

Bioeconomy & Low Carbon Technology Overview for August 2024

Our summary of low carbon technology developments for August 2024 is based on data and information collated by Gifford Consulting and provided on our website: [Gifford Consulting](#)

Highlights by Topic: August 2024

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Ammonia production

1. **Ammonia production:** Clariant announced the expansion of its strategic cooperation with KBR for ammonia production. Ammonia plays a vital role in today's food production, and it will become even more important as a clean energy source in the future. The partners will continue collaborating on traditional ammonia projects while significantly increasing their focus on low-carbon and carbon-free "green ammonia" applications. The solutions will combine Clariant's outstanding AmoMax ammonia synthesis catalysts with KBR's K-Green® ammonia technologies to maximize the economics and energy efficiency of ammonia production.
2. **Ammonia production:** Egypt. Fertiglobe has confirmed a contract with German state-backed company HintCo for the delivery of up to 397,000 tonnes of green ammonia by 2033 from Egypt to Europe after the UAE-based fertiliser company won the pilot H2Global auction. The renewable ammonia will be delivered at a price of EUR 1,000 (USD 1,116) per tonne, including transport costs, from Fertiglobe's existing ammonia plant in Ain Sokhna, Egypt. The green hydrogen will be supplied from the Egypt Green Hydrogen project, developed by Norwegian renewables company Scatec in partnership with Fertiglobe and Orascom Construction.
3. **Ammonia production:** USA. Navigator Holdings, the world's largest owner and operator of handysize liquefied gas carriers, announced a significant investment alongside Attis Clean Energy in Ten08 Energy LLC to develop a clean ammonia production facility on the U.S. Gulf Coast. This facility aims to produce 1.4 million metric tonnes of ultra-low carbon ammonia annually by late 2029/early 2030. Navigator Gas has an option to invest up to \$100 million towards the construction of the terminal and export infrastructure.
4. **Ammonia production:** USA. OCI Global announced the sale of its Clean Ammonia project in Beaumont, Texas, to Woodside Energy Group Ltd for \$2.35 billion. The project, which aims to produce 1.1 million metric tonnes of low-carbon ammonia annually, is under construction and is expected to be operational by 2025. The Beaumont project will utilize Linde's low-carbon hydrogen production and carbon capture technology. It aims to capture and sequester 1.7 million metric tonnes of CO2 annually.
5. **Ammonia production:** Taiwan. Mitsubishi Heavy Industries, Ltd. entered a MoU with Taiwan Fertilizer Co., Ltd to conduct a joint pre-feasibility study for the development of an ammonia value chain in Taiwan in support of Taiwan's '2050 Net-Zero Emissions' goal.

Biobased chemicals

6. **Biobased chemicals:** Switzerland. Clariant and OMV announced a collaboration for the supply of ethylene with a lower carbon footprint. In response to increasing consumer demand for more sustainable options, and with a particular focus on Europe, this partnership will help both companies meet their sustainability targets and deliver on the carbon reduction strategies of their customers.
7. **Biobased chemicals:** Germany. BASF announced that their (Meth)Acrylate portfolio will switch to bio-based Ethyl Acrylate (EA) starting Q4 2024. With a 14C-traceable bio content of 40% according to DIN EN 16640 and a low Product Carbon Footprint (PCF1). Bio-based EA from BASF helps its customers worldwide to reach their sustainability goals. The product offers a PCF reduction of ~30% compared to fossil-based EA. Additionally to regular bio-based EA, BASF is also offering bio-based Ethyl Acrylate BMB ISCC Plus. BASF's bio-based Ethyl Acrylate uses sustainable bioethanol predominantly from European sources with grain as a feedstock.

8. **Biobased chemicals:** India. GAIL (India) Limited and Petron Scientech Inc have signed a MoU to jointly explore setting up of a 500,000 tons per annum bio-ethylene plant along with its downstream unit(s) in India, based on bio-ethanol produced in the plant in a 50:50 Joint Venture.
9. **Biobased chemicals:** USA. Covestro AG and Carlisle Construction Materials developed a partnership for bio-circular products for the construction industry. As part of this collaboration, Covestro will supply Carlisle with methylene diphenyl diisocyanate (MDI) made from ISCC PLUS certified mass-balanced bio-circular raw materials. The bio-based MDI has a significantly reduced carbon footprint compared to fossil-based MDI, with a potential CO₂ reduction of 2.4 kilograms per kilogram of MDI produced. This will enable Carlisle to produce its high-performance polyiso insulation boards with lower embodied carbon.
10. **Biobased chemicals:** USA. ADM and LG Chem indicated that their previously announced projects for the production of lactic and polylactic acid will not be developed. Since these projects were originally announced the joint ventures with LG Chem for lactic and polylactic acid in 2022, construction costs have markedly increased. The company has looked at a variety of options, but when the time came to make final investment decisions, it was obvious that these projects no longer represented a prudent use of our investors' capital that would meet expected returns.

Biodiesel

11. **Biodiesel:** Delek announced that it will 'temporary idle' its Crossett, Arkansas; Cleburne, Texas and New Albany, Mississippi biodiesel facilities, while it explores 'viable and sustainable alternatives'. The company's Q2 results indicated that Delek's decision to idle the facilities was 'driven by the decline in the overall biodiesel market.
12. **Biodiesel:** India. M11 Industries commenced operations at its biodiesel plant in Padubidri, Udupi district, Karnataka. The state-of-the-art facility, built under the 'Make in India' initiative with an investment of ₹350 crore, is the largest of its kind in India, with a production capacity of 450 tonnes per day. The plant converts used cooking oil and other waste oils into biodiesel, which is supplied to oil marketing companies.

Biofuels

13. **Biofuels:** Brazil. Vale, Komatsu, and Cummins announced a strategic agreement to develop the Dual Fuel Program, aimed at retrofitting the 830E and 930E diesel trucks with ethanol-diesel dual fuel capable engines. Converting existing diesel engines in haul trucks to run on a mix of ethanol and diesel will extend the trucks' lifespan and considerably reduce carbon emissions. The retrofitted trucks will be capable of using a fuel mix of up to 70% ethanol and reducing direct CO₂ emissions by up to 70%.
14. **Biofuels:** European biodiesel prices began falling early in 2023 thanks to both poor spot demand and oversupply. Declining prices in the North American biodiesel markets has occurred for similar reasons and the global downturn in demand has also affected Asian prices. As a result, the oil majors that had branched out into renewables in recent years have been pausing biorefinery projects in quick succession over the summer of 2024. Prices for biofuels are low because Europe and the US right now have more capacity to make the product than the market needs. In the last several years, US petroleum refiners have decided to devote capacity to biofuels. Similarly in Europe, some fossil capacity has been converted into biofuels, such as the Livorno site in Italy and the La Mede and Grandpuits oil refineries in France. Overall, 17% of completed or announced petroleum oil refinery closures for 2020 to 2027 involve plans to transform the capacity into biofuel production facilities. One of the

firms backing biofuels in Brazil is Abu Dhabi's Mubadala Capital, which still intends to invest about \$13.5bn on a major biofuels project in Brazil, Acelen, consisting of five modules capable of processing 20,000 barrels a day. It will also convert an oil refinery in Bahia to biofuels.

