-Tropsch (FT) technologies supplying the remaining 1.6 billion gallons/yr. Conversion of existing surplus US gasoline-ethanol production capacity to SAF may be key to meeting Biden's short-term target. But SkyNRG highlights that such food or feed-based SAF wouldn't be allowed under European SAF blending mandates which only allow waste feedstocks.

The SkyNRG analysis suggests power-to-liquids (PTL) won't play any significant part in meeting Biden's 2030 target, mainly because the current US Renewable Fuel Standard (RFS) only provides fiscal incentives for biogenic feedstocks.

>> continued on page 2

PTL could still be a game-changer in the longer term. SkyNRG sees it making up a third of the US SAF market by 2050, when demand is set to hit 27 billion gallons/yr (75 million tons/yr) under current targets for airlines to use 100% SAF by that date. Some 750 homegrown SAF plants would be needed by 2050 for the US to remain self-sufficient but SkyNRG analysis currently projects a little over 250 SAF facilities active by that date.

Biden's 2030 target is for US production, whereas his administration's longer-term goals for airline SAF use leave the door open to imports. Projected US production of 18 billion gallons/yr (50 million tons/yr) would be enough to meet only two-thirds of expected US SAF demand by 2050. Highlighting the enormity of the challenge, SkyNRG concludes that, "To meet the 100% SAF goal, the US will need to double down on valorizing cellulosic waste feedstocks, develop novel sustainable biomass supply chains and accelerate green hydrogen deployment for power-to-liquids."

## European SAF Demand Takes Off

SkyNRG has also updated its demand and production forecasts for Europe to reflect the impact of UK plans for a SAF blending mandate. The number of SAF plants planned in Europe has gone from 15 when SkyNRG published its first *Market Outlook on SAF* in July 2021 to 23 by last month, boosting regional SAF production capacity from 2 million tons/yr to a potential 2.6 million tons/yr from 2027 onwards. Most current EU plants are HEFA and due on line by 2026, while the bulk of UK facilities utilize municipal solid waste feedstocks via the FT pathway.

Projected European SAF demand is now expected to reach 4.7 million tons/yr by 2030, up from the 3.5 million ton/yr reported in SkyNRG's last report. Demand is also expected to outstrip regional supply one year earlier in 2028. The EU SAF blending mandate is currently set at 5% in 2030 while consultation documents suggest the UK is considering a 10% mandate by the end of the decade. SkyNRG analysis suggests Europe will need to import 2 million tons/yr of SAF by 2030 unless there is large-scale switching of HVO/HEFA capacity from renewable diesel to SAF.

In the long term, Europe would need more than 200 SAF plants making 40 million tons/yr using all available SAF pathways by 2050 in order to be self-sufficient. That is up from capacity of 30 million tons/yr needed the last time SkyNRG ran the numbers — and probably not achievable. SkyNRG's analysis suggests feedstock limits will keep Europe's HEFA SAF production capped at 2.5 million tons/yr, with FT adding 6.5 million tons/yr by 2050, ATJ 14 million tons/yr and PTL 12 million tons/yr. That suggests Europe will need to import around 5 million tons/yr of SAF in 2050.

*Kerry Preston, London*

MARKET FORCES

# Fuel Shortages Loom After EU Agrees Russian Oil Ban

A new EU agreement to ban Russian oil imports has sparked fresh jet fuel supply fears in Europe. The region is heavily dependent on Russian ultra-low-sulfur diesel (ULSD) imports and the scramble to find alternatives is likely to hit critical jet fuel flows from the Mideast and Asia this summer.

A London-based jet trader put it simply: "You make more diesel and you don't have enough jet, and vice versa."

Europe's airlines are already struggling to fuel their post-pandemic recovery, even as widespread flight cancellations caused by staff shortages keep a tight lid on demand.

The embargo plans were almost derailed by Hungary's worries about crude supplies, but products will be Europe's pain point. And traders know it: Gains in ICE low-sulfur gasoil (LSGO) futures outpaced Brent crude by 3-to-1 when the markets opened to the embargo news on Tuesday, propelling diesel and jet fuel prices to new highs.

