

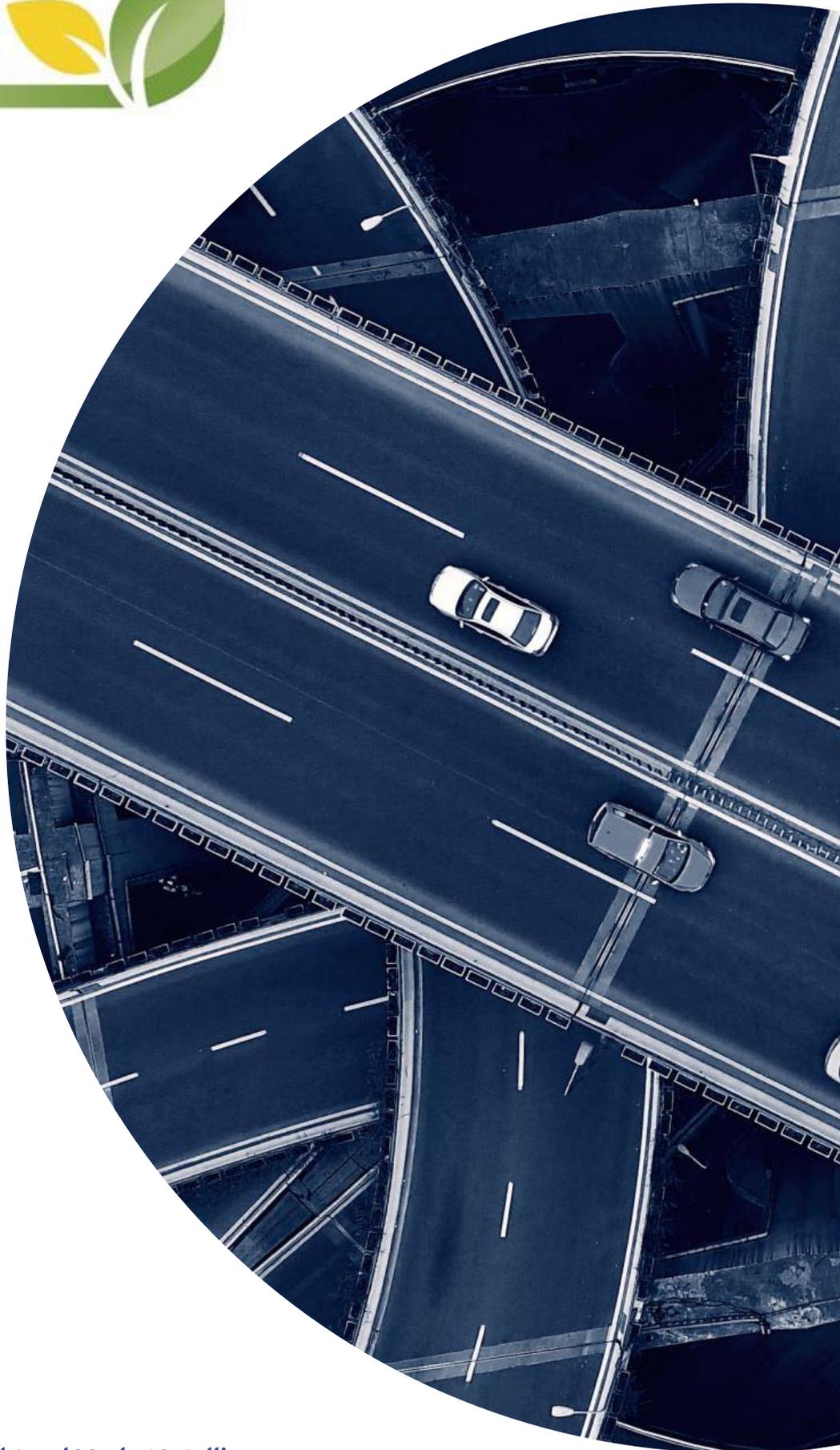
The Bioeconomy Consultants



BIOFUELS

Each month we review the latest news from across the global biofuels sector.

April 2022



Your Partners for Business Insight and Market Intelligence

Providing clients with a strategic view of feedstock, technology, policy and marketing opportunity across the bioeconomy.