15. **Biofuels:** Hungary. MOL Group increased biofuel production to over 200,000 tons annually through its subsidiary, Rossi Biofuel Zrt. This development is part of MOL's ambitious "shape tomorrow" strategy, emphasizing renewable fuels such as biodiesel derived from sustainable sources including vegetable oils, animal fats, and recycled cooking oils.
16. **Biofuels:** India. Swachh Bio, a leading manufacturer of lignocellulosic biofuels, has announced plans to establish a second-generation cellulosic biofuel plant in Telangana. With an investment exceeding Rs 1,000 crore in the first phase, the plant will have a capacity of 250 kiloliters per day.
17. **Biofuels:** India. LanzaTech Global announced that they have been awarded a contract by Jakson Green to provide NTPC Limited, India's largest power utility, with its 4G ethanol technology. This new facility, located in Central India, will use LanzaTech's second-generation bioreactor to transform CO2 emissions and green hydrogen into ethanol, supporting India's energy transition.
18. **Biofuels:** Malaysia. EcoCeres Limited, a subsidiary of EcoCeres Inc. agreed to lease 100,000 cubic meters in Dialog Terminals Langsat's expanded storage facilities in Tanjung Langsat, Johor Darul Ta'zim, Malaysia. Dialog Terminals Langsat is an indirect wholly owned subsidiary of Dialog Group Berhad. It recently expanded its facilities with an additional 150,000 cubic meters of storage for renewable and petroleum products at its terminal. The expansion of the Dialog terminal is expected to be completed in the first quarter of fiscal year 2027. The EcoCeres renewable refinery, also a new development in Malaysia will produce sustainable aviation fuel, hydrotreated vegetable oils (HVO), and renewable naphtha, which will be stored in DTL3's dedicated tanks. The facility will have an annual capacity of up to 400,000 tons.
19. **Biofuels:** Austria. OMV has started up its co-processing plant at the Schwechat refinery in Austria. Almost EUR 200 million were invested to allow up to 160,000 metric tons of liquid biomass to be converted into high-quality renewable hydrogenated vegetable oil components. These more sustainable blending components will be used also for formulation of OMV's MaxxMotion Diesel. OMV will also have a new unique CleanTech+ formula combining lower carbon footprint along with superior performance. The new product will be available for consumers at approximately 550 OMV filling stations in Austria, the Czech Republic, and Hungary during 2024.
20. **Biofuels:** Italy. Poste Italiane's ground and air fleet will run on biofuels supplied by Enilive, Eni's company dedicated to mobility services and products. This will accelerate Poste Italiane's progress towards achieving its energy transition. Poste Italiane and Enilive have signed a Letter of Intent to start a collaboration based on the supply of biofuels produced in Enilive's biorefineries by processing waste materials such as used cooking oils, animal fat and by-products from the agri-food industry. Under the agreement, Enilive will supply HVOlution (a diesel produced from renewable feedstock*) for road transport. HVOlution is available at over 1,000 Enilive service stations across Italy.
21. **Biofuels:** Spain. Cepsa Bioenergia San Roque SL, a joint venture between Cepsa1 and Bio-Oils (subsidiary of Apical), awarded Worley a services contract for the expansion of CBSR's renewable fuel complex in Huelva, Spain, including a new biofuel plant. When completed, the new biofuel plant is expected to become one of the largest second-generation biofuel plants in southern Europe, supporting lower carbon aviation, maritime and land

transportation. The new biofuel plant will be designed to feature flexible annual production of 500,000 tons of sustainable aviation fuel (SAF) and renewable diesel (hydrogenated vegetable oil or HVO), doubling the current complex's production capacity to 1 million tonnes per annum.

22. **Biofuels:** USA. Energy Information Administration published its latest U.S. Renewable Diesel Fuel and Other Biofuels Plant Production Capacity report which contains data for U.S. renewable diesel fuel and other biofuels plants, as of January 1, 2024. It shows that renewable diesel production reached 4.3 billion gallons of installed capacity at a total of 22 plants.

Biogas

23. **Biogas:** USA. Clean Energy Fuels announced the completion of its latest production facility at Ash Grove Dairy in Lake Benton, Minnesota where biogas is converted into approximately 165 MMBtus of renewable natural gas each day. The new facility injects RNG into the interstate natural gas pipeline grid and is expected to produce up to 480,000 gasoline gallon equivalents of negative carbon-intensity RNG annually. Located on a 55-acre site, Ash Grove Dairy houses over 2,000 milking cows and processes up to 60,000 gallons of manure daily through the anaerobic digester.
24. **Biogas:** USA. Clean Energy Fuels Corp. announced the opening of its latest renewable natural gas (RNG) fueling station in Davenport, Florida. The site is now providing RNG to heavy-duty trucking and other fleets operating busy routes around Highway 27, I4 and the Florida Turnpike area. RNG is a fuel made entirely from organic waste, and drastically reduces carbon emissions by an average of 300% compared to fossil diesel.
25. **Biogas:** Finland. Viking Line will reduce emissions by 90% on its Stockholm-Turku route by running its vessels, Viking Glory and Viking Grace, entirely on liquefied biogas (LBG) for one week, from August 29 to September 4.
26. **Biogas:** Ireland. Gas Networks Ireland announced plans to purchase up to 250 gigawatts of biomethane annually, marking an entry into biomethane procurement. The company has published a Prior Information Notice on the e-tenders system to gauge supplier interest. This move aligns with the Irish government's policy to replace 10% of natural gas with biomethane by 2030.
27. **Biogas:** Finland. Gasum announced that from August 30, its Finnish filling stations will exclusively offer biogas, ceasing the sale of natural gas. This transition aligns with customer preferences, as nearly all have been choosing biogas over natural gas due to competitive pricing. Gasum will modify its stations to remove natural gas price markings and options from automatic filling machines by the end of August. The company currently operates 45 gas filling stations in Finland.
28. **Biogas:** Germany. Landwärme, a prominent German supplier of biomethane, was declared insolvent amidst a dramatic plunge in the prices of greenhouse gas emission reduction quotas. Opting for self-administration, similar to America's Chapter 11, the company is seeking to restructure while continuing operations. This was caused by a market destabilized by an influx of mislabelled biodiesel imports and fraudulent upstream emission reduction projects, which have reportedly bled the industry of approximately €4.5 billion. Landwärme pointedly criticized the lack of rigorous enforcement against these fraudulent activities, which it claims could have prevented such financial issues.
29. **Biogas:** Lithuania. AB Kaišiadorių Paukštynas, an indirect subsidiary of AB Akola Group, has announced plans to build a biomethane production plant in the Kaišiadorys district. Construction start of the estimated EUR 19.4 million investment is expected in the first

quarter of 2026. The biomethane aka renewable natural gas (RNG) will be produced using chicken, cow manure, slurry, and other biodegradable waste, totalling 120,000 – 140,000 tonnes of biowaste annually.