## EU Claims 90% Ban

Brussels claims its May 31 plan to ban seaborne Russian crude and product exports by the end of this year will hit 90% of Russian oil flows. All of the 1.1 million barrels per day of Russian oil products the EU imported last year — mainly gasoil and fuel oil — was shipped by sea, along with around two-thirds of the 2.3 million b/d of Russian crude the bloc imported.

A further 800,000 b/d of Russian crude is transported through the Druzhba pipeline, only some of which is set to continue beyond the end of the year. Brussels was forced to provide a temporary exemption for the 300,000 b/d carried on the southern leg of the pipeline to Hungary, Slovakia and the Czech Republic in order to win Hungary's support. But Druzhba's bigger northern leg customers Germany and Poland have already committed to a full embargo on Russian oil by the end of the year.

## New Trade Routes

The EU move will push more Russian oil onto the global market. India and non-EU Turkey have already emerged as major buyers of discounted Russian crude, with China likely to follow. All could ramp up jet fuel and diesel sales to Europe as a result, although current market dynamics suggest their focus will increasingly be on diesel.

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Unwanted Russian ULSD is meanwhile already heading to North Africa with occasional tankers moving to South America. That trans-Atlantic trade is expected to increase, potentially freeing up US Gulf Coast exports to Europe and relieving some of the market pressure. European diesel brokers had been confident that would happen shortly after Russia's invasion of Ukraine but underestimated the post-pandemic strength of US diesel demand. They also underestimated the willingness of some European oil traders to keep handling tainted but cheap Russian fuel.

Making the situation even harder to second-guess is the fact that Europe's refiners could struggle to make as much diesel and jet fuel themselves if replacement crudes aren't as distillate-rich as Russian Urals. Natural gas and blue hydrogen shortages have already hit their ability to make ULSD and increased the region's dependence on imports at the worst possible time.

*Staff Reports*

SPOT CARGO MARKETS

# Europe's Gasoil Contract Sees Shortage, Hits Fresh High

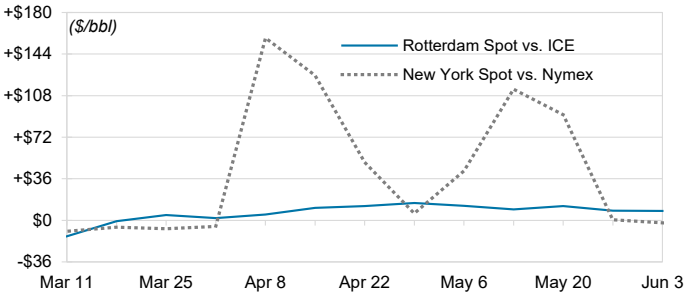
Europe's gasoil contract on ICE Futures hit a fresh high of $1,300 per ton on Jun. 2 in an attempt to lure cargoes from far afield to replace Russian diesel and replenish storage tanks — for both diesel and jet fuel. Russia's product exports from the Baltic and Black Seas have already dropped by 600,000 barrels per day and more might be looming after the EU not only finalized a ban on imports by the end of the year but also slapped insurance sanctions on all vessels carrying Russian oil. Both crude oil and refined product prices remain in steep backwardation with the premium for prompt prices signaling an undersupplied market.

The last time Brent averaged around $110, in 2011-14, Europe's gasoil contract never strayed long beyond $1,000/ton. Back then, high crude prices were an incentive to invest more in upstream capacity. Now, skyrocketing product prices signal a need to invest foremost in more refining capacity. More capacity is coming on line later in the year and in 2023, in China, the Mideast and the US, but that is too late to meet higher demand in the coming months. Tight product supply is set to keep fuel prices on the boil. Forward price curves show all products are undersupplied, not just middle distillates but also gasoline and fuel oil.

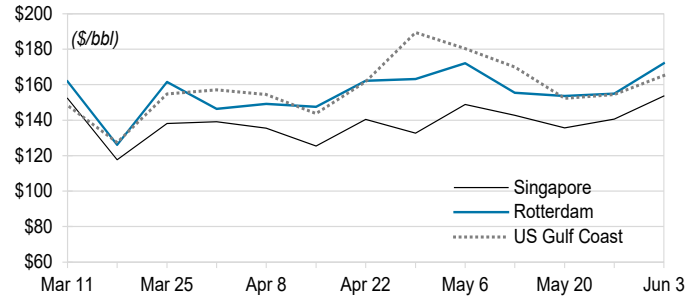
In a prelude, European jet fuel prices jumped again after the EU ban with markets extra jittery ahead of London's Jun. 2-5 closure for the Queen's Platinum Jubilee. Seaborne crude and product flows plus crude carried along the northern leg to Germany and Poland will be embargoed to the tune of 3.1 million b/d. Europe's jet fuel traders fear the scramble to find alternatives to the 1 million b/d or so of Russian diesel included in that figure will impact lifeblood jet fuel imports from the Mideast and Asia. So far, Russia has kept the crude exports flowing through steep discounts. Keeping the product flows going will be harder, especially with additional shipping insurance sanctions limiting transport options.