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Foreword

Welcome readers, to this month's Biofuels News Review.

Because of methanol's high octane and oxygen content, it is blended in low quantities with gasoline to substantially reduce vehicle exhaust emissions – a solution that was economically viable before biofuel blending mandates or government subsidies, according to the Methanol Institute. Alternatively, it is used in biodiesel production, methyl tert-butyl ether (MTBE) production – another chemical which is blended with gasoline for cleaner burning, or in dimethyl ether (DME) production, a promising fuel in its own right (in LPG blends) or for use in diesel engines. Methanol is also being examined as a marine fuel that, when obtained from biobased resources, can provide a sustainable alternative to heavy fuel oil (HFO) to help meet strict emissions regulations in the shipping industry.

Danish shipping company Maersk has recently established six partnerships with various companies to support global green methanol production, to source over 700,000 tonnes/year of methanol fuel by the end of 2025 via these offtake agreements. The partnering companies are based across the world, but the resulting projects from these partnerships will be built in the Americas and China. A variety of feedstocks will be utilised for green methanol production depending on the company involved – from agricultural and non-recyclable forestry residues to municipal solid waste. In addition, Maersk's partnerships with renewable energy company European Energy, and Danish power company Orsted, will develop e-methanol projects, which utilise CO₂ captured from industry, and renewable hydrogen from electrolysis. This abundance of methanol production will drive the eight large methanol-fuelled container ships that Maersk have ordered, for arrival in 2024.

Newer technologies, processes, and feedstocks can be introduced to provide alternative pathways for commercial biobased methanol production. In Finland, Veolia has integrated the refining of crude sulphate methanol into a pulp mill production process to create CO₂-neutral biomethanol for low carbon biofuel. Elsewhere, in Rotterdam, GIDARA Energy will deploy their High-Temperature Winkler (HTW®) technology to convert non-recyclable waste into advanced methanol, in a new project very similar to their existing one in Amsterdam.

Novel methods of methanol production are also being researched and developed to assess their potential for future implementation. German research institute Fraunhofer UMSICHT has successfully operated a demonstration scale plant in which feed gas containing carbon monoxide, carbon dioxide, nitrogen, and hydrogen, mixed to resemble steel mill gases, was converted to methanol. They consequently plan to run tests under real steel mill conditions in Duisburg.

Read on for the latest news.

Policy

UK fuel duty cut

The UK Chancellor has presented the Spring Statement. Measures to support businesses include cutting fuel duty on petrol and diesel by 5p per litre for 12 months, worth around £200 for the average van driver and £1,500 for the average haulier.

This came into effect on midnight 23rd March 2022. This is the biggest cut ever on all fuel duty rates and represents an action to address recent energy costs inflation concerns following the supply crisis caused by return from the COVID crisis and the Russian invasion of Ukraine.

Click [here](#) for more information.

Industry supports UK mandate on SAF

A total of 79 stakeholders, including airlines, airports, fuel producers and suppliers who responded to the UK government's proposal to introduce a sustainable aviation (SAF) mandate, were broadly in favour of its introduction from 2025. The UK last year proposed introducing a mandate for up to 10% SAF by 2030 and up to 75% by 2050 with the obligation starting in 2025.

Most respondents to the consultation agreed that the proposed mandate should start in 2025 because this allows sufficient time for the fuel industry to prepare and should apply to the fuel supplier. And they were largely in favour of a greenhouse gas (GHG) emissions scheme, rather than a volumetric mandate.

Most stakeholders agreed that the targets should assume a linear growth up to 2035 and

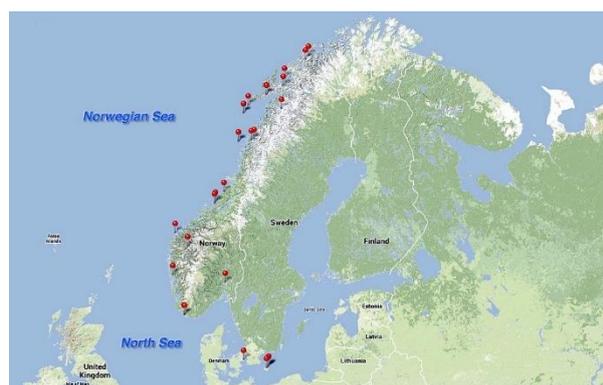
an exponential growth after that date, and agreed that the mandate should align with EU mandate provisions as well as EU ETS and Corsia schemes to prevent the risk of tankering and the double counting of emissions reductions.