30. **Biogas:** Brazil. Natura, has introduced its first fleet of 20 biomethane gas-powered trucks, replacing traditional diesel vehicles. This change affects 35% of the company's heavy freight operations in Brazil. The biomethane powered fleet includes 20 trucks and 50 trailers and is expected to handle around 1,250 trips monthly. Initially, these vehicles will operate exclusively in São Paulo, transporting raw materials, inputs, and finished products for both Natura and Avon.
31. **Biogas:** USA. Opal Fuels announced South Jersey Industries and OPAL have begun construction on a renewable natural gas production facility at the Burlington County Resource Recovery Complex in Florence Township, New Jersey. The facility, with an annual design capacity of nearly 0.92 million MMBtus, will capture methane from the landfill and convert it into RNG. This will produce approximately 6.5 million gas gallons equivalent annually, significantly reducing emissions from heavy-duty trucks and lowering fuel costs.
32. **Biogas:** Uniper has become the first shipper to start using the BioLNG production capacity to convert biomethane into BioLNG. The BioLNG produced at the Gate terminal is certified under the International Sustainability and Carbon Certification (ISCC) scheme. The underlying commodity is biogas produced in one of the EU member states, upgraded to biomethane to remove substances such as carbon dioxide, hydrogen sulphide and fed into the Dutch natural gas grid. At the Gate exit point, the LNG terminal takes over the biomethane and liquefies it using the terminal's existing infrastructure. The capacity of the liquefier is about 100,000 tons per year and can be used by the existing shippers.
33. **Biogas:** United Kingdom. Future Biogas, one of the largest anaerobic digestion plant developers and biogas producers in the UK, has agreed to acquire 51% of a portfolio of six gas-to-grid AD facilities, with a combined gas output of 333GWh, from JLEN Environmental Assets Group Limited for £68.1 million. £30 million will be funded by 3i Infrastructure, with the balance funded by Future Biogas from committed debt facilities.
34. **Biogas:** United Kingdom. ReFuels N.V. has broken ground on a new refuelling station at Livingston in West Lothian, Scotland. The public access Bio-CNG station operated under the CNG Fuels brand will enable low-emission transport between Edinburgh and Glasgow. The Livingstone station can refuel 14 trucks simultaneously when fully utilised, enabling more than 600 trucks to be refuelled per day with a total capacity of 20 million kilograms (kg) of Bio-CNG annually.
35. **Biogas:** USA. GreenGasUSA and Wayne-Sanderson Farms are collaborating to produce renewable natural gas at Wayne-Sanderson Farms facilities across the U.S by leveraging existing wastewater treatment and biogas assets to bring pipeline quality RNG to market. The two companies also plan to identify and develop additional RNG facilities at other poultry processing sites in the Wayne-Sanderson Farms portfolio, targeting locations with the largest potential to decrease methane emissions and those with capacity for co-location of a liquid CO₂ recovery system.
36. **Biogas:** USA. HoSt Bio-Energy Systems North America and Bright Renewables North America were selected to provide Renewable Natural Gas (RNG) technologies for Global NRG Renewables' distillery waste-to-RNG project in Louisville, Kentucky. The project will convert 105 million gallons per year of distillery waste into high-quality RNG, which can be used for heat, electricity, transportation, and the production of food-grade quality liquid bio-CO₂.
37. **Biogas:** Italy. Verdalia Bioenergy, backed by Goldman Sachs Asset Management's infrastructure unit, has acquired four biomethane plants in the northern Italian regions of

Piedmont and Friuli-Venezia Giulia. The plants, which will be operational between Q4 2025 and Q2 2026, will have a total annual production capacity of approximately 230 GWh of biomethane derived from the treatment of 262,000 tons of biomass waste. Between them they will eliminate approximately 53,000 tons of greenhouse gas (CO₂) emissions per year.

Biojet/SAF

38. **Biojet/SAF:** Australia. Boeing has become an early investor in Wagner Sustainable Fuels to support the development of its sustainable aviation fuels (SAF) production facility in Brisbane. Boeing said its investment in the Wagner refinery is part of its strategy to support development of local SAF supply and expand global access to SAF. SAF facilities such as Wagner's new Brisbane site also strengthen Australia's fuel security, since the country currently imports 90% of its liquid fuel including jet fuel, and the demand is expected to increase by 75% towards 2050. The Brisbane facility will use waste-to-SAF technology that converts ethanol produced from waste-based feedstocks such as industrial waste into SAF.
39. **Biojet/SAF:** Australia. LanzaTech Global, Inc. and LanzaJet, Inc. announced a new project with Australia's Wagner Sustainable Fuels to evaluate equipping Wagner's Brisbane SAF Refinery with the CirculAir platform. The CirculAir platform is LanzaTech and LanzaJet's joint technology solution that converts waste carbon and renewable power into SAF. With this commercial partnership involving LanzaTech and LanzaJet, the Project has received financial investments from The Boeing Company and the Queensland Government.
40. **Biojet/SAF:** Belgium. EcoCeres announced it made its initial delivery of 10 million liters of hydroprocessed esters and fatty acids Synthetic Paraffinic Kerosene sustainable aviation fuel to the Evos Ghent terminal. Evos Ghent, known for its role in the first-ever sustainable aviation fuel delivery through NATO's Central European Pipeline System to Brussels airport, is becoming one of the largest SAF terminals in Europe. This partnership leverages Evos Ghent's extensive experience and infrastructure to meet the growing demand for SAF.
41. **Biojet/SAF:** Germany. HOLBORN is a successful oil refinery that supplies Hamburg and northern Germany with fuels and heating oil. Topsoe has signed an agreement with HOLBORN Europa Raffinerie, to provide its HydroFlex™ technology for the production of SAF and renewable diesel at its plant in Hamburg. The plant is expected to be operational in early 2027, including the interconnecting infrastructure with the existing facilities.
42. **Biojet/SAF:** Gunvor Group is to join VARO Energy in building a large-scale SAF manufacturing facility at the Gunvor Energy Rotterdam site through a joint venture. The facility is being designed to process a variety of feedstocks. It will also have the capability to produce either SAF or HVO end products, allowing VARO and Gunvor to capture potential value by switching between markets and meet a range of regulatory requirements.
43. **Biojet/SAF:** India. Honeywell announced that Jiutai Group has selected its UOP eFinishing technology to produce 100,000 tons of sustainable aviation fuel per year from eMethanol. The eFinishing technology, which converts eMethanol into low-carbon jet fuel, is expected to reduce greenhouse gas emissions by 88% compared to conventional jet fuel. Honeywell's technology will be implemented at Jiutai's methanol-to-olefins facility, converting it into a SAF production plant leveraging local wind resources for its electricity supply.
44. **Biojet/SAF:** USA. JetBlue and World Fuel Services announced a new agreement to bring the first regular supply of Blended Sustainable Aviation Fuel (SAF), provided by Valero Marketing and Supply Company, a subsidiary of Valero Energy Corporation to John F. Kennedy International Airport (JFK) by the fourth quarter of 2024. Under the terms of the initial 12-month agreement, JetBlue is expected to take delivery of a minimum of 1,000,000 gallons of neat sustainable aviation fuel (approximately 3,300,000 gallons blended) – with an option to

purchase up to an additional 4,000,000 gallons (approximately 13,300,000 gallons blended). The blended SAF will be made available via existing infrastructure, including the Colonial Pipeline.