East of Suez refiners had only just started switching back to jet production after Covid-19. Indian refiner Reliance made its first appearance in Europe's end-of-day pricing window Jun. 1, offering jet on board the LR1 *Hafnia Arctic* from Jamnagar and due into Rotterdam Jun. 18-22. Reliance has been taking full advantage of Russia's pariah status by picking up unwanted Russian crude cargoes at a steep discount and selling the resulting non-Russian diesel and jet at a premium. Jet fuel stocks are too low to provide much of a safety net for European carriers. Jet tanks in Amsterdam-Rotterdam-Antwerp stood just above 800,000 tons on May 27, according to Insights Global, down from almost 1.2 million tons the same time last year. The only bearish note came from airport staff shortages that are capping Europe's jet demand at around 1.2 million b/d, or around 85% of pre-pandemic levels. The holiday week saw widespread flight cancellations, especially in the UK. There is little sign that

JET-GASOIL SPREADS




SPOT JET FUEL PRICES




EUROPEAN QUARTERLY JET FUEL SWAPS QUOTES

*(Bid/Offer Range in $/ton, c.i.f. NWE)*

| Q | Chg. | Jun 1 | May 27 |
|---|---|---|---|
| Q3'22 | 75.50 | 1,238.50 - 1239.50 | 1,163.00 - 1,164.00 |
| Q4'22 | 56.75 | 1,129.00 - 1130.00 | 1,072.25 - 1,073.25 |
| Q1'23 | 35.25 | 1,037.75 - 1038.75 | 1,002.50 - 1,003.50 |
| Q2'23 | 25.00 | 984.50 - 985.50 | 959.50 - 960.50 |

*Prices are live for midday. Source: FCStone*

higher jet fuel costs are being reflected in higher ticket prices. "You can book forward flights cheaply," said a leading jet trader, "but will those flights actually happen?" No jet cargoes traded in Europe's end-of-day pricing window with all market discussions on a Platts-related basis — a standard market move in times of stress.

Jet markets in the US remain tight, with spot prices high even as the discount to benchmark Nymex diesel futures widens. New York Harbor jet fuel now trades more than 10¢ below diesel futures, while the Gulf Coast spread is some 28¢. Like other products, jet fuel markets face strained downstream capacity, thin inventories and robust demand that seems stubborn in the face of high outright prices. Nationwide jet stocks were 39.6 million bbl, according to the Department of Energy, up 500,000 bbl from the week prior. Implied demand, meanwhile, rose 184,000 b/d to 1.7 million b/d, matching nationwide output of 1.7 million b/d. Jet could face even tighter times ahead, however. Energy Intelligence's downstream model shows gasoline cracks against incremental medium, sour crude are now rivaling diesel. Meanwhile, refiners are bidding up prices for light, sweet crude richer in gasoline components than middle distillates.