Most respondents agree with the SAF sustainability criteria proposed by the government, including minimum GHG savings for the fuels, although several stakeholders felt that setting out a list of eligible feedstocks was premature.

Respondents were fairly evenly divided in their views on the introduction of a cap for hydroprocessed esters and fatty acids (HEFA) SAF, currently the most developed production method, although there was a broad agreement that an excessive reliance on HEFA would be detrimental to the environment and feedstock competition for other uses.

Click [here](#) for more information.

Norway proposes to drop double counting for waste derived fuels



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The Norwegian Environment Agency (NEA) has proposed an increase in the amount of waste and advanced biofuels used in road and off-road transport from 1 July 2022 following

public consultation. But the overall biofuels mandate for road fuels will fall as part of the proposals, from 24.5% to 17% by volume.

The sub-mandate for waste and advanced biofuels for road use, derived from Annex IX part A and B of the EU's Renewable Fuel Energy directive (RED II) and currently capped at 9%, will increase to 12.5% under the proposals.

Double counting for waste and advanced biofuels will no longer be accepted towards the overall target, except when the 12.5% sub-mandate has been exceeded. Previously, while double counting did not apply to meeting the Annex IX sub-mandate, waste and advanced biofuels could be double counted to meet the overall target. This could raise the actual volume of biofuels within the road fuel mix to around 17%, from a maximum of 15.5% currently, because of the abolition of double counting.

Currently, the Norwegian road fuel biofuel mandate allows for the double counting of waste and advanced biofuels and was originally scheduled to increase this year from 24.5% to 25.1%.

The NEA is carrying out an assessment for a possible increase in the aviation biofuel mandate for 2023 and 2024, with public consultation likely later this year.

Click [here](#) for more information.

Markets

oneworld® Alliance members plan to purchase up to 200 million gallons of SAF per year from Gevo



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one world® Alliance, a network of world-class airlines, and Gevo, Inc. have announced that certain one world members plan to purchase up to 200 million gallons per year of sustainable aviation fuel from Gevo. The delivery of the SAF is expected to commence in 2027, for a five-year term.

one world members Alaska Airlines, American Airlines, British Airways, Finnair, Japan Airlines and Qatar Airways expect to utilise Gevo's SAF for their operations in California including San Diego, San Francisco, San Jose and Los Angeles International Airports.

One member has already executed a binding fuel sales agreement whereby Gevo expects to produce and sell 30 million gallons per year of SAF in support of the one world Alliance SAF Purchase Goal. Based on current assumptions, including those around future pricing of commodities and the future values of certain environmental benefits, Gevo estimates that the fuel sales agreement should generate approximately \$800 (£615) million of revenue, inclusive of the value from environmental benefits, across the life of the contract.

Gevo's SAF is expected to be produced using field corn products that will then be processed to create ethanol that will then be converted into SAF. Gevo expects to produce the SAF at one or more facilities under development in the Midwest of the United States.

Click [here](#) for more information.

Delta Air Lines signs 75 million gallon per year agreement with Gevo



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Gevo, Inc. has signed a "take-or-pay" agreement with Delta Air Lines, Inc. to supply 75 million gallons of sustainable aviation fuel per year for seven years. Based on current assumptions, including those around future pricing of commodities and the future values of certain environmental benefits, Gevo estimates that the agreement should generate approximately \$2.8 (£2.15) billion of revenue, inclusive of the value from environmental benefits, for Gevo over the seven-year term of the agreement.

The agreement replaces the existing agreement signed with Delta in 2019 to purchase 10 million gallons per year and bolsters Delta's commitment to incorporating SAF into its operations.

The agreement is subject to certain conditions precedent, including Gevo developing, financing and constructing one or more production facilities to produce the SAF contemplated by the agreement. A copy of the agreement between Delta and Gevo has been filed with the U.S. Securities and Exchange Commission on Form 8-K.

Click [here](#) for more information.