45. **Biojet/SAF:** Kazakhstan. KazMunayGas the national oil and gas company signed a memorandum of cooperation with LanzaJet, to produce SAF in Kazakhstan.
46. **Biojet/SAF:** USA. KBR announced it will provide technology licensing, proprietary engineering design, and front-end engineering design to Avina Clean Hydrogen for the production of sustainable aviation fuel in the US. The plant is set to be located in the Midwest region and is projected to produce 120 million gallons of SAF annually with plans to integrate existing rail and pipeline infrastructure for delivery to regional airports, including Chicago O'Hare.
47. **Biojet/SAF:** USA. Neste will provide up to 1 million gallons (3,000 metric tons) of Neste MY Sustainable Aviation Fuel™ to United Airlines for use at Chicago O'Hare International Airport in the U.S. through the end of 2024. This expansion of the existing partnership between the two companies enables United to become the first airline to purchase SAF for operational use for flights from Chicago O'Hare, one of the busiest airports in the U.S. The first supply of Neste MY Sustainable Aviation Fuel blended with conventional jet fuel will arrive at Chicago O'Hare Airport via pipeline in August from Neste's newly commissioned SAF terminal capacity in Houston.
48. **Biojet/SAF:** Norway. Mana, research institution NORCE, and energy company Equinor announced signing of a MoU to develop a waste-to-SAF plant at Mongstad on the western coast of Norway. The SAF facility will transform non-recyclable waste into clean fuel for the aviation industry.
49. **Biojet/SAF:** United Kingdom. ABSL's proprietary RadGas technology converts wastes and biomass into a high-quality syngas that can be used to produce biofuels and capture biogenic carbon dioxide in an efficient, reliable process. The specialized technology integrates four process steps based on mature technologies and is a key enabler in biohydrogen, biomethanol and SAF production.
50. **Biojet/SAF:** USA. DG Fuels announced it has selected Phelps County, Nebraska, for its first Midwest sustainable aviation fuel production facility. The innovative plant, expected to begin operations in 2030, will produce 193 million gallons of sustainable aviation fuel annually, with near-zero carbon emissions, meeting ASTM fuel standards. The facility will utilize cellulosic biomass, primarily corn stover, and clean hydrogen.
51. **Biojet/SAF:** USA. Montana Renewables achieved record sustainable aviation fuel (SAF) production of approximately 7 million gallons. Montana Renewables achieved operational records across the board and ran at planned production levels. The facility's feedstock pretreatment unit allowed it to choose from a range of feedstocks., Benefits for Montana Renewables are that its costs are becoming more consistent as reliability and utilization increases. The company is also optimistic that ongoing financial improvements are ahead – such as on the supply side, declining ag commodity prices, incremental biodiesel capacity closure, reduced imports, the conversion of renewable diesel capacity to SAF, and renewable diesel capacity being reversed back to crude oil. These market conditions will all support improved margins for the company.
52. **Biojet/SAF:** USA. Southwest Airlines started work on its new SAFFiRE plant in Liberal, Kansas that will turn corn stover and husks into ethanol for Sustainable Aviation Fuel. The groundbreaking was led by U.S. Senator Jerry Moran (R-Kan.) – the co-chair of the Senate Sustainable Aviation Caucus, who introduced the Farm to Fly Act earlier this year in an effort to get the USDA to accelerate SAF production and development through existing programs.

53. **Biojet/SAF**: USA. Universal Fuel Technologies has developed a revolutionary sustainable aviation fuel production process called flexiforming, capable of using over 50 different feedstocks and enhancing production efficiency by integrating into existing SAF facilities. Based in Los Altos, California, UFT's innovation not only drives down manufacturing costs by upgrading low-value byproducts but also promotes significant energy savings, consuming 75% less energy than traditional ethanol-to-jet technologies and 33% less hydrogen.

Biomaterials

54. **Biomaterials**: Brazil. Raízen, an integrated energy company with a broad portfolio of renewables, and Vertoro, a Dutch biotechnology company, announced the signing of a Joint Development Agreement to enhance the value of lignin by transforming it into advanced, sustainable biofuels, chemicals, and materials. As a second-generation feedstock, Lignin boasts a very low carbon footprint, making it an ideal solution for decarbonizing hard-to-abate sectors. As the world's largest producer of 2nd Generation Ethanol, Raízen generates substantial amounts of lignin as a by-product alongside its sustainable ethanol operation. Raízen has an expected lignin production capacity of 1,5 million tons (wet basis) across 7 already announced and 2 operating E2G plants. The potential production is up to 3.4 million tons (wet basis) across 20 E2G plants. Vertoro will apply its innovative technology to this collaboration, focusing on upgrading the lignin into a form that dissolves and blends more easily with other materials, thereby simplifying its transformation and making it suitable for a variety of applications.

CO2 Removal

55. **CO2 removal**: ANDRITZ was selected to develop the front-end engineering design (FEED) for a large-scale carbon capture unit for Westenergy's waste-to-energy plant in Mustasaari, Finland. The aim is to capture all the carbon dioxide from the flue gases of the Mustasaari waste-to-energy plant, which produces district heating and electricity from sorted, non-recyclable municipal waste. The captured carbon dioxide will be liquefied, and a large portion will be made available to produce carbon-neutral synthetic e-fuels.
56. **CO2 removal**: Methanex Corporation, one of the world's largest methanol producers and suppliers and Entropy Inc, a leader in carbon capture and storage solutions, have entered into an agreement to invest in a Pre-FEED study for carbon capture, utilization and sequestration deployment at Methanex's Medicine Hat, Alberta facility. This collaboration will leverage Entropy's proprietary modular post-combustion carbon capture technology and Methanex's manufacturing expertise to utilize a portion of the captured CO2 to produce additional methanol.
57. **CO2 removal**: Rohrdorfer has successfully started ethylene production from carbon dioxide (CO2). In a newly developed process, CO2 generated during cement production is recovered and converted into ethylene. The technology is based on a new type of CO2 electrolysis that can be used to produce both formic acid and hydrocarbons such as ethylene.

E-Fuels

58. **e Fuels**: United Kingdom. OXCCU, a company specialising in the conversion of carbon dioxide into fuels, chemicals and plastics, has announced the launch of its first official demonstration plant, OX1, at Oxford Airport, representing an important advance in Sustainable Aviation Fuel (SAF) production. Through its novel catalyst and reactor design, the plant will convert CO2 and H2 directly to long-chain hydrocarbons with high conversion and selectivity for use as SAF, named OX•EFUEL. The facility will produce 1 kilogram (around 1.2 litres) of liquid fuel

per day and will commence operations in September 2024. The plant will be the world's first demonstration of the direct conversion of CO₂ and H₂ to jet fuel range hydrocarbons in a single step with minimal oxygenated byproducts and using OXCCU's novel catalyst.