The Asian jet market rebounded as prompt jet demand received some support from recovering overall air traffic in Asia's three largest regional aviation markets. The benchmark Singapore spot price differential jumped to a premium of $4.32 per barrel to Singapore quotes on Jun. 1, its highest level in nearly three weeks. The differential subsequently weakened to a premium of $3.90/bbl to Singapore quotes on Jun. 2, although that still represents a jump of 64¢/bbl compared to a week ago. Two arbitrage cargoes loaded from Asia and the Mideast through end May with more arbitrage jet from the two regions loading in early to mid-June. A 320,000 bbl jet cargo loaded on May 30 from Japan and is headed to Alaska, with an expected arrival date of Jun. 12, according to data intelligence company Kpler. Another 332,000 bbl cargo loaded from the United Arab Emirates on May 29 and is headed to France with an expected arrival date of Jun. 18. For June so far, a total of 1.62 million bbl of arbitrage jet have loaded or are scheduled to load from India and South Korea from Jun. 1-8. The volumes are pointed at Europe and West Africa. Another 1.96 million bbl of arbitrage jet have loaded or are scheduled to load from Kuwait, Saudi Arabia, Qatar and the UAE from Jun. 3 through Jun. 8, according to Kpler. The volumes are all pointed at Europe. Scheduled airline capacity expanded in Northeast and Southeast Asia, with the increases outweighing a marginal dip in South Asia. Scheduled capacity for the week of May 30 recovered by 1.4% from the previous week in Northeast Asia, the world's third-largest regional aviation market, according to aviation data analysis firm OAG. Scheduled capacity also rose by 2.9% over the same period in Southeast Asia, Asia's second-largest regional market. These more than offset the slight 0.1% decline over the same period in South Asia, Asia's third-largest regional aviation market, OAG noted.

*John van Schaik and Frans Koster, New York, Kerry Preston, London, Freddie Yap, Singapore*

## IN BRIEF

### Neste Expands SAF Sales in Japan

Mideast carrier Etihad has become the first overseas customer for Neste-made sustainable aviation fuel (SAF) in Japan as the country moves to 10% SAF use by 2030. "This delivery … is a major step forward in further growing the use of our sustainable aviation fuel in the Japanese market," said Neste Vice President, Asia-Pacific, Renewable Aviation Sami Jauhiainen in a May 27 statement. Neste is working with Japanese conventional fueling company Itochu to supply SAF at Japan's two biggest airports: Narita International and Tokyo Haneda. SAF will initially come from Neste's Porvoo SAF plant in Finland, at least until the firm's 1 million ton/yr Singapore expansion project is complete in the first quarter of next year.

The Japanese government is meanwhile working on incentives to boost domestic SAF production. A report by the Japan Transport and Tourism Research Institute (JTTRI) came up with a maximum potential production figure of 7 billion-13 billion liters/yr (1.5 billion-2.9 billion gallons/yr) by 2030, with power-to-liquids supplying around two-fifths and second-generation Fischer-Tropsch or alcohol-to-jet pathways using municipal and industry waste feedstocks a further third. The 10% target is roughly 1.4 billion liters/yr (310 million gallons/yr).

### South Korean Refiners Switch to Max Jet Mode

Korea - Latest data from Korea National Oil Corp. (KNOC) show South Korean jet production hitting 348,000 b/d in April, up a whopping 71,000 b/d on March, at the same time that gasoil output fell 70,000 b/d to 913,000 b/d. Jet exports rose by 12,000 b/d to 222,000 b/d in April while jet inventories rose by a massive 41% from 3.6 million bbl at the end of March to 5.08 million bbl by the end of April. Refinery runs were up 26,000 b/d on the month to 2.78 million b/d with utilization rates up from 77.9% to 78.7%.

### Aemetis Adds Alaska Airlines to Roster for SAF

California-based Aemetis has added Alaska Airlines to its roster of customers for low-carbon sustainable aviation fuel (SAF) from a plant that is due on line in 2025 in the agricultural Central Valley. The company is building a 90 million gallon/yr "Carbon Zero 1" biorefinery that will use onsite hydroelectric and other renewable power sources to convert orchard wood waste into green hydrogen for SAF and renewable diesel production. The process further reduces carbon intensity by injecting the plant's CO2 into a sequestration well to capture 200,000 tons/yr. The offtake agreement with Alaska covers 13 million gallons of blended SAF over seven years for flights out of San Francisco Airport. Most of the plant's output is already committed under much larger supply deals for San Francisco Airport. Late last year Aemetis signed agreements with Delta (250 million gallons) and American Airlines (280 million gallons) covering seven to 10-year periods. Other customers include Japan Airlines (90 million gallons), Qantas (35 million gallons), Finnair (17.5 million gallons) and JetBlue (125 million gallons).