Repsol builds Spain's first advanced biofuels plant in Cartagena

Repsol will build the first low-emissions advanced biofuels plant in Spain at its refinery in Cartagena. The plant will have an annual production capacity of 230,000 tonnes of hydrobiodiesel, biojet, bionaphtha, and biopropane.

The plant, projected to be operational in 2023, will produce advanced biofuels from recycled raw materials to be used in aircraft, trucks, or cars. The new advanced biofuels will make it possible to cut CO₂ emissions by 820,000 tonnes per year.

This pioneering facility will represent an investment of €188 (£157) million. The new facility will include the commissioning of a hydrogen plant that will fuel a new hydrotreatment unit equipped with cutting-edge technology.

The company emphasised the circular economy as a tool for the efficient use of resources and noted that it will double production of high-quality biofuels from vegetable oils (HVO) to 545,000 tonnes by 2030, half of which will be produced from waste before 2025.

Spanish legislation has established, in the Integrated National Plan for Energy and

Climate (PNIEC), a stricter target of 28% renewable energy in transportation for 2030. With this new project, Repsol stays one step ahead of the regulatory framework and decisively advances towards its goal of becoming a carbon neutral company by 2050.

Click [here](#) for more information.

Veolia launches an industrial solution to produce CO₂-neutral biofuel from pulp production



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Veolia has launched the world's largest biorefinery project producing CO₂-neutral bio-methanol from a pulp mill, located in Finland. The project allows unlocking of the potential of this alternative source of feedstock for biofuel that is almost completely unexplored to date.

Developed in close cooperation with Metsä Fibre, the largest cooperative forestry association in Europe, the refinery will be based on Veolia's innovative industrial scale concept of commercial bioproduct-derived biomethanol production, which safely integrates the refining of crude sulphate methanol into the pulp production process.

The project will contribute to European energy security while supporting the European Green

Deal decarbonisation ambitions for transportation, as the industrial grade quality CO₂-neutral biomethanol represents a new source of sustainable low carbon fuel replacing fossil-based fuels.

The refinery, owned and operated by Veolia, will be adjacent and partly built into Metsä Fibre's Äänekoski plant in Finland. With an annual production capacity of 11,000 tonnes, the plant, due to come on stream by 2024, will avoid up to 27,000 tonnes of CO₂ emissions per year. The €50 (£42) million investment is supported by a grant from the Finnish ministry of economy and employment.

Click [here](#) for more information.

Topsoe supports new production of sustainable aviation fuel and renewable diesel in Ontario, Canada

Refuel Energy Inc. has announced its plans for the construction of a 3000 barrels (126,000 gallons) per day renewable fuel plant in Southern Ontario, Canada.

The proposed project, called Refuel YYZ, would supply the aviation and terrestrial fuel needs of the Greater Toronto area, home to 6 million Canadians, while lowering the CO₂ emissions for the end users by up to 80%. It is also strategically located for exporting to the US Northeast.

The plant would utilise Haldor Topsoe's proprietary HydroFlex™ and H2bridge™ technologies for the production of renewable diesel and sustainable aviation fuel (SAF). Planned feedstocks include a mix of waste fats, oils and greases, such as regionally-sourced used cooking oil, animal fats and non-edible crop oils.

Refuel expects to make a final investment decision in 2023. If approved, production at the new facility would start in 2025.

Click [here](#) for more information.

GIDARA Energy's Rotterdam facility will convert non-recyclable waste into advanced methanol



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GIDARA Energy and the Port of Rotterdam have announced GIDARA's next advanced biofuels facility in The Netherlands: Advanced Methanol Rotterdam (AMR). Located in the Port of Rotterdam, the plant will convert non-recyclable waste into advanced methanol.

The advanced methanol achieves CO₂ emission reductions outlined in the Renewable Energy Directive II (RED II) and Fit-for-55 frameworks. The renewable fuel will replace fossil fuels, creating significant carbon savings. The Port of Rotterdam Authority has provided a unique site location in the port for this facility.

In 2021, GIDARA Energy announced Advanced Methanol Amsterdam, a state-of-the-art renewable fuels facility that will serve as a blueprint for AMR. The two facilities will be identical, utilising GIDARA's patented High-Temperature Winkler (HTW®) technology,

which converts non-recyclable waste to renewable fuels. This technology has been used commercially in four other waste to clean syngas production facilities.