59. **e-fuels:** Japan Organization for Metals and Energy Security (JOGMEC), a Japanese government agency, has made a USD-36-million (EUR 33m) equity investment into global e-fuels project developer HIF Global, intending to secure shipments of the carbon-free fuels for Japan. JOGMEC invested through Idemitsu E-fuels America Corp, a subsidiary of Japanese petroleum refiner Idemitsu Kosan Co Ltd, gaining an equity stake of an undisclosed size. HIF operates a pilot e-fuels plant at its Haru Oni site in Magallanes, Chile, and is expected to start construction of a commercial-scale facility in Matagorda, Texas, sometime in 2024. The company is also developing e-fuels production sites in Australia and Uruguay.
60. **e-fuels:** Sweden. Ørsted A/S has announced that it has decided to cease development of the FlagshipONE electro-fuels project in Örnköldsvik, Sweden. Located in Örnköldsvik in northern Sweden, FlagshipONE was expected to produce up to 55,000 tonnes of e-methanol annually to enable the shipping industry to achieve a >95 percent reduction in carbon emissions versus when using conventional fossil fuels. The liquid e-fuel market in Europe is developing slower than expected, and the company has taken the strategic decision to de-prioritize their efforts within the market and cease the development of FlagshipONE.

Ethanol

61. **Ethanol:** ADM's ethanol operations were reported under the company's Carbohydrates Solutions segment, which reported operating profit of \$357 million for the second quarter, up 12% when compared to the same period of 2023. The Vantage Corn Processing subsegment, which consists of the company's dry mills, reported \$34 million in operating profit, up 89%. ADM attributed the increase to higher ethanol margins supported by strong demand for ethanol exports.
62. **Ethanol:** Brazil. Be8 began construction of a new ethanol plant in Passo Fundo, Rio Grande do Sul, with a planned annual production capacity of 220 million liters. Planned to operate in 2026, this facility will be capable of producing both anhydrous ethanol, which can be mixed with gasoline, and hydrated ethanol for direct fuel use. Funded by R\$ 729.7 million from the National Bank for Economic and Social Development, this project introduces wheat and triticale as novel raw materials for ethanol production in Brazil.
63. **Ethanol:** Brazil. CARAMURU ALIMENTO S.A. has teamed with Biocen – Bioenergia Celeiro do Norte S.A. to form a joint-venture focused on development and exploration of a corn grinding plant for ethanol production, in Nova Ubiratã, in the State of Mato Grosso. The new unit will have an initial processing capacity of 605,000 metric tons of corn per year, with the start of operations scheduled for the end of the first half of 2026.
64. **Ethanol:** Pedra Agroindustrial has announced the acquisition of the Orbi Bioenergia Plant in Paranaíba, Mato Grosso do Sul forecast to initially process about 1.2 million tons of sugarcane, with the goal of reaching 5 million tons over time. The plant will produce 310,000 liters of anhydrous ethanol and 580,000 liters of hydrated ethanol daily. Pedra Agroindustrial's expansion into Mato Grosso do Sul signifies a major step in its growth strategy, strengthening its position in Brazil's sugar-alcohol sector. This marks the company's first venture outside São Paulo.
65. **Ethanol:** Verbio has commenced the commercial production of corn-based ethanol at its biorefinery facility in Nevada, Iowa. Operating as a full biorefinery, Verbio has installed a total capacity to produce 60 million gallons of corn-based ethanol per year and 2.3 million MMbtu of renewable natural gas (RNG).

Hydrogen

66. **Hydrogen:** Algerian state-owned oil company Sonatrach and Tosyali Iron Steel Industry, Algeria have teamed up to explore the potential production of renewable hydrogen in the North African country.
67. **Hydrogen:** Australia. Fabrum said it has collaborated on the design, build and commissioning of Australia's largest liquid hydrogen plant at a mine site with and for Fortescue, an energy and metals company headquartered in Western Australia. The liquid hydrogen plant at Christmas Creek comprises a hydrogen liquefaction facility, liquid hydrogen storage and a liquid hydrogen refuelling station. Liquid hydrogen from the plant will be used to power Fortescue's zero-emissions mining equipment prototypes including its Offboard Power Unit and its hydrogen-powered haul truck prototype.
68. **Hydrogen:** Australia. Fortescue Metals has announced work has commenced on its \$50 million green metals project in the Pilbara, now emerging as one of the key parts of its still ambitious green hydrogen and industry plans. Fortescue is eyeing big opportunities in the green metal supply chain, with a particular focus on the China market, and the project at its Green Energy Hub at Christmas Creek is expected to produce more than 1,500 tonnes of green metal a year, with production starting in 2025. The project combines green hydrogen produced on site, courtesy of local solar power, and an electric smelting furnace to produce the high purity green metal that it says will be suitable for use in any steel plant around the world.
69. **Hydrogen:** Australia. Province Resources in Australia has been pushing its plans for many years for the HyEnergy project in the Gascoyne region near Carnarvon, north of Perth, but recently announced that the project – still very much in the early planning stages – has been put on hold, attributing this change to lack of government support – and its refusal to provide “tenure” for the project on acceptable terms.
70. **Hydrogen:** Austria. A joint Hydrogen Valley project spanning three provinces in Austria has been selected for EU funding, with the parties' starting discussions on initial financing of EUR 20 million (USD 22.3m). The project will be implemented in Upper Austria, Styria, and Carinthia, focusing on the decarbonisation of the steel, chemicals and cement industries as well as the energy and mobility sectors. Hydrogen Valley is estimated to require a total investment of EUR 578 million.
71. **Hydrogen:** Brazil. CPFL Energia announced that it is planning a green hydrogen pilot project in the state of Rio Grande do Norte in partnership with cement producer Mizu Cimentos. Scheduled to commence operations in 2027, the planned green hydrogen production facility will feed its output to Mizu Cimentos' factory in Barauna municipality. The partnership will also contribute to certain market studies. CPFL noted that the pilot facility will go through a six-month monitoring period to measure the real impact of green hydrogen on reducing carbon dioxide (CO₂) emissions.
72. **Hydrogen:** Brazil. Fuella secured a 1 million square meter site at Porto do Açú in Brazil to establish a facility capable of producing 400,000 tons of green ammonia annually. This marks Fuella's first entry into Brazil, as part of a landmark agreement with Porto do Açú, a subsidiary of Prumo Logística. The newly licensed low-carbon hydrogen hub, approved by the Rio de Janeiro Government in January 2024, aims to integrate renewable hydrogen production with ammonia and methanol units for both export and domestic markets.
73. **Hydrogen:** Ceres Power Holdings has signed a long-term licence agreement for producing its solid oxide electrolyser cells (SOECs) for hydrogen applications with Japan's Denso Corp. Denso explained that Ceres' solid oxide technology combines metal and ceramic that leads

to high-output performance. Denso also aims to achieve mass production of cell stacks by using Ceres' technology with its own expertise of ceramic technology which has been acquired from the automotive sector.