# THE METHODOLOGY BEHIND JFI'S PRICE PAGE

The Jet Fuel Intelligence data track prices and trends in spot cargo and futures markets as well as key biofuel prices, providing a concise summary of weekly trends. Spot cargo and futures prices represent weekly averages, and last week quotes are subject to revisions since JFI goes to press before final Friday prices are available. Assessments for regional prices are based on the common cargo size for that particular area. Quotes reported for the New York Mercantile Exchange and the Intercontinental Exchange (ICE) contract reflect the weekly average for the front-month contracts. Cargo prices are provided by Thomson Reuters as well as OPIS.

In the Key Biofuel Prices table, prices are listed for some of the main ethanol and biodiesel markets in the US and Europe. In the US there are prices for two futures contracts, the front-month CME CBOT ethanol contract and the front-month Nymex RBOB contract, as the equivalent gasoline contract. There are also prompt-month prices for ethanol in three spot markets: the Midcontinent hub, New York Harbor and the US Gulf Coast.

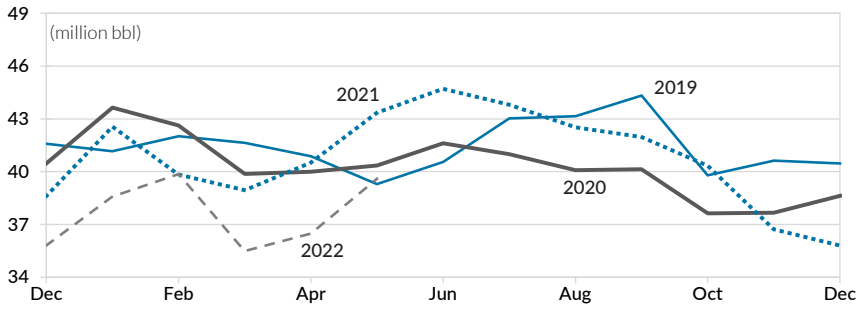
In Europe we list benchmark gasoil futures prices on the ICE in addition to prompt barge prices on a dollar-per-metric-ton basis f.o.b. in the Amsterdam-Rotterdam-Antwerp (ARA) market for unleaded premium gasoline and ultra-low-sulfur diesel (ULSD) as fuel reference prices alongside a range of biodiesel prices, all provided by Thomson Reuters.

Biodiesel prices are all quoted on a dollar-per-ton basis. Fatty Acid Methyl Ester (FAME) matches European fuel standards for summer grade with a cold filter plugging point (CFPP) of 0°C, and winter grade with a CFPP of -10°C on an f.o.b. ARA basis. Prices are also quoted for the main forms of feedstock biodiesel used in blending in Europe: SME produced from imported soya oil has a CFPP of around 0°/-5°C and is quoted on a c.i.f. ARA basis; PME produced from imported palm oil has a CFPP of +11°/+15°C and is quoted on a c.i.f. ARA basis; while RME produced from rapeseed has a CFPP of -10°/-12°C and is quoted on an f.o.b. ARA basis by Reuters on the basis of prices published by brokerage Kingsman SA.

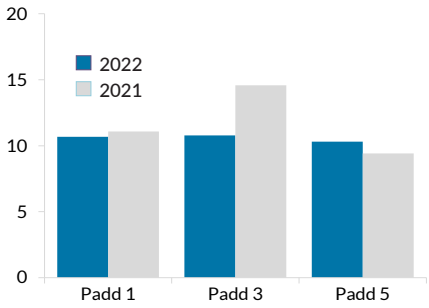
The JFI data table also charts mid-distillate crack spreads for Nymex heating oil versus ICE gasoil on a weekly and monthly basis, as well as global carbon and carbon futures prices from the ICE. EUAs are the credits used in the EU Emissions Trading System. Each is equivalent to one metric ton of carbon dioxide ($CO_2$) and are used by power generators and large industrial plants to cover their emissions. EUAs can be bought in the market, are auctioned by government, with some given away free.