Advanced Methanol Rotterdam will achieve a reduction of 320,000 tonnes of carbon dioxide equivalents (CO₂eq) of greenhouse gas (GHG) emissions per year, producing approximately 80,000 tonnes of renewable methanol yearly by converting 160,000 tonnes of local non-recyclable waste that is currently being incinerated.

The facility is scheduled to start detailed engineering and commence construction in the first half of 2023, when a permit is received, and start production of renewable methanol in 2025.

Click [here](#) more information.

Research & Development

Increasing moves towards 100% biofuel for aviation

Tests to use 100% sustainable aviation fuel (SAF) in aircraft engines are growing in a bid to surpass the current blending requirements set out by the American Society for Testing and Materials (ASTM), which only allow up to 50% of SAF to be blended with fossil jet fuel.

Aircraft manufacturer Airbus has recently performed a first A380 flight powered by 100% SAF, for which 27 tonnes of unblended biojet were provided by TotalEnergies. The SAF was produced in Normandy from waste fats and used cooking oil (UCO). This is the third Airbus aircraft type to fly on 100% SAF over the last year, the company said.

Further, aircraft engine manufacturer Pratt and Whitney has entered an initial agreement with Air BP to test the application of SAF blends up to 100% in its engine testing and research. As part of the agreement, the parties will work collaboratively to explore the viable supply to Pratt and Whitney of SAF blends with up to 100% SAF for engine and propulsion systems testing through 2024.

Rolls-Royce has already successfully tested 100% SAF in an engine last year and said that all its Trent aircraft engines will be cleared to run on 100% biojet by 2023.

And US manufacturer Boeing said its commercial airplanes will be capable and certified to fly on 100% SAF by 2030, and has successfully tested a plane flying on 100% SAF.

Click [here](#) for more information.

Methanol from steel mill gas



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Fraunhofer UMSICHT has been working on the production of methanol from steel mill gases and sustainably produced hydrogen in the Carbon2Chem project. The researchers are already successfully operating a demonstration-scale plant on the institute's premises in Oberhausen. In the next step, tests

under real conditions are planned at a steel mill in Duisburg.

Researchers succeeded in demonstrating the production of methanol on the basis of hydrogen and gases that correspond to steel mill gases in their composition (typically and importantly containing CO).

The most recent success was continuous methanol production using a demonstration plant over a five-week period. "Initially, the plant ran on carbon dioxide and hydrogen for 20 days, as this corresponds to the design point of the plant. Subsequently, we varied the composition of the feed gas and adjusted the proportions of carbon monoxide, carbon dioxide, nitrogen and hydrogen to the composition of steel mill gases," explained Dr. Andreas Menne, head of the Low Carbon Technologies department at Fraunhofer UMSICHT.

A total of 1700 litres of raw methanol – corresponding to about 1000 litres of methanol – were obtained during this test series.

In parallel developments, LanzaTech's proprietary technology involves use of engineered microorganisms to capture and ferment steel mill gases into ethanol.

Click [here](#) for more information.

Bioethanol

EU renewable ethanol makes contribution to Europe's energy independence and food security



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The European Commission's RePowerEU proposal to boost EU energy security is an important step to reducing dependence on imported crude oil and ensuring stable domestic production of fuel and food, while continuing the drive to carbon-neutrality.

As a proven, domestically sourced technology for reducing emissions from road transport – renewable ethanol from ePURE members achieves more than 75% average emissions saving compared to fossil petrol – EU renewable ethanol has a strategic role to play in this effort.

"EU renewable ethanol production is about more than just renewable low-carbon fuel that helps Europe achieve its climate goals by displacing fossil petrol," said ePURE Director of Government Affairs Simona Vackeová. "For every tonne of renewable ethanol produced in the EU, there is also a tonne of high-protein, GMO-free animal feed with a high metabolic value, contributing to EU food security by reducing the need to import such feed."

European renewable ethanol production alone supplied around 1.7% of the protein feed of EU origin in 2019. In 2020, ePURE members produced 4.22 million tonnes of animal feed while continuing to supply fuel ethanol to offset fossil petrol.