74. **Hydrogen:** German utility EnBW has started a new initiative by allocating 1 billion euros (\$1.08 billion) to build pipelines to carry clean hydrogen as part of a plan for a nationwide grid that will start commercial operations by 2032. Germany is betting on green hydrogen, produced through electrolysis driven by wind and solar power, as an alternative to fossil fuels. For some, it is a gamble, for others a world-leading example.
75. **Hydrogen:** Germany. German electrolyser manufacturer H-TEC Systems is getting ready to rebrand to Quest One as it initiates automated series production of proton exchange membrane (PEM) electrolysis stacks at its new 'Gigahub' in Hamburg. The company, which is a subsidiary of MAN Energy Solutions and part of the Volkswagen Group, focuses on the proton exchange membrane (PEM) technology. At full capacity, the new factory will be able to manufacture more than 5 GW of PEM electrolysers a year, which will then be assembled at another site in Augsburg.
76. **Hydrogen:** Germany. Germany is developing a 130-metre pilot hydrogen network as part of the TransHyDE initiative which is contributing to hydrogen transport infrastructure in the country. The pilot network was set up at the site of German energy major RWE AG in Lingen, Lower Saxony, and consists of pipelines previously used for gas delivery. The mini network is designed to test various technologies for hydrogen transportation including systems for measuring hydrogen quality and flow, purification technologies and inspection methods.
77. **Hydrogen:** Germany. Germany will proceed with two major hydrogen projects in Hamburg – the establishment of a 40-km hydrogen distribution network and the construction of a 100-MW electrolysis plant at a decommissioned coal-fired power station in the Moorburg district. Gasnetz Hamburg, the developer of the network project, has already started the construction of the first major pipeline sections. The next phases will cover the establishment of connections to the planned hydrogen hub in Moorburg and industrial areas in Hamburg and its districts of Altenwerder and Finkenwerder. Gasnetz's project, known as Hamburg Hydrogen Industry Network (HH-WIN), envisages the construction of 40 km of supply infrastructure, which can be later extended to 60 km.
78. **Hydrogen:** Germany. ITM Power Plc has selected Shell and its technology for the 100-MW Refhyne II electrolyser project in Germany. The plant at Shell Deutschland GmbH's Energy and Chemicals Park Rheinland will be equipped with ITM's Trident stacks and skids, which will enable the production of up to 44,000 kg of green hydrogen per day. The fuel will be used in the manufacturing of lower carbon intensity fuels, which will partly lower the carbon footprint of Shell's Wesseling refinery,
79. **Hydrogen:** Germany. RWE AG has started operation for a 14-MW electrolysis facility in Lingen, Lower Saxony, marking the initial phase of a plan to deploy 300 MW of green hydrogen capacity there by 2027. The pilot plant, powered by renewable energy, is located on the site of RWE's Emsland gas-fired power plant and can generate up to 270 kg of green hydrogen per hour. The facility features two different electrolysis technologies - a 10-MW alkaline electrolyser from Sunfire and a 4-MW PEM electrolyser from ITM Power. The use of two different technologies at the pilot plant is to provide insights for developing future industrial-scale hydrogen production.
80. **Hydrogen:** Hygenco Green Energies and Mitsubishi Power, a subsidiary of Japan's Mitsubishi Heavy Industries Ltd, will study the possibility of providing green hydrogen or ammonia-fired gas turbine combined cycle (GTCC) power plants both in India and internationally. Hygenco will supply green fuel for Mitsubishi Power's GTCC technology to prospective customers. The

company will develop green hydrogen and green ammonia production assets on a build-own-operate or gas-as-a-service basis. Mitsubishi Power, meanwhile, is developing hydrogen and ammonia firing technologies to decarbonise existing GTCC plants.

81. **Hydrogen:** New Zealand. In New Zealand, green hydrogen (which is produced with electricity from renewable sources) has attracted government support of \$186.3 million from 2017 to 2023. This provided funding for a hydrogen refuelling network, vehicle conversions and purchases, research, and the establishment of the New Zealand Hydrogen Council (now Hydrogen New Zealand).
82. **Hydrogen:** Japan. DENSO Corporation and JERA announced that they will jointly develop high-efficiency hydrogen generation technology that combines SOEC with waste heat utilization and conduct joint demonstration testing at a JERA thermal power station. Using an SOEC developed by DENSO, the two companies will develop a high-efficiency hydrogen production technology utilizing waste heat. Beginning in fiscal year 2025, DENSO and JERA will conduct a joint demonstration testing at a JERA thermal power station. Based on the outcomes of the 200kW joint demonstration test, the companies will aim to scale up the technology to a multi-thousand kW level by integrating multiple SOECs.
83. **Hydrogen:** Malaysia. Singapore-based ChemOne Group has secured USD 500 million (EUR 447.9m) from banks and financial institutions in the Middle East for the Pengerang Energy Complex which is being developed in Malaysia and is one of the largest low-carbon integrated condensate splitter and aromatics facilities in the world. The complex will have an energy products output of 3.9 mmtpa and a hydrogen output of 50,000 mmtpa. The hydrogen is planned to be used to support the development of downstream renewable fuel facilities in Johor.
84. **Hydrogen:** Canada. MAX Power Mining said it has nearly tripled the size of its recently announced Rider Natural Hydrogen Project along the expanded Torquay-Rocanville Corridor in southeast Saskatchewan. The firm noted that Rider is Canada's largest Natural Hydrogen target area and now covers 3,356 sq. km with MAX Power's staking of an additional eight claim blocks comprising 2,112 sq. km.
85. **Hydrogen:** Morocco. Morocco's Competition Council has given approval for a joint venture by Australia's Fortescue Ltd and Casablanca-based fertiliser producer OCP Group which plans to build a large-scale renewable energy, green hydrogen and ammonia production hub in the country.
86. **Hydrogen:** Germany. North Rhine-Westphalia, Germany's largest steel and chemical hub, is accelerating hydrogen production as the federal state plans that its hydrogen use will reach 127 to 177 TWh by 2045 and account for about 30% of Germany's total demand. North Rhine-Westphalia is expected to become the federal state with the highest hydrogen demand in Germany.
87. **Hydrogen:** India. Oriana Power is planning to build a gigawatt-scale factory for producing alkaline electrolyzers and balance-of-plant (BOP) modules in India. This factory will be a critical component in the company's efforts to develop green hydrogen and e-fuels, including green ammonia, e-methanol, and green methanol. The first phase of 500 MW annual capacity is expected to be operational in 2026. The new facility is being set up in partnership with Splitwaters, a US-based provider of alkaline electrolyzer and BOP (Balance of Plant) equipment.
88. **Hydrogen:** Poland. Orlen SA obtained EUR 9 million (USD 9.9m) in grant financing from the European Union to test the use of green hydrogen-powered vehicles for the Chopin Airport in Warsaw and the city's public transport system. Orlen will produce hydrogen at its hub in Wloclawek city, in the Kuyavian–Pomeranian Voivodeship in central Poland, and supply it to a

refuelling station that will be installed at Chopin Airport in 2026. The project also involves the delivery of hydrogen buses and trucks by Arthur Bus and Quantron, respectively.