## US SUPPLY, DEMAND AND STOCK TRENDS AT A GLANCE

### US JET KEROSENE STOCKS




### REGIONAL STOCK LEVELS, MAY 27




| JET KEROSENE STOCKS | 2022 | | | | | 2021 | | Latest Levels vs. | |
|---|---|---|---|---|---|---|---|---|---|
| (million bbl) | May 27 | May 20 | May 13 | Apr (p) | Mar p | May 28 | Apr | May 20 '22 | May 28 '21 |
| East Coast (Padd 1) | 10.7 | 8.7 | 8.7 | 8.8 | 7.3 | 11.1 | 10.7 | +22.9% | -3.6% |
| West Coast (Padd 5) | 10.3 | 9.8 | 9.5 | 8.5 | 8.2 | 9.4 | 8.8 | +4.7 | +9.5 |
| Central (Padd 2-4) | 18.6 | 20.6 | 20.1 | 19.2 | 19.9 | 21.8 | 21.1 | -9.5 | -14.6 |
| **Total Stocks** | **39.6** | **39.1** | **38.3** | **36.5** | **35.5** | **42.3** | **40.5** | **+1.3%** | **-6.4%** |

| | 2022 | | | | 2021 | | Latest Wkly. | Apr '22 vs. | Mar '22 vs. |
|---|---|---|---|---|---|---|---|---|---|
| ('000 b/d) | May 27 | 4 Wk. Avg. | Apr p | Mar p | Apr | Mar | Change | Apr '21 | Mar '21 |
| Jet Refinery Output | 1,715 | 1,734 | 1,640 | 1,417 | 1,263 | 1,101 | +0.2% | +29.8% | +28.7% |
| % Jet Yield | 10.3 | 10.5 | 10.2 | 8.7 | 7.1 | 6.5 | +0.9 | +43.3 | +33.9 |
| % Utilization | 92.6 | 91.9 | 90.0 | 91.2 | 86.2 | 82.0 | -0.6 | +4.4 | +11.2 |
| Imports | 250 | 138 | 128 | 130 | 141 | 93 | +194.1 | -9.2 | +39.6 |
| Sales | 1,716 | 1,579 | 1,534 | 1,487 | 1,279 | 1,158 | +12.0% | +19.9% | +28.4% |

p=Preliminary. *Source: US Department of Energy. Latest available data, including historical revisions.*

# JET FUEL INTELLIGENCE DATA

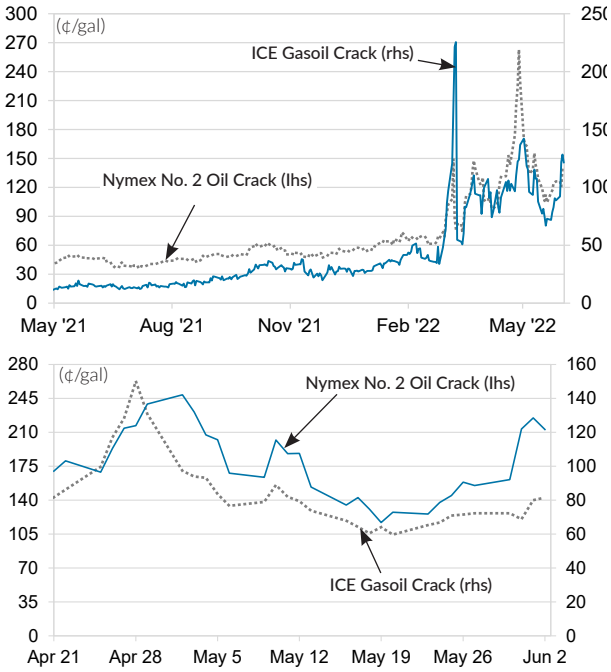
## PRICES IN SPOT CARGO AND FUTURES MARKETS

| | ICE Prompt Futures ($/ton) | European Spot Jet Fuel ($/ton)* | | Asian Spot Jet Fuel Markets ($/bbl)† | | |
|---|---|---|---|---|---|---|
| | Gasoil 0.1% Sulfur | NW Europe | Mediterranean | Mideast | Singapore | Japan c.i.f. |
| Weekly Trend | +121.69 | +120.74 | +89.20 | +12.47 | +11.58 | +12.88 |
| This Week | 1242.19 | 1,360.19 | 1,259.63 | 149.18 | 153.70 | 156.66 |
| Previous Week r | 1120.50 | 1,239.45 | 1,170.43 | 136.71 | 142.12 | 143.79 |
| May 16-May 20 | 1069.05 | 1,201.45 | 1,171.40 | 132.56 | 135.81 | 141.29 |
| May 9-May 13 | 1118.75 | 1,235.25 | 1,247.82 | 137.08 | 141.95 | 145.57 |

