

Bioeconomy & Low Carbon Technology Overview for June 2024

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

Highlights by Topic: June 2024

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Ammonia

1. **Ammonia production:** Hive Hydrogen, South Africa is seeking to attract some of Japan's biggest companies to invest in a \$5.9 billion green ammonia project. Senior officials from Mitsubishi UFJ Financial Group, Itochu, Mitsubishi Heavy Industries and Mitsui OSK Lines will visit the site of the proposed plant in Eastern Cape province, South Africa, to assess whether to lend it money or take equity investments.
2. **Ammonia production:** thyssenkrupp Uhde and Johnson Matthey announced they have signed a MoU to jointly offer a fully integrated low carbon (blue) ammonia solution utilising thyssenkrupp Uhde's dual pressure technology. Johnson Matthey's LCH technology, which utilizes autothermal reformer alone, or in conjunction with a gas heated reformer, has been selected for several of the world's first large scale blue hydrogen projects including bp's H2Teesside, a 700-megawatt low carbon hydrogen production plant, and the H2H Saltend project with Equinor and Linde for a 600-megawatt low carbon hydrogen production plant. These technology options will enable the production of blue ammonia with up to 99% CO2 capture.

Biobased chemicals

3. **Biobased chemicals:** BASF is expanding its biomass balance offering to include BMBCert™ 1,4-butanediol (BDO), tetra-hydrofuran (THF), polytetra-hydrofuran (PolyTHF®) and 3-(di-methyl-amino)pro-pyl-amine (DMAPA). In addition to the production site in Ludwigshafen, Germany, the site in Geismar, Louisiana, has also achieved certifications for all these products. The Ulsan site in South Korea has obtained certification for PolyTHF. With these certifications, BASF can now offer its customers regionally produced ISCC PLUS and REDcert2-certified products with low carbon intensity.
4. **Biobased chemicals:** BASF is now offering the packaging industry a way to increase the use of renewable feedstocks. It is expanding its portfolio of certified compostable biopolymers to include a biomass-balanced (BMB) ecoflex®, a polybutylene adipate terephthalate (PBAT) that is frequently used in the compounding of biopolymers. For the new ecoflex® F Blend C1200 BMB, the fossil raw materials that are usually used in the production process are replaced with renewable feedstock at the beginning of the value chain. The renewable feedstock comes from waste and residual biomass and is attributed to the ecoflex® grade via a mass balance approach which is certified according to REDcert2 and ISCC PLUS.
5. **Biobased chemicals:** BioBTX has secured over €80 million to launch its first commercial-scale plant. This investment will fund the world's first renewable chemicals plant utilizing BioBTX's innovative ICCP Technology to produce sustainable aromatics — benzene, toluene and xylene — from plastic waste and biomass. Aromatics are essential for producing every-day products like insulating foams, coatings, PET bottles, batteries, and pharmaceuticals. BioBTX has developed the so-called Integrated Cascading Catalytic Pyrolysis (ICCP) technology, a novel form of catalytic pyrolysis. This is a two step-process, i.e. pyrolysis followed by direct catalytic conversion of pyrolysis vapours, which gives high yields of aromatics.

6. **Biobased chemicals:** Borealis announced the installation of a semi-commercial demonstration recycle-based polyolefins (rPO) compounding line in Beringen, Belgium. The new line will use Borealis' proprietary Borcycle™ M technology to transform mechanically recycled post-consumer waste into high-quality rigid polypropylene (PP) and polyethylene (PE) materials. Capable of processing a broad range of recycle flakes from both PP and high-density polyethylene (HDPE) waste sources, the new line will offer exceptional versatility and flexibility. This development complements Borealis' recent acquisitions of recycle-based compounding business Rialti, and advanced mechanical recycler Integra.
7. **Biobased chemicals:** Braskem Siam Co., Ltd. has received approval from the Thailand Board of Investment for a 19.3 billion baht (\$526 million), 200,000 tons/year biobased ethylene plant. The project will convert ethanol produced using agricultural products such as sugarcane, cassava, and corn feedstock. Braskem Siam, a joint venture between leading biopolymer producer Braskem and Thailand's SCG Chemicals PCL, plans to build the facility at the Map Ta Phut Industrial Estate in Rayong province, Thailand.
8. **Biobased chemicals:** Cellugy's team of scientists has developed a unique platform technology that harnesses the power of bacteria, leveraging cellulose-producing microorganisms to produce high-purity, crystalline cellulose derived from the bioconversion of sugar.
9. **Biobased chemicals:** Covestro has invested in BioBTX to support the construction of the world's first demonstration plant for the BioBTX ICCP-Technology in the Netherlands. The technology produces benzene, toluene and xylene from organics and mixed plastic waste. These aromatics are essential for the chemical industry and are used in plastics production, along with many other applications. Other partners in this project are NL and Infinity Recycling. Once operational, the demonstration plant will convert 20 kilotons of mixed plastic waste per year to aromatic precursors.
10. **Biobased chemicals:** Dow and SCG Chemicals (SCGC), signed a MoU for a partnership in the Asia Pacific region to transform 200 KTA of plastic waste into circular products by 2030. The partners intend to accelerate technology development in the value chain to enable recycling through both mechanical recycling (MR) and advanced recycling (AR) and to convert a broader range of plastic waste into high-value applications. The initial phases are expected to include establishing a value growth partnership for post-consumer recycled materials (PCR) with current suppliers and developing technology solutions in waste sorting using both MR and AR in Thailand. The partnership will build a materials recycling ecosystem in South-east Asia. This ecosystem will ultimately enable better plastic waste collection, recycling and management.
11. **Biobased chemicals:** Evonik has been leading the development of industrial-scale biosurfactants with its IP-protected, fermentation-based process for rhamnolipid production and the development of industrial-scale biosurfactants. Rhamnolipids are made from renewable corn feedstocks using a fermentation process. Rhamnolipids are increasingly in demand as they provide a sustainable alternative to surfactants traditionally based on fossil sources.
12. **Biobased chemicals:** Godavari Biorefineries Limited (GBL) has launched a new specialty biochemical plant in Maharashtra, India. The plant will produce biobased chemicals for various industries, including coatings, cosmetics, pharmaceuticals, and food and fragrances. The plant is expected to produce biochemicals like biobutanol, biobased ethers, and esters.