89. **Hydrogen:** Saudi Arabia. NEOM Green Hydrogen Company (NGHC) has started a major recruitment campaign for its green hydrogen plant in Saudi Arabia's futuristic city, as the project moves closer to its operational phase. The \$8.4 billion facility, set to be the world's largest green hydrogen production plant, is progressing on schedule for full operations by the end of 2026. The project aims to produce up to 600 tons of carbon-free hydrogen daily, potentially eliminating five million tons of CO₂ emissions annually.
90. **Hydrogen:** Spain. Hygreen Energy, a Chinese electrolyser manufacturer, has committed to investing in a green hydrogen production plant and a components factory in the Spanish region of Andalusia. Hygreen Energy is planning to invest EUR 2 billion (USD 2.22bn) to construct a green hydrogen plant in the port city of Huelva.
91. **Hydrogen:** Sweden. Lhyfe has teamed up with Swedish renewables developer OX2 AB and local green fertiliser company Velarion Group to create a hydrogen-based industrial cluster in northern Sweden. The project, which is now entering the conceptual stage, will be situated in Gronsta just north of the Torpshammar locality in Ange municipality, Vasternorrland County. The idea is to source electricity from the Marktjarn wind farm that is being developed by OX2 in Torpshammar to power a 300-MW electrolyser that will be built by Lhyfe in the same locality for the daily production of up to 100 tonnes of green hydrogen. OX2's wind park will be able to produce some 1.4 TWh of power a year.
92. **Hydrogen:** Chile. The first phase of a USD-11-billion (EUR 10.0bn) green hydrogen and green ammonia project in Chile, owned by Copenhagen Infrastructure Partners (CIP) and two Austrian companies, has been filed for environmental approval. The first phase of the project includes a seawater desalination plant and onshore wind capacity of 1.4 GW from plants equipped with 194 turbines. It also envisages the construction of a process plant for converting electrical energy into green hydrogen and subsequently into green ammonia, a green ammonia interim storage facility and a multi-purpose port with a sea terminal. The project will have annual production of 270,000 tonnes of hydrogen which will then be available to be converted into 1.3 million tonnes of ammonia.

LNG

93. **LNG:** NextDecade Corporation announced that its subsidiary, Rio Grande LNG Train 4, LLC, has agreed to a \$4.3 billion lump sum turnkey engineering, procurement, and construction contract with Bechtel Energy Inc. for the construction of Train 4 at the Rio Grande LNG Facility. The contract's price validity extends through December 31, 2024. NextDecade is a low carbon LNG producer using CO₂ removal technology.

Marine fuels

94. **Marine fuels:** Argentina. Agunsa is now offering UCOME biofuel blends in Argentina. Agunsa's subsidiary Total Bunkering, in partnership with a leading biodiesel producer in Argentina, are blending biodiesel into very low sulfur fuel oil or low sulphur gas marine oil using trucks to adjust the blend as required.
95. **Marine fuels:** Brazil. Petrobras has obtained authorisation from the National Agency of Petroleum, Natural Gas and Biofuels (ANP) to market maritime fuel with renewable content. The company is the first in the country to receive authorisation to deliver a bunker with 24% biodiesel to the market.
96. **Marine fuels:** France. GTT, a French LNG containment company, booked orders for 52 liquefied natural gas carriers in H1 2024 including 18 large-scale LNG vessels as part of Qatar

Energy's extensive shipbuilding initiative at China's Hudong-Zhonghua shipyard. In its recent financial report, GTT detailed that these orders are scheduled for delivery between 2026 and 2031. The orders were split evenly between the first and second quarters, with 25 in Q1 and 27 in Q2. Additionally, GTT secured contracts for four large ethane carriers, one floating storage regasification unit and one floating LNG unit.

97. **Marine fuels:** Japan. The ammonia-fuelled tugboat 'Sakigake' was completed by Nippon Yusen Kabushiki Kaisha (NYK Line) and IHI Power Systems Co., Ltd. as an ammonia-fuelled vessel. This is the world's first ammonia-fuelled vessel for commercial use. The NYK Group company Shin-Nippon Kaiyosha will employ the vessel in tugboat operations in Tokyo Bay over a three-month demonstration period. This vessel was a Green Innovation Fund Project*2 initiated in October 2021 under Japan's New Energy and Industrial Technology Development Organization (NEDO) to develop vessels equipped with domestically produced ammonia-fuelled engines.
98. **Marine fuels:** Singapore. TotalEnergies Marine Fuels supplied its first B100 biofuel bunker in Singapore, marking a significant expansion in its low-carbon fuels offer as it supports the decarbonization goals of global shipping. TotalEnergies Marine Fuels used an IMO Type II chemical bunker tanker, owned by Global Energy Group, to transfer 700 metric tons (mt) of the 100% Used Cooking Oil Methyl Ester biofuel to a Pure Car and Truck Carrier (PCTC), which is owned by Hyundai Glovis.
99. **Marine fuels:** Spain. Peninsula announced the successful biofuel bunkering of the containership Yantian Express by its IMO II chemical tanker, Aalborg. The supply operation was carried out for Hapag-Lloyd AG in the Port of Barcelona. Peninsula said that the 88,500 GT vessel received 2,200mt of B30 VLSFO. The sustainable biofuel used for this blend was ISCC EU certified biodiesel derived from used cooking oil

Market Development

100. **Market Development:** USA. Auris-Avalon Group of Companies and Prismecs announced a strategic alliance aimed at advancing the development and deployment of integrated clean energy projects globally. The strategic alliance leverages the unique strengths of both companies to meet the growing demand for sustainable aviation fuel (SAF), biodiesel, green electricity, green hydrogen, and other renewable energy products. Auris-Avalon's combined strength in agriculture, agronomy, agriprocessing, and biofuels production positions it as a low-cost producer of energy products.

Methanol

101. **Methanol:** Australia. HAMR Energy has partnered with German technology and engineering company thyssenkrupp Uhde to promote the development of a green methanol project in Portland, Australia, to decarbonize the shipping sector. The project will integrate its PRENFLO gasification technology with uhde green methanol technology to convert forestry residue into high value green chemicals. The facility will produce 300,000 tons per annum of green methanol.

Plastic recycling

102. **Plastic recycling:** Canada. Aduro Clean Technologies Inc, a Canadian technology company using the power of chemistry to transform lower-value feedstocks, such as waste plastics, heavy bitumen, and renewable oils, into resources for the 21st century, announced a new collaboration with TotalEnergies.

103. **Plastic recycling:** Finland. Neste is expanding its logistics infrastructure for liquefied recycled raw materials at its refinery in Porvoo, Finland, including materials such as liquefied waste plastic and liquefied rubber tires. This development will allow handling larger amounts of liquefied raw materials and their subsequent processing at the Porvoo refinery.

Policy

104. **Policy:** A severe lack of rain, wind and sun is exposing the risks of renewable electricity generation's role in New Zealand's baseload electricity requirements. Prices look set to rise for retail users. Prices over \$1000/MWhr (megawatt hour) are becoming frequent as the cold winter blast coincides with low lake levels and inflows, and low wind generation.
105. **Policy:** Brazil has introduced the Special Incentive Regime for the Production of Low Carbon Hydrogen (Rehydro), effective from January 2025 for five years. It aims to develop Brazil's hydrogen production capabilities, leveraging the country's vast energy resources. President Lula highlighted Brazil's unmatched potential in green hydrogen, solar, wind, and biomass energy. With 57 Gigawatts of announced projects and R\$ 212 billion in investments, primarily in Ceará and Piauí, the initiative aims to make Ceará a major green hydrogen hub.
106. **Policy:** India. The Indian Government is planning to blend 5% ethanol into diesel, a shift that could shake up both the energy sector and environmental efforts. This initiative is part of a broader strategy to reduce dependence on imported crude oil and aims to integrate over 1 billion litres of ethanol into India's diesel supply annually. Ethanol, primarily derived from surplus sugarcane and corn, presents a dual opportunity for India: reducing agricultural waste and fostering an indigenous biofuel industry. However, the plan is not just about energy security or cleaner emissions. It's also seen as a lifeline for farmers, who stand to gain new markets for their crops, which may also boost rural incomes.
107. **Policy:** Indonesia. Indonesia has started testing for the implementation of its "B50" biodiesel mandate, which aims to blend 50% palm oil-based biodiesel with conventional diesel. This initiative, set to build on the current B35 program, is one of the most ambitious biofuel mandates globally. The new mandate is part of incoming President Prabowo Subianto's plan to reduce the country's reliance on oil imports.
108. **Policy:** The Spanish ministry for the ecological transition has released the rules and criteria for its next green hydrogen subsidy programme, which, with a budget of EUR 1.2 billion (USD 1.29bn), will fund larger-sized projects and the installation of more powerful electrolyzers.