| | Nymex Prompt Futures ($/gal) | | US Spot Jet Fuel Markets (¢/gal) | | |
|---|---|---|---|---|---|
| | NY Harbor ULSD | New York† | US Gulf† | Chicago* | Los Angeles† |
| Weekly Trend | +0.27 | +19.59 | +22.29 | +20.61 | +35.38 |
| This Week | 4.15 | 404.67 | 393.37 | 415.35 | 421.20 |
| Previous Week r | 3.88 | 385.08 | 371.08 | 394.74 | 385.82 |
| May 16-May 20 | 3.78 | 546.24 | 359.94 | 397.26 | 371.04 |
| May 9-May 13 | 3.91 | 652.21 | 403.86 | 409.62 | 393.41 |

*r=Revised.* Source: *OPIS Worldwide Jet Fuel Report, †Refinitiv .

## DISTILLATE CRACK SPREADS – ICE vs Nymex







## KEY BIOFUEL PRICES

| US ($/gallon) | May 27 | May 20 | Chg. |
|---|---|---|---|
| **Futures** | | | |
| CBOT Ethanol | 2.76 | 2.75 | +0.00 |
| RBOB Gasoline | 3.87 | 3.87 | -0.00 |
| **Spot market:** | | | |
| Ethanol Midcont. | 2.76 | 2.68 | +0.08 |
| Ethanol NY Harbor | 2.84 | 2.76 | +0.08 |
| Ethanol US Gulf | 2.83 | 2.75 | +0.08 |
| **Europe ($/ton)** | **May 27** | **May 20** | **Chg.** |
| **Futures** | | | |
| ICE Gasoil | 674.35 | 641.80 | +32.55 |
| **Spot market** | | | |
| Gasoline | 745.80 | 709.56 | +36.24 |
| Diesel | 664.00 | 646.35 | +17.65 |
| **Biodiesel:** | | | |
| Fame 0 | NA | NA | NA |
| RME | NA | NA | NA |
| SME | NA | NA | NA |
| PME | NA | NA | NA |

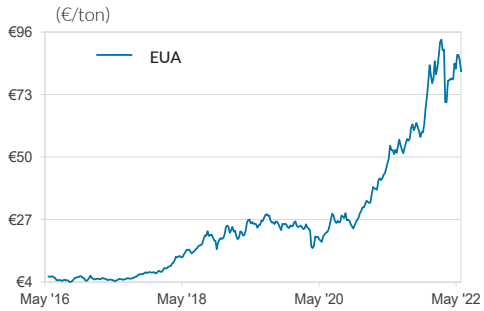
*Source: Refinitiv, Exchanges*

## GLOBAL CARBON PRICES

| (€/ton) | May 31 | May 24 | Chg. |
|---|---|---|---|
| EUA Dec '22 | 84.02 | 81.32 | +2.70 |
| **US ($/ton)** | | | |
| CCA (Calif.) Dec '22 | 32.75 | 31.47 | +1.28 |
| RGGI (NE) Dec '22* | 13.90 | 13.86 | +0.04 |
| **New Zealand (NZ$/ton)** | | | |
| NZU (spot) | 76.85 | 77.00 | -0.15 |
| **Asia ($/ton)** | **May 27** | **May 20** | **Chg.** |
| China (National) | 8.81 | 8.67 | +0.14 |
| South Korea | 17.89 | 16.17 | +1.72 |

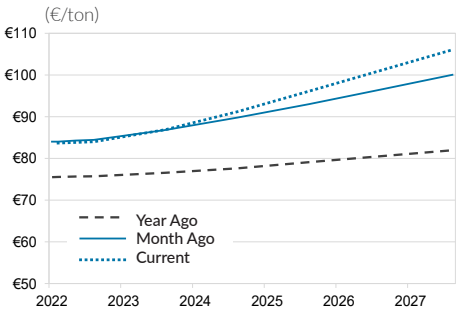
Benchmark months. *Short tons; all others metric tons.Based on given week's exchange rates. Source: ICE, OMF

## EU CARBON FUTURES PRICES




ECX front-month futures. Source: ICE

## EU CARBON FORWARD CURVE




ECX EUA forward curve. Source: ICE

DATA: JFI's biofuel and carbon data are sourced from EI New Energy, Energy Intelligence's publication on renewables, carbon and transportation. For more data and information, see www.energyintel.com/newenergy.