13. **Biobased chemicals:** INEOS Nitriles confirmed the world first sales of INVIREOTM a new bio-based acetonitrile necessary for the production of many pharmaceuticals such as insulin and vaccines.
14. **Biobased chemicals:** LG Chem is planning to jointly develop the technology that creates 100% bio-based plastic from renewable sources of carbohydrates such as corn, with Gevo. Through the joint development agreement, the companies expect to produce bio-propylene with bio-ethanol produced from carbohydrates including corn and sugarcane. Under the terms of the agreement, Gevo will provide LG Chem with the source technology, ETO (Ethanol to Olefins), required for production of propylene from ethanol, and together with Gevo, LG Chem will verify and advance the technology through technical scale-up, pilot research, and commercialization.
15. **Biobased chemicals:** Resonac Corporation, Neste and Marubeni Corporation entered into an agreement to promote the production of renewable olefins and their derivatives. The cooperation involves Neste RE™, a Neste-produced renewable raw material, being used to manufacture products at leading Japanese chemical company Resonac's Oita Complex in Japan. Marubeni, a Japanese general trading and investment conglomerate, will coordinate all the logistical arrangements between Neste and Resonac.
16. **Biobased chemicals:** Solugen has secured a conditional, \$213.6-million loan guarantee from the U.S. Department of Energy. The Loan Programs Office funds will support construction of Solugen's 500,000 square foot organic acids production facility planned for Marshall, Minnesota. The site will deploy Solugen's Bioforge technology for converting biomass into organic acids. These organic acids are used for wastewater treatment, construction, agriculture, and energy applications.
17. **Biobased chemicals:** Trillium Renewable Chemicals (Trillium) has selected of INEOS Nitriles' Green Lake facility in Port Lavaca, Texas to establish the world's first demonstration plant for converting plant-based glycerol into acrylonitrile. Trillium Renewable Chemicals has developed technology for producing sustainable acrylonitrile, a key raw material in numerous manufacturing process, including for toys, auto parts, aerospace components, medical supplies, and apparel.
18. **Biobased chemicals:** Verbio commenced construction of the world's first large-scale ethenolysis plant using rapeseed oil methyl ester at its Bitterfeld location. This plant will be able to manufacture large quantities of bio-based speciality chemicals for use in detergents and cleaning agents, high-performance lubricants for engines, or plastics. With ethenolysis, Verbio provides the market with the bio-based speciality chemicals methyl 9-decenoate (9-DAME) and 1-decene. The Bitterfeld plant will have a nominal annual capacity of 32,000 tonnes of 9-DAME and 17,000 tonnes of 1-decene. The objective is to manufacture 60,000 tonnes of renewable products for the chemical industry annually. Verbio plans to commission the plant in 2025 and commence regular production in 2026.

Biobased plastics

19. **Biobased plastics:** Floreon has secured £250 million (US\$320 million) from the Centre for Process Innovation to scale up its polylactic acid bioresin technology. Floreon's 70-90% plant-based PLA uses corn and sugarcane as feedstock which gives a stronger PLA resin compared to other PLA materials on the market. The company's portfolio also includes a halogen-free bioplastic alternative to acrylonitrile butadiene styrene – this is the first bioplastic to achieve UL94V-0 flammability certification.

20. **Biobased plastics:** Floreon produces proprietary compounds made from plant-based materials, including corn and sugarcane, which offer improved performance and sustainability. The Centre for Process Innovation (CPI), a UK-based technology and sustainable materials accelerator, has invested £250 million (\$319 M) in Floreon, a bioplastics developer from the University of Sheffield. With CPI's investment, Floreon will be able to scale up its technology and bring its innovative bioplastics to the market.
21. **Biobased plastics:** NatureWorks, a leading manufacturer of polylactic acid (PLA) biopolymers made from renewable resources, announced the historic financial support from Krungthai Bank PCL to optimize the capital structure for the new fully-integrated Ingeo™ PLA manufacturing facility in Thailand.
22. **Biobased plastics:** Neste, Borealis and Covestro have signed a project agreement to enable the recycling of discarded tires into high-quality plastics for automotive applications. The collaboration aims at driving circularity in plastics value chains and the automotive industry. When no longer fit for use, tires are liquefied by means of chemical recycling and then processed into base chemicals and further into polycarbonates of high purity. These can then be used in various automotive applications, to form parts of headlamps and radiator grilles.

Biodiesel

23. **Biodiesel:** Kyotherm SAS (a French company) has announced that it is extending its biodiesel-powered generating capacity on the Emerald Isle. The company is extending its capacity with 4 MW to 20 MW in Northern Ireland, and has launched construction of 6.4 MW of capacity in Ireland. CoolPlanet Group will support Kyotherm with the construction and, operation, and as a shareholder in all the projects. The projects will be commissioned in Q3 2024 and will make power available to the Irish electricity grid.
24. **Biodiesel:** OMV has started up its co-processing plant at the Schwechat refinery in Austria. Almost €200 million has been invested to allow up to 160,000 metric tons of liquid biomass being converted into high-quality renewable hydrogenated vegetable oil components. The plant has considerable feedstock flexibility. waste-based (e.g., used cooking oil) and advanced feedstocks (e.g., liquid from nut shells).