Recycling plastic

109. **Recycling plastic:** Turkey. CARBIOS, a pioneer in the development and industrialization of biological technologies to improve the life cycle of plastic and textiles, and SASA, one of the world's leading manufacturers of polyester, fiber, filament yarn, polyester-based polymers, specialty polymers and intermediates, have signed a LOI to cooperate through SASA's potential acquisition of a license for CARBIOS' unique PET biorecycling technology. This licensing agreement would allow SASA to construct and operate an enzymatic depolymerization plant in Adana, Turkey, with a capacity of 100,000 tons per year of prepared PET waste.

Renewable Diesel

110. **Renewable Diesel:** Amtrak has replaced more than a million gallons of fossil fuel with renewable diesel in the past 12 months. The company has begun to integrate climate resilience and sustainability design measures into capital projects, and it has finalised plans to host its first clean energy generation facility.

111. **Renewable diesel:** USA. PBF Energy Inc. announced that its St. Bernard Renewables facility produced approximately 16,500 barrels per day of renewable diesel during the second quarter of 2024. Like many renewable diesel producers, the company is also considering a pivot to sustainable aviation fuel (SAF). The SBR biorefinery is co-located at PBF Energy's Chalmette oil refinery in Louisiana. The 320 MMgy facility primarily produces renewable diesel and is jointly owned by PBF Energy and Eni Sustainable Mobility Spa. PBF and Eni closed on the 50-50 partnership in St. Bernard Renewables in mid-2023.
112. **Renewable Diesel:** USA. According to a new report from the USDA the production of renewable diesel in the US grew from 40 million gallons in the 2010/11 marketing year to 2.3 billion gallons in 2022/23 - surpassing biodiesel production for the first time. This is important because RD offers significant advantages over biodiesel, including that it is a drop in solution and offers significant GHG emissions reductions compared to both biodiesel and fossil diesel. Production of biodiesel grew steadily beginning in the early 2000s to a peak of 1.8 billion gallons during the 2018/19 marketing year for soybean oil (October–September) but has declined slightly to 1.7 billion gallons in 2022/23. Renewable diesel has displaced biodiesel's share of the market.
113. **Renewable Diesel:** Finland. Valtra, tractor manufacturer belonging to AGCO Corporation, has reached a significant milestone by having used altogether 5 million litres of Neste MY Renewable Diesel as a factory-fill fuel as well as in testing and in its factory forklift trucks at its Suolahti factory.

Technology Development

114. **Technology Development:** USA. Hyliion Holdings Corporation, a US-based developer of sustainable electricity-producing technology, has announced that it has entered into a non-binding MoU with Hong Kong-based Jardine Engineering Corporation Ltd, a Jardine Matheson Group company. The KARNO generator is a groundbreaking fuel-agnostic solution that utilizes a linear generator architecture to produce electricity both economically and efficiently. The KARNO generator uses heat to expand a working fluid within a hermetically sealed cavity, pushing a piston assembly through a magnetic field to create an electric current. This heat can be obtained by reacting fuels in an external reaction chamber or captured from other external heat sources.
115. **Technology Development:** USA. Fluid Quip Technologies (FQT) announced the successful completion and commissioning of the world's largest MSC System to date at Tharaldson Ethanol's 175 million-gallon biorefinery in Casselton, North Dakota. This marks the twelfth FQT MSC system installed world-wide and expands the production of corn fermented protein, a high-quality protein ingredient in animal feed, providing superior nutrition solutions for pet, aquaculture and other animal feed markets which has up to a 40% lower carbon-intensity than competing products.

Sector Status Report: August 2024

As the low carbon and energy transition develops the nature and mix of projects and developments will change. Below is an overview of the mix of projects and activities during August 2024 characterised by Technology Development, Infrastructure, Policy and Commercial deployment.

| Sector Status | Number of Projects/Activities summarised on website | Examples |
|-------------------------------|--|---|
| Technology Development | 48 | <ul style="list-style-type: none"> - Hyliion Holdings' KARNO generator technology- Fluid Quip Technologies' MSC system - OXCCU's e-fuels demonstration plant in the UK - LanzaJet's CirculAir platform in Australia - Germany's 40-km hydrogen distribution network |
| Infrastructure | 20 | <ul style="list-style-type: none"> - Rio Grande LNG facility Train 4 construction in the U.S. - Japan's ammonia-fuelled tugboat |
| Policy | 20 | <ul style="list-style-type: none"> - Brazil's Special Incentive Regime for Low Carbon Hydrogen (Rehydro) - India's ethanol blending policy - Indonesia's B50 biodiesel mandate |
| Commercial Deployment | 27 | <ul style="list-style-type: none"> - Amtrak's renewable diesel integration - Gunvor and VARO Energy's SAF facility in Rotterdam - Natura's biomethane-powered fleet in Brazil |

Company Summary – August 2024

Frequency of mention.

| Company | Frequency |
|---------------------------|------------|
| Fortescue | 3 |
| Neste | 3 |
| ADM | 2 |
| BP | 2 |
| Clariant | 2 |
| Clean Energy Fuels | 2 |
| EcoCeres | 2 |
| Uniper | 2 |
| VARO | 2 |
| AB Kaišiadorių Paukštynas | 1 |
| ABSL, UK | 1 |
| Aduro Technologies | 1 |
| Agunsa | 1 |
| Amtrak | 1 |
| Andritz | 1 |
| Auris-Avalon | 1 |
| BASF | 1 |
| Be8 | 1 |
| Boeing | 1 |
| Borealis | 1 |
| Brazilian Government | 1 |
| Caramuru | 1 |
| Carbios | 1 |
| Celanese | 1 |
| Cepsa Bioenergia | 1 |
| ChemOne | 1 |
| CIP | 1 |
| Covestro | 1 |
| CPFL Energy | 1 |
| Total | 122 |

Topics & Themes Summary– August 2024

Frequency of mention

| Category | Frequency |
|------------------------|------------|
| Hydrogen | 31 |
| Biojet | 19 |
| Biogas | 15 |
| Biofuels | 12 |
| Marine fuels | 7 |
| Biobased chemicals | 6 |
| Ammonia production | 5 |
| Ethanol | 5 |
| Policy | 5 |
| Renewable diesel | 4 |
| CO2 Removal | 3 |
| Plastic recycling | 3 |
| Biodiesel | 2 |
| e-fuels | 2 |
| Methanol | 2 |
| Technology development | 2 |
| Biomaterials | 1 |
| e Fuels | 1 |
| LNG | 1 |
| Market Development | 1 |
| Recycling plastic | 1 |
| Total | 128 |