Importantly, EU renewable ethanol also has other strategic uses, including applications for industry, food and beverage, and health care. The latter has been demonstrated during the COVID-19 pandemic as EU ethanol producers ensured a stable domestic supply of ethyl alcohol for use in hand sanitisers and gels.

Click [here](#) for more information.

Technip Energies and Clariant sign agreement for sunliquid® cellulosic ethanol license projects

Technip Energies and Clariant have announced that they have signed a cooperation agreement for the implementation of Clariant's sunliquid® cellulosic ethanol technology. By choosing Technip Energies, sunliquid® customers can benefit from combining Clariant's proven technology with Technip Energies' deep experience as an engineering, procurement and construction (EPC) contractor to build advanced biofuel plants.

The sunliquid® process converts agricultural residues, woody materials or municipal solid wastes into advanced biofuel. The bio-sourced feedstock is converted into cellulosic sugars, which is then fermented into cellulosic ethanol.

The process design is completely integrated and based upon proven process technology. The innovative technology involves enzymes that are produced as part of the process and

tailored to respective raw materials to deliver the highest possible sugar yields.

At the end of 2021, Clariant completed the construction of its first full-scale commercial sunliquid® cellulosic ethanol plant in Podari, Romania, which is currently started-up and will be fully operational in 2022. The plant will process approximately 225,000 tonnes of straw to produce 45,000 tonnes of cellulosic ethanol per annum.

The cellulosic ethanol from the sunliquid® process can be used as a drop-in solution for fuel blending and offers further downstream application opportunities into sustainable aviation fuels and bio-based chemicals.

Click [here](#) for more information.

Biodiesel

HVO for rail transport

DB Cargo UK has successfully trialed the use of 100% renewable Hydro-treated Vegetable Oil (HVO) as it continues to look for new and innovative ways to power its fleet and decarbonise its operations.

Ground-breaking tests have taken place at the company's load bank facility at Toton Traction Maintenance Depot in Nottinghamshire where traditional red diesel has been substituted for the more environmentally friendly HVO fuel.

A Class 67 diesel locomotive has been put through its paces – from idling to full power – with monitoring showing no adverse impact on the performance of the locomotive's powerful 3,200 bhp engine.

Click [here](#) for more information.

Aviation and Shipping Biofuels

BA takes delivery of first UK produced SAF



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British Airways has taken delivery of the first batch of sustainable aviation fuel produced by Phillips 66 Limited, making it the first airline in the world to start using SAF produced on a commercial scale in the UK.

The Phillips 66 Humber Refinery near Immingham is producing thousands of tonnes of SAF that will now help power a number of British Airways flights. The SAF is produced from sustainable waste feedstock at the refinery and British Airways will add it into the existing pipeline infrastructure that directly feeds several UK airports including London Heathrow.

British Airways and Phillips 66 are both committed to a lower carbon future. The sustainable aviation fuel bought by the airline will be enough to reduce lifecycle CO₂ emissions by almost 100,000 tonnes, enough to power 700 net zero CO₂ emissions flights between London and New York on its fuel-efficient Boeing 787 aircraft.

Both companies support Government plans for a future SAF mandate and a business model for investing in advanced waste to jet fuel projects through participation in the Department for Transport's Jet Zero Council Delivery Group.

International Airlines Group (IAG), the airline's parent company, is investing \$400 (£310) million over the next 20 years into the development of SAF and British Airways has existing partnerships with several companies to develop plants and purchase the sustainable fuel.

Click [here](#) for more information.

TotalEnergies and ENEOS to study sustainable aviation fuel production at ENEOS Negishi Refinery



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TotalEnergies and ENEOS Corporation have announced a collaboration to jointly conduct a feasibility study to assess the production of Sustainable Aviation Fuel (SAF) in ENEOS Negishi Refinery in Yokohama city, Japan.

The companies have already started to conduct the study for feedstock procurement and production of SAF related to this project. The proposed unit, with capacity to produce 270,000 tonnes per year of SAF, would process

waste or residue sourced notably from the circular economy, mainly used cooking oil and animal fat. The two companies are considering establishing a new joint venture to produce SAF.

This collaboration would leverage the companies' respective areas of excellence and expertise for the development of the sustainable supply chain of SAF in Japan around 2025: TotalEnergies' experience in feedstock procurement and SAF production technology, and ENEOS's available production and loading/unloading facilities of the Negishi Refinery. This refinery is located in the largest aviation fuel demand area in Japan (Narita and Haneda airports) and marketing network of aviation fuel in Japan.