Biofuels

25. **Biofuels:** A British agri-technology company, York-based specialists in agricultural bioacoustic AI technology, AgriSound, is working with the UK Agri-Tech Centre and GYO Systems based in South Africa, to help improve yields of sugarcane through improved monitoring of crop pests. The project is focused on pivoting South Africa towards a net-zero carbon economy by optimising bio-energy production. Increased availability of sugarcane has the potential to be used to generate bioenergy. AgriSound, received a grant of around £200,000 from Innovate UK's African Innovation Collaborations for Net Zero Places.
26. **Biofuels:** Comstock Inc. has developed agreements with RenFuel K2B AB involving the development of RenFuel's pre-existing, planned biorefinery project at a pulp and paper mill in Sweden.
27. **Biofuels:** Dimeta B.V. a leader in accelerating the production and use of renewable and recycled carbon fuel, is partnering with Delft University of Technology and The Green Village to trial the use of renewable dimethyl ether (rDME) with a liquefied petroleum

- gas (LPG) blend in home heating for the first time in Europe. Dimeta is hoping to demonstrate a sustainable heating solution for some 137 million people in Europe who are living in off-grid and hard-to-decarbonise homes. The use of DME can avoid costly retrofits or the need for new appliances. DME can be blended with LPG up to 12 percent.
28. **Biofuels:** OMV is planning to invest some EUR 750 million (USD 805m) in a number of projects to produce sustainable aviation fuels (SAF), renewable diesel (HVO), and green hydrogen at its existing Petrobrazi refinery, Romania. The company has made the final investment decision to build a EUR-560-million plant with the capacity to produce 250 kt/year of SAF and HVO along with by-products such as bio-naphtha and bio-LPG for the chemical industry. In addition, OMV Petrom will construct two green hydrogen production facilities with a combined capacity of 55 MW at a total cost of around EUR 190 million, of which EUR 50 million will be covered by European funds. Those two units are expected to produce about 8 kt of green hydrogen per year and meet most of the hydrogen needs of the new SAF/HVO plant.
 29. **Biofuels:** The Renewable Fuels Association, USA released a report on the benefits of plug-in technology and flex-fuel light vehicles. Such vehicles can be easily refuelled and they offer optimal convenience and affordability to consumers. The PHEFFV overcomes many of the barriers to BEV adoption commonly identified by consumers, including limited driving range, high purchase price, reliability, and lack of refuelling (recharging) infrastructure. Furthermore, they have low carbon emissions based on life cycle analysis when compared to BEV.
 30. **Biofuels:** UPM Biofuels has already made significant strides in reducing emissions with its existing Lappeenranta facility. This is the first commercial-scale biorefinery, producing 130,000 tonnes of renewable wood-based diesel and naphtha.

Biogas

31. **Biogas:** Cemex and Clean Energy Fuels Corp. have entered a fueling agreement to provide ultra-clean renewable natural gas (RNG) to power 39 of Cemex US's ready-mix and cement bulk trucks in Southern California. Forecasted to provide approximately 300,000 gallons of RNG annually, the fleet will utilize Clean Energy's public station network in Southern California to fuel with RNG.
32. **Biogas:** Gasum and Scania opened a biogas filling station in Södertälje.
33. **Biogas:** IndianOil has entered into a Joint Venture Agreement with GPS Renewables Private Limited, one of the leading biofuels companies in India. This association will pave the way for the formation of a 50:50 joint venture company dedicated to advancing biofuel adoption across the country. The joint venture will focus on integrating advanced biogas technologies to convert organic waste into Compressed Biogas (CBG). IndianOil and GPS Renewables aim to accelerate the deployment of CBG plants nationwide.
34. **Biogas:** Sevana Bioenergy, a leading developer and operator of large-scale renewable natural gas (RNG) facilities, announced the successful acquisition of the Rialto Bioenergy Facility in Rialto, California. The Rialto Bioenergy Facility is the largest organic waste to energy facility in North America. The plant has a permitted capacity of 1,000 tons per day of a combination of food waste separated from municipal solid wastes, and municipal biosolids. The facility has a designed capacity for converting these organic waste streams into 1 million MMBtu per year of RNG and soil amendment products.
35. **Biogas:** The International Center for Renewable Energy (CIBiogás) and the Brazil-Germany Cooperation for Sustainable Development, through the H2Brazil project,

commenced operation of the first pilot plant in Brazil for the production of synthetic oil from biogas. The process produces sustainable aviation fuel. With an investment of 1.8 million euros from the German government, specifically from the Federal Ministry for Economic Cooperation and Development of Germany (BMZ), the Renewable Hydrocarbons Production Unit, installed on the premises of Itaipu Binacional, will produce 6kg/day of bio- syncrude – a mixture of hydrocarbons synthesized from biogas and green hydrogen, which will be used for the production of SAF. The pilot plant uses up to 50 Nm³/day of biogas produced in the Itaipu Binacional biodigestion unit as the main source of carbon for the production of hydrocarbons. In addition, 53 Nm³/day of green hydrogen produced by the Itaipu Technological Park (PTI) is used.

36. **Biogas:** ATH Bioenergy plans to invest €100 million in four biomethane plants in the Canary Islands. The project has now begun with construction underway on the first plant in Puerto de Arinaga, Gran Canaria. Subsequent facilities will be built in Tenerife, Fuerteventura, and Lanzarote. All the plants are designed to process organic waste from local hotels and supermarkets.
37. **Biogas:** Between 2017 and 2022, the Bio Based Industries Joint Undertaking (BBI JU) funded the EU URBIOFIN project. URBIOFIN has focused on the technoeconomic feasibility of turning urban waste into fuel and materials, making municipal waste management more circular as a result. To achieve this aim, URBIOFIN established lab, pilot, and semi-industrial demos of an urban biorefinery design in three locations across Spain. The first module that made up the URBIOFIN three-part biorefinery was located in PERSEO Biotechnology's plant (L'Alcudia, Valencia). Modules two and three were located in the Innovation Centre of Urbaser (Zaragoza) and the CLAMBER biorefinery (Puertollano, Ciudad Real) respectively.
38. **Biogas:** Biokraft, Sweden has signed an exclusive land agreement with the industrial group Perstorp where Biokraft is given the opportunity to design a biogas plant at the Group's industrial park in Perstorp. The plant's capacity is planned to be 130 GWh of biomethane and 17,000 tons of liquid CO₂ per year. The plant is expected to be completed in 2027.
39. **Biogas:** Copenhagen Infrastructure Partners (CIP), through its CI Advanced Bioenergy Fund I (CI ABF I), has launched a new partnership to develop, construct and operate biogas plants across Ireland using animal manure. Greengate Biogas comprises CI ABF I, Atlas Renewables and Energex Partners. When fully established, Greengate Biogas will produce nearly 1.8 TWh per year of biomethane across multiple projects, representing approximately 3.5% of Ireland's current natural gas demand. The projects will inject biomethane into the grid and provide organic fertilizers to farmers.
40. **Biogas:** EnviTec Biogas (a German Company), has successfully completed two more biogas projects in the USA in Cassville, New York and Ellington, Connecticut. The two plants were planned, designed, and constructed by the company's subsidiary, EnviTec Biogas USA Inc. over the past 18 months. EnviTec supplied South Jersey Industries (SJI), the owner of both plants, with fermenter technology, internal and external heating systems, digester covers, pumps, raw gas treatment, O₂ generation and EnviThan gas upgrading system. The combined biogas and EnviThan gas upgrading plant in Cassville produces 135 scfm while the plant in Ellington produces 150 scfm of RNG.
41. **Biogas:** Flogas, part of DCC plc, has officially opened Ireland's first ever dedicated Bio-CNG refuelling self-service station. Flogas, a commercial and industrial energy supplier and supplier of renewable biomethane to transport in Ireland, wants this new self-service station to support large companies making the switch to Bio-CNG to reduce their

Scope 3 emissions. This 2,900 square meter site can refuel up to 50 Heavy Goods Vehicles (HGVs) per day from one dual sided high-speed dispenser. When the station is at full capacity, it will cut over 9,000 tons of CO₂ emissions per year compared to diesel fuelled HGVs.

42. **Biogas:** Hydron Energy Inc is commercializing a low-cost INTRUPTor™ system, a revolutionary gas upgrading solution. Hydron Energy's Intensified Regenerative Upgrading Platform Technology (INTRUPTor™) system is a platform solution that converts raw gases into clean refined product. The compact system will provide significant capital and operating cost savings over conventional gas-upgrading technologies. The INTRUPTor™ cycle runs orders of magnitude faster than conventional cycles using parallel passage contactor sorbent architecture. INTRUPTor™ rapid cycle sorption technology overcomes the inherent disadvantages of conventional technologies such as slow gas diffusion, relatively large vessels, and complex balance of the plant
43. **Biogas:** SUBLIME Energie (France) is revolutionizing the valorization of biogas by developing a unique technology: the liquefaction of biogas. By efficiently transporting and pooling the biogas production of several farms, it reduces their initial investment and operating costs, thus opening access to unexploited biomass resources, increasing the resilience of agricultural operations and territories, and offering a decarbonization pathway for the agricultural and transport sectors.
44. **Biogas:** The Bank of Ireland announced its support for the Irish agriculture industry at the launch of two white papers on the development of the biomethane sector, and its need to support the sustainable transition of the agrifood sector.
45. **Biogas:** The European biomethane sector will receive an injection of €25 billion in private investments by 2030, according to a European Biogas Association (EBA) analysis released recently. This represents a 30% increase compared to last year's estimates. The 2nd edition of the Biomethane Investments Outlook forecasts €2.1 billion investments in the pipeline, but yet to be allocated.
46. **Biogas:** Veolia, Waga Energy and ENGIE have created a partnership to develop the RNG industry in France. Since March 2022, Veolia has been supplying Waga Energy with biogas from the Claye Souilly landfill site in the Île-de-France region to produce RNG using its patented WAGABOX® technology. This RNG was initially sold to ENGIE under a feed-in tariff subsidized by the French Government. A Biomethane Purchase Agreement (BPA), valuing RNG at a higher price than the subsidized price, came into force on May 1, 2024, for a period of 13 years. This is the longest BPA signed in France to date, which enabled Waga Energy to retain the financing of the RNG production unit.
47. **Biogas:** Mitsubishi Gas Chemical Company has begun producing bio-methanol at a new facility within the company's Niigata Plant, becoming the first producer of bio-methanol from digester gas in Japan. MGC concluded a basic agreement with Niigata Prefecture to purchase and sell digester gas generated at the Niigogawa Sewage Treatment Center, which is owned by Niigata Prefecture. In order to effectively utilize the center's unused digester gas. MGC's production of bio-methanol and its derivative dimethyl ether (DME) in Niigata has obtained International Sustainability and Carbon Certification (ISCC) PLUS.

Biojet/Sustainable Aviation Fuels

48. **Biojet/SAF:** The International Air Transport Association is planning to establish a SAF Registry to accelerate the uptake of Sustainable Aviation Fuels by accounting and reporting emissions reductions from SAF. Seventeen airlines, one airline group, six

national authorities, three Original Equipment Manufacturers (OEMs), and one fuel producer are supporting the effort to develop the Registry. The Registry is expected to launch in the first quarter of 2025.

49. **Biojet/SAF:** Avfuel Corp.—one of business aviation’s leading suppliers of sustainable aviation fuel—marks a new milestone in its SAF supply journey, expanding its supply globally to three French airports. With SAF supply agreements at Paris Le Bourget Airport (LBG), Bordeaux-Mérignac Airport and Clermont-Ferrand Auvergne Airport.
50. **Biojet/SAF:** Chevron Lummus Global LLC (CLG) announced its ISOTERRA technology was selected for a sustainable aviation fuel (SAF) project in China. CLG will provide the technology license, engineering services, and supply proprietary equipment and catalysts for this new facility.
51. **Biojet/SAF:** GPS Renewables has partnered with Dubai-based SAF One, a platform focused on the development of global sustainable aviation fuel solutions, for the construction and development of sustainable aviation fuel projects in India. As a part of this partnership, GPS’ project platform, ARYA, along with SAF One, will co-develop a 20 to 30 million litres per year sustainable aviation fuel (SAF) facility using lignocellulosic waste feedstock (residual dry plant matter). GPS Renewables has expertise in biofuel technology, compressed biogas (CBG), renewable natural gas (RNG), 2G ethanol, and green hydrogen. The company has a track record of establishing over 100 biogas plants, including Asia’s largest RNG plant based on municipal solid waste (MSW) in Indore, India.
52. **Biojet/SAF:** Neste has further expanded its capability to supply sustainable aviation fuel to customers in Europe with a collaboration with VTTI, a global leader in energy storage and developer of energy infrastructure. Neste commissioned terminal capacity at VTTI’s ETT terminal in Rotterdam, the Netherlands, for the storage and blending of Neste MY Sustainable Aviation Fuel™. This was a significant step in expanding the availability of Neste’s sustainable aviation fuel (SAF) to customers across Europe.
53. **Biojet/SAF:** Paris-Vatry SAF, the Sustainable Aviation Fuel (SAF) production plant project at Paris-Vatry airport will be developed with leading ATJ (Alcohol-To-Jet) technology provider LanzaJet. The project, carried by Haffner Energy, will provide an initial capacity of 30,000 tonnes of Sustainable Aviation Fuel (SAF) per year, with the possibility of tripling production. Paris-Vatry SAF is the first in a series of new SAF projects with Haffner Energy’s solutions. SAFNOCA®, the biomass-agnostic solution developed by Haffner Energy will be used along with the ATJ pathway. Syngas produced by SAFNOCA® will be converted into ethanol using LanzaTech’s carbon recycling system.
54. **Biojet/SAF:** Pittsburgh International Airport (PIT) has partnered with SkyClean to have an SAF production plant at the airport. SkyClean is currently in the process of signing a land lease agreement to build a sustainable aviation fuel production facility at the airport. Once complete, PIT will be the first major airport in the US to have SAF production on-site. The proposed facility would be capable of producing 25 million gallons of unblended SAF annually, with future production up to 75 million gallons – enough to supply all the fuelling needs at PIT and other airports in the Midwest and Northeast.
55. **Biojet/SAF:** SkyNRG is launching Project Runway, an initiative which brings together airlines and corporates to simplify SAF procurement. Microsoft is joining as a founding member. Using a Book & Claim approach, Project Runway not only allows airlines access to SAF, but also allows them to share the SAF price premium with ambitious corporates aiming to reduce their own Scope 3 aviation emissions.
56. **Biojet/SAF:** Sparfell is working to boost the availability of sustainable aviation fuel through a book-and-claim scheme offered by its new partner, Squake. Under a new

agreement, Sparfell's customers will be able to opt for SAF to be used for their flight where it is available or offset usage of fossil fuels by acquiring credits based on its use elsewhere.

57. **Biojet/SAF:** Synhelion and Pilatus Aircraft have entered into a strategic cooperation with the aim of accelerating the scaling of solar fuels for aviation. The Swiss aircraft manufacturer wants to use Synhelion's solar fuels for its own flight operations and offer it to its customers in the medium term. Pilatus has developed, built, and delivered more than 4,400 aircraft worldwide. In the future, the company would like to use Synhelion's solar fuel not only for its own aircraft fleet – but to also be available to its customers.
58. **Biojet/SAF:** Zero has signed a MoU with Airbus to advance the development of synthetic Sustainable Aviation Fuel (eSAF) and enable commercial-scale adoption of the technology by combining their unique resources and expertise. Zero's 100% drop-in synthetic SAF will be manufactured in a fully carbon-neutral process using air and water. The fuel's energy density and ability to power existing engines without modification make it an ideal solution for aviation.
59. **Biojet/SAF :** LanzaJet announced an investment from MUFG, one of the world's leading financial groups with total assets of approximately \$2.9 trillion. The investment enables LanzaJet to continue building its capability and capacity to deploy its proprietary ethanol to sustainable aviation fuel (SAF) process technology. MUFG's investment is part of LanzaJet's current \$100 million growth equity funding round, with support from leading companies across industries and around the world. In the last few months, LanzaJet has announced investments from Southwest Airlines, Microsoft, Groupe ADP, and now MUFG. While SAF production continues to scale, LanzaJet maintains its role in developing the industry by continuing its work building the ecosystem required to decarbonize aviation through SAF. LanzaJet continues to be at the forefront by commercializing its next generation ethanol-to-SAF technology and opening its fully-funded LanzaJet Freedom Pines Fuels biorefinery – the world's first commercial-scale ethanol-to-SAF plant.
60. **Biojet/SAF:** NEXTCHEM (Sustainable Technology Solutions BU), through its subsidiary MyRechemical, a leading the Waste-to-Chemical company, has signed a licensing contract with DG Fuels Louisiana LCC to use its proprietary NX Circular gasification technology. The plant is expected to be operational in 2028 and will produce 450 million liters per year of SAF derived from residual biomass and municipal waste. MyRechemical has been selected as technology licensor for the gasification and gas treatment units able to process 1 million tons per year of bagasse and sugar cane trash and pulp.
61. **Biojet/SAF:** Producers of sustainable aviation fuel in the European Union cannot increase output fast enough to meet SAF quotas. The European Union has adopted rules requiring flights departing from EU airports to carry progressively increasing amounts of SAF. The SAF quota will increase to 70% by 2050 and start with 2% of total fuel in 2025.
62. **Biojet/SAF:** Synhelion started an industrial-scale plant to produce synthetic fuels using solar heat in Jülich, Germany. The facility, named DAWN features a 20-meter-high solar tower and a mirror field. The solar tower contains a solar receiver, a thermochemical reactor, and a thermal energy storage that enables cost-efficient solar fuel production. The project will produce several thousand liters of fuel per year. Production is expected to start in 2024.

Biotechnology

63. **Biotechnology:** BASF has sold its Spartec bioenergy enzyme portfolio to Lallemand subsidiaries Danstar Ferment AG and Lallemand Specialties Inc. All business activities were transferred to Lallemand Biofuels & Distilled Spirits on June 1. LBDS is a leading global supplier of fermentation ingredients and has worked with BASF's bioenergy business since 2017. Jointly, they have developed the expression of gluco and alpha amylase enzymes in bioengineered yeast. The yeast is now widely used in North American ethanol production facilities.
64. **Biotechnology:** Danone and Michelin, the American start-up DMC Biotechnologies and Crédit Agricole Centre France, a key investor in the region, have agreed to create the Biotech Open Platform to bolster the development of advanced fermentation processes, particularly precision fermentation, on a larger scale. Precision fermentation is a revolutionary biotechnological process to produce bio-based materials and ingredients.
65. **Biotechnology:** BASF is researching the transformation of sugar and carbon dioxide into fumaric acid, an important intermediate for chemical production. To achieve this, the company is collaborating with Saarland University, University of Marburg and the University of Kaiserslautern-Landau in a joint research project entitled FUMBIO (FUMarsäure BIObasiert). The bacterium, which was isolated in 2008 from the rumen of a Holstein cow, will be genetically modified by researchers so that it produces large quantities of bio-based fumaric acid.
66. **Biotechnology:** Neogen® Corporation announced that it has launched the new CelluSmart technology from Megazyme® by Neogen for the measurement of cellulosic ethanol from biofuel production. In creating this industry-first technology, Neogen improved upon the previous National Renewable Energy Laboratory procedure by using a yeast-degrading cocktail.

CO2 Removal

67. **CO2 Removal:** Carbon Clean has signed a MoU with AGRA Industries. The partnership allows AGRA Industries and Carbon Clean to collaborate and provide Carbon Clean's semi-modular CaptureX technology to companies in agricultural-related sectors, including the production of biofuel ethanol and sustainable aviation fuels. Carbon Clean's CaptureX technology is proven across 49 sites throughout the world, with 80% of such plants modularized and containerized. This reduces on-site activity and installation time. AGRA Industries provides a single source solution for engineering, procurement and construction projects in multiple markets, including corn and soybean seed, animal feed, biomass pellet, and bio-based fuels.
68. **CO2 Removal:** Climeworks started operations of its largest direct air capture and storage (DAC+S) plant, Mammoth, in Iceland. It is the second commercial DAC+S facility of Climeworks and is about ten times bigger than its predecessor plant. The plant has capacity of up to 36,000 tons of CO₂ per year. Climeworks uses renewable energy to power its direct air capture process, which requires low-temperature heat like boiling water. The geothermal energy partner ON Power in Iceland provides the energy necessary for the process.
69. **CO2 Removal:** Jakson Green has won a tender to build the world's first flue gas CO₂-to-4G ethanol plant. The licensing and EPC contract is expected to last two years to bring the facility that will synthesize 25 tons per day of CO₂ captured from flue gas using

Veolia's Carbon Clean technology together with 3 tons per day of green hydrogen through a 7.5MW electrolyzer. LanzaTech's microbial fermentation will then take the CO₂ and hydrogen to produce 4G ethanol.

70. **CO₂ Removal:** Researchers at TU Berlin have developed a combination of two electrolysis cells that can use electricity to convert carbon dioxide and water directly into basic chemicals for the chemical industry. In the first electrolysis process, carbon monoxide is produced from carbon dioxide, which then combines with water in the second electrolysis cell to form hydrocarbons. The procedure uses a nickel-nitrogen-doped carbon electrode which only requires a metal content of less than one percent, making it less expensive than the usual metal catalysts. In addition, the researchers have developed a diagnostic system that monitors the condition of the tandem electrolyzer during operation.
71. **CO₂ removal:** Metsä Group has entered into a cooperation with international technology group ANDRITZ to explore the integration of carbon capture into a bioproduct mill. ANDRITZ will conduct a process concept study to seamlessly integrate carbon capture into the bioproduct mill process in the most energy-efficient way. A carbon capture module based on ANDRITZ's proven amine process with a capacity of 600,000 tons per year will be developed as the basis for a modular concept that aims to eventually capture all the CO₂ – about 4.2 million tons per year – from the flue gases of a bioproduct mill.

Energy Transition

72. **Energy Transition:** Aramco a major player in the petrochemicals sector, could seek a further \$100bn in Saudi investments this decade. The company is planning to direct 1m barrels of its oil production into making advance petrochemicals using electricity. Sabic, a Saudi petrochemical company which Aramco has a 70% stake in, is working with BASF and Linde on technology that converts oil into chemicals using electricity, rather than natural gas, to heat the process. A full-scale pilot plant has been developed in Germany.

Ethanol

73. **Ethanol:** Lan-Oil LLC, a company established by fuel retailer OKKO Group in Ukraine has been granted a loan of 60 million euros for the construction of a greenfield bioethanol project.
74. **Ethanol:** Raízen commissioned its new second generation ethanol plant at the Bonfim Bioenergy Park, in Guariba (SP). With an investment of R\$1.2 billion, the company's second cellulosic ethanol plant is the largest in the world and has 80% of the volume already contracted with a production capacity of 82 million litres per year.
75. **Ethanol:** A starch to ethanol plant for Fermap Industria De Alcool at Ipiranga do Norte, Mato Grosso, Brazil has been completed. This plant can make 63,000 litres per day using 150 million tonne of corn feedstock a day. This plant uses low energy, has a high ethanol yield, and zero liquid discharge along with a low carbon footprint.
76. **Ethanol:** Raízen has started its new, \$228 million, second-generation ethanol plant, at the Bonfim Bioenergy Complex, in Guariba, in the state of São Paulo, Brazil. The plant is the largest in the world and has 80% of its 82 million liters annual production capacity (21.6M gallon) already contracted.
77. **Ethanol:** SAF production may offer long-term and sustainable growth prospects for U.S. corn ethanol producers. Apart from incentive programs spurring growth, such as the

Inflation Reduction Act, global SAF mandates are also pressuring the airline industry to adopt more SAF. By 2050, the U.S. aims to scale up SAF production to 35 billion gallons through its SAF Grand Challenge. In the E.U., airlines are expected to adopt a 20% SAF blend by 2035. These factors are each likely to increase SAF demand. There are several SAF pathways, including hydrotreated esters and fatty acids (HEFA), alcohol-to-jet, Fischer-Tropsch and e-SAF. The HEFA process has proven to be the most readily available technology to produce SAF from fats and oils. While the HEFA process is an effective technology, it won't be sufficient to meet the anticipated demand of SAF due to lack of feedstock availability. So, the ATJ pathway may help the SAF industry achieve its future production targets.

78. **Ethanol:** Verbio is furthering its growth strategy in the USA. The company had a launch ceremony in South Bend, Indiana for the expansion of an ethanol plant acquired by Verbio in May 2023 from Mercuria Investments. The new development will establish an innovative biorefinery with combined bioethanol-biomethane production. The South Bend plant expansion will provide the combined production of bioethanol and biomethane based on Verbio's technology.
79. **Ethanol:** Case IH has worked in partnership with FPT Industrial to develop an ethanol-powered engine. The Cursor 13 propellant is a prototype for the use of fuel derived from sugarcane. It is currently in the development phase and will be tested on Case IH sugarcane harvesters in the next harvest season. Among the solutions offered by the Case IH are grain harvesters, sugarcane and coffee harvesters, as well as tractors with a wide range of powers, self-propelled sprayers and planters.

Feedstock

80. **Feedstock:** According to estimates from the Flax-Linen and Hemp Economic Observatory, the growing area of European FlaxTM, spring flax and winter flax combined will be about 180,000 hectares for the 2024 season. Flax sowing in the spring began later this year due to a rainy start to the season.
81. **Feedstock:** Sweden based wood fibre supplier Skogsaktiebolaget Eternali has launched a new woodchip business focused on supplying biomass to domestic customers in northern Brazil. The first delivery of biomass will be to JBS Foods, one of the world's largest meat producers with large operations in Brazil.
82. **Feedstock:** The latest outlook published by the US Department of Agriculture (USDA); 2024/25 global production of vegetable oils will amount to 228.3 million tonnes. This would be a 4.5 million tonne rise compared to 2023/24. This level of production could fully cover demand of presumably 224.9 million tonnes. Palm oil is set to remain the world's most important vegetable oil in terms of manufacture and consumption, with global output estimated at 80.0 million tonnes. This translates to a 715,000 tonne increase over 2023/24. Palm oil accounts for just over 35 per cent of total global vegetable oil production. Indonesia remains the largest producer with an output of 47.5 million tonnes, followed by Malaysia with 19 million tonnes and Thailand with just less than 3.4 million tonnes.
83. **Feedstock:** The University of Florida at the Centre for Advanced Bioenergy and Bioproducts Innovation (CABBI) has used CRISPR/Cas9 system to fine-tune leaf angle in sugarcane. These genetic developments allow the sugarcane to capture more sunlight, which in turn increases plant production.

Gasification

84. **Gasification:** Cielo will form the Cielo LP, which will determine and control the structure, ownership and management of a concurrently formed general partner in order to affect the building of a gasifier and expanded operations adjacent to the acquired EGTL facility in Carseland, Alberta. The EGTL Facility which is to be acquired through the transaction is an existing synthetic fuel facility, owned and operated by Rocky Mountain Clean Fuels Inc. The plant deploys patented Enhanced Gas-To-Liquids technology designed to make synthetic diesel and jet fuel from natural gas and natural gas liquids, which was developed by Expander Energy Inc. ("Expander"). Cielo holds an exclusive license in Canada from Expander for the patented Enhanced Biomass to Liquids technology and includes related intellectual property.

Hydrogen

85. **Hydrogen:** Ceres has been awarded a contract for the second phase of its collaboration with Shell, to cooperate in the design of a solid oxide electrolyzer ("SOEC") module, for use in large-scale industrial applications such as synthetic fuels, ammonia and green steel. Ceres has been working with Shell since 2022, leading to the deployment of a 1MW SOEC system at Shell's R&D facility in Bangalore, India. Building on this demonstration, the focus of this contract is to develop a pressurized module design that can be scaled to 100s of megawatts and be integrated with industrial plants to produce sustainable fuels.
86. **Hydrogen:** ENEOS Corporation and Mitsubishi Corporation announced the signing of a MoU to undertake a joint study on the social implementation of hydrogen and decarbonized fuels, which expands the ongoing joint feasibility study in relation to sustainable aviation fuel (SAF). ENEOS currently operates hydrogen stations for fuel cell vehicles (FCV) in Japan and is focusing on building CO₂-free hydrogen supply chain to realize a hydrogen supply business for domestic industrial complex areas utilizing Japanese governmental support, such as Green Innovation Fund Projects. MC is developing and creating demand, and building supply chains for next-generation energy, including hydrogen, in order to promote the Energy Transformation.
87. **Hydrogen:** Hindustan Petroleum Corporation Ltd. has successfully commissioned India's first Solid Oxide based Electrolyser (SOE) at its HP Green R&D Centre, Bengaluru for green hydrogen (GH₂) production. This highly efficient pilot-scale electrolyzer can generate green hydrogen with 99.99% purity using a 20 kW Solid Oxide Electrolyser stack. The electricity for the electrolyser is generated from a solar and wind plant. An advantage of the SOEC is it does not use rare earth materials for the electrodes and electrolytes.
88. **Hydrogen:** Abraxas Power Corporation, for its Exploits Valley Renewable Energy Corporation (EVREC) project located in Central Newfoundland, Canada, have contracted McDermott. The project will include the development of up to 530-turbine wind farm with the ability to generate 3.5 gigawatt (GW) of electricity and 150 megawatt (MW) solar photo voltaic (PV). The combined facility will have the capacity to produce 165kta of hydrogen and 5000 metric tons per day of ammonia. This project is the first in Canada to produce green ammonia. McDermott will provide front-end engineering design (FEED), engineering, procurement, and construction (EPC) execution planning services

89. **Hydrogen:** Bangkok Industrial Gas (BIG), a Thai climate-technology innovator has formed a partnership with RATCH Group, an energy and infrastructure company focused on creating value in the Asia-Pacific region. The collaboration aims to meet future clean-energy demand in the industrial and transportation areas.
90. **Hydrogen:** Everfuel A/S announced that it has submitted a project proposal for the phased development of up to 2 GW green hydrogen production capacity at the Revsing Energy Park in the municipality of Vejen, Denmark. Everfuel has secured land for the project (named Frigg) and is now continuing development and feasibility work to secure access to the available infrastructure. Frigg is located in close proximity to the Revsing transformer station and close to other hydrogen infrastructure. Frigg is expandable up to 2 GW of electrolyser capacity with potential for direct connection to greenfield local renewable energy production from solar and wind developed by Everfuel or partners. Furthermore, the project can be integrated with local district heating.
91. **Hydrogen:** Everfuel announced the opening of a hydrogen refuelling station at the Frankfurt municipal bus company In-der-City-Bus' (ICB) bus depot in Germany. The station is owned by the bus operator ICB and will service 23 zero emission fuel cell buses used for daily city and municipal public transport. Everfuel developed and constructed the refuelling station and will supply hydrogen to ICB for a three-year contract.
92. **Hydrogen:** Fabrum, a specialist in zero-emission transition technologies in New Zealand reported that is set to supply Toyota with its proprietary liquid hydrogen storage technology.
93. **Hydrogen:** H2 Energy Europe has obtained a building permit for its 1-GW green hydrogen project in the Danish seaport town of Esbjerg, Denmark. The Njordkraft Hydrogen project will source power from existing and future offshore wind farms to produce about 90,000 tonnes of green hydrogen per year. The output of the plant will be used for the decarbonisation of heavy industry and road transportation, and possibly for the production of green e-fuels like methanol and ammonia.
94. **Hydrogen:** Hazer Group Ltd, Australia, has announced it has signed a non-binding MoU with POSCO Steel (POSCO) to prepare a project pathway for the integration of Hazer's hydrogen technology into POSCO's low-carbon steel. Based in Pohang South Korea, POSCO is one of the world's largest steel makers and has announced its plan to achieve carbon neutrality by 2050. With POSCO Holdings in the lead, POSCO Group is focused on low carbon technologies across seven core businesses: steel, rechargeable battery materials, lithium/nickel, hydrogen, energy, construction/infrastructure, and agri-bio.
95. **Hydrogen:** HDF Energy announced the start-up of a plant to manufacture 1MW+ PEM fuel cells. This industrial site is dedicated to the decarbonization of heavy maritime and rail mobility, as well as the production of electricity for public power grids.
96. **Hydrogen:** HTEC will receive CAD 337 million (USD 246.6m/EUR 227.4m) in debt financing to move to further develop its plan to build green hydrogen production plants and refuelling stations across British Columbia and Alberta. HTEC will fund the set-up of the network of up to 20 hydrogen refuelling stations across the two Canadian provinces to serve the heavy-duty transportation sector. The green fuel will be sourced from three new production sites which the company will build in Burnaby, Nanaimo and Prince George and from a liquefaction facility in North Vancouver.
97. **Hydrogen:** Hungary's first green hydrogen plant has commenced operation at the Bükkkábrány Energy Park. "One of Hungary's largest solar parks is located on the outskirts of Bükkkábrány, covering 32 hectares and is capable of generating more than 22 MWp. The new plant is the first of its kind in Hungary. The electrolyzer uses the electricity

generated from a solar panel system. The hydrogen produced is stored in cylinders after pressurization, while the oxygen is discharged. The green hydrogen produced is of high quality, allowing it to be used for medical and scientific purposes, but it can also be used in fuel cells and mixed with natural gas for energy production.

98. **Hydrogen:** Hy2gen Canada Inc, a subsidiary of German hydrogen plant developer Hy2gen AG, has been awarded renewable electricity supply for its Courant green hydrogen and green ammonia project in Baie-Comeau in the Canadian province of Quebec. Courant envisages the production of 237,000 tonnes green ammonia per year with an electrolyser capacity of 300 MW. The location offers short transport routes to users of the ammonia to decarbonise chemical production. The steady supply of power from the hydroelectric-based power grid will provide constant operation of the electrolysers.
99. **Hydrogen:** Hynion has commenced construction of a new hydrogen refuelling station in Jönköping. This station is part of Hynion's plans to develop a new generation of hydrogen refuelling stations with a capacity of 1500 kg of hydrogen per day. The station is designed for heavy vehicles, but passenger cars will also be able to refuel at the facilities. Hynion previously announced that they have been granted a subsidy of 61.4 million SEK from the Swedish Energy Agency to build two hydrogen refuelling stations. The first station is already under construction in Västerås, and now the construction begins for a station in Jönköping, located in Torsvik.
100. **Hydrogen:** HYVIA, a joint venture between Renault Group, Plug, and HYPE, a company developing hydrogen taxis, announced a partnership to accelerate hydrogen-based transportation. The partnership aims to rapidly develop the use of hydrogen mobility, while producing sufficient volume to reduce the supply costs for hydrogen. The partnership will address: the supply of hydrogen, H2 refuelling stations and hydrogen vehicles.
101. **Hydrogen:** Jemena and Spanish solar developer Solarig have teamed up to develop green hydrogen production and blending projects in New South Wales. The MoU will pave the way for a study that will assess the feasibility of producing green hydrogen and injecting it into the Australian firm's gas distribution network for use by homes, businesses and industrial customers.
102. **Hydrogen:** Lhyfe secured a grant of up to SEK 125.6 million (USD 11.9m/EUR 11.2m) to build a renewable hydrogen production plant in Sweden's southern city of Trelleborg. With a 10-MW electrolysis capacity, the project will be able to produce up to 4 tonnes of green hydrogen per day. Production is expected to start in 2027. The area of Trelleborg is a transport hub, featuring Scandinavia's biggest roll-on roll-off harbour. As transport and logistics companies are looking to green their fleet, the project will provide green hydrogen to hydrogen refuelling stations in the area.
103. **Hydrogen:** Meld Energy received approval from the East Riding of Yorkshire