Click [here](#) for more information.

Alfanar approaches FEED study for Teesside SAF development

The UK Government has awarded alfanar £2.4 million to develop its site in Tees Valley that will process household and commercial waste and turn it into sustainable aviation fuel (SAF). The funding from Department for Transport (DfT) will help the project, called Lighthouse Green Fuels (LGF), to start the "front-end engineering and design" (FEED) stage of development.

The site in the Tees Valley has already been acquired and commercial operations are planned to commence within five years. The project will utilise innovative technologies and alfanar aims to be the first company to produce SAF from waste at scale in the UK. The funds were awarded by the DfT through their Green Fuels, Green Skies initiative.

The investment forms part of the Government's levelling-up agenda, as the

project will also create over 700 jobs during construction and around 240 full-time jobs once it is fully operational.

The innovative waste-to-liquid (WtL) process destined for the Teesside plant utilises gasification and Fischer-Tropsch (FT) technology to convert household and commercial waste - otherwise destined for landfill or incineration - into SAF.

SAF generated by the LGF plant has the potential to reduce greenhouse gas emissions by as much as 80% when compared to their fossil fuel equivalent. When coupled with carbon capture and storage (CCS) the SAF produced by the plant could achieve negative emissions.

Click [here](#) for more information.

Maersk to ramp up methanol for marine applications



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Shipping line Maersk is forming partnerships with six companies to boost global capacity of green methanol and source at least 730,000 tonnes/year of the fuel by the end of 2025. The six partners include Hong Kong-based CIMC ENRIC, Chinese Green Technology Bank (GTB), renewable energy company European Energy, Danish utility Orsted, methanol

producer Proman and US-based methanol producer WasteFuel.

CIMC ENRIC will develop biomethanol projects for Maersk in China, with the first phase of the project scheduled to produce 50,000 tonnes/year of biomethanol from 2024 and the second phase expected to produce 200,000 tonnes/year with the start date to be determined.

GTB will also facilitate the development of biomethanol projects in China, with the first planned to produce 50,000 tonnes/year from 2024 and the second planned to have a capacity to produce 300,000 tonnes/year at a start date to be determined.

WasteFuel is developing a biomethanol project in South America that will produce over 30,000 tonnes/year starting in 2024, with Maersk planning to offtake the full volume produced. Proman will supply Maersk with 100,000-150,000 tonnes/year of green methanol from its development facility in North America.

European Energy will develop e-methanol projects in Latin America and the US and will have a capacity to produce up to 200,000-300,000 tonnes/year of the fuel starting in 2025-26. Orsted will also develop an e-methanol project in the US that will have capacity to produce 300,000 tonnes/year from 2025.

Maersk last year ordered the first methanol-fuelled container ship for delivery in mid-2023 and eight larger methanol-fuelled container ships for delivery in 2024.

Click [here](#) for more information.

Events

CHEMUK 2022 **Birmingham, 11th-12th May 2022**

A brand new 'feature area' for CHEMUK 2022 sees the introduction of the 'Bio-based Chemicals & Processing' INNOVATION ZONE. Bringing together illuminating 'poster displays', from across the rapidly evolving 'biochemical/industrial biotech' landscape, together with on-site responsible key personnel, the zone provides a hugely valuable showcase of some of the most exciting breakthrough innovation in this sector.

Click [here](#) for more information.

IBioIC's 8th Annual Conference **Glasgow, 6th-7th June 2022**

This conference is focused around how sustainable development in industrial biotechnology can secure Scotland's path to Net Zero.

IBioIC's annual conference is the largest industrial biotechnology conference in the UK and attracts an ever-growing cohort of key figures across policy, industry, and research and academia.

Delegate registration, exhibition and sponsor opportunities will be launched in March 2022.

Click [here](#) for more information.

International Biofuels Congress & Expo **Brussels, 5th-6th July 2022**

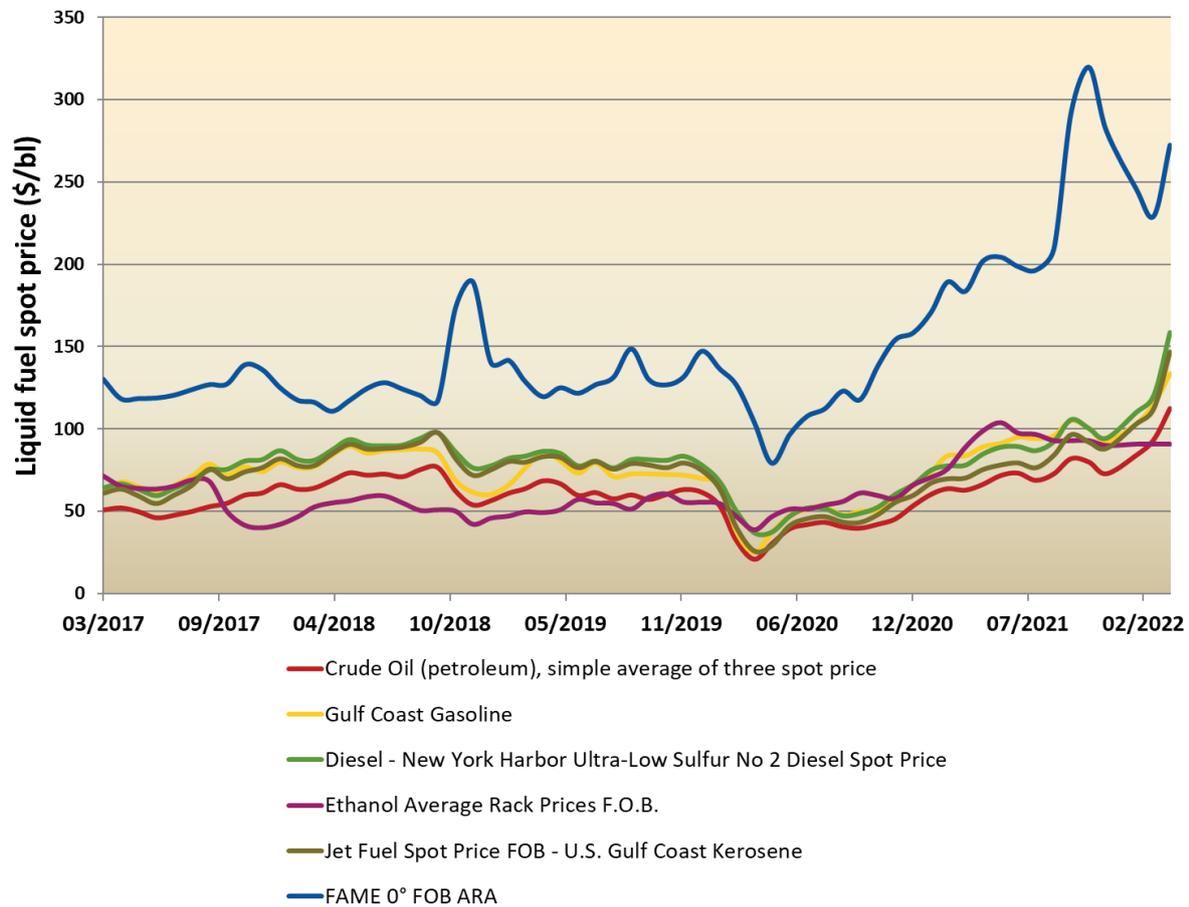
The International Biofuels Congress & Expo aim to bring together leading producers, suppliers, regulators and other engaged organisations over a two day period. High-level speakers, experts in their field, will address a range of topical issues relating to the biomass and the biogas sectors.

This year's conference will be held in Brussels, Belgium and co-located with the Biomass and the Biogas International Conferences and Expos.

Click [here](#) for more information.

Price Information

Historical spot prices of liquid fossil fuels and liquid biofuels. Five years prices and up to March 2022 are given in \$ per barrel.



Prices of Crude oil, diesel, jet fuel and gasoline are recorded from www.ycharts.com

Prices of ethanol from www.markets.businessinsider.com

Prices for FAME 0° from www.spglobal.com and www.indexmundi.com

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NNFCC is a leading international consultancy with expertise on the conversion of biomass to bioenergy, biofuels and biobased products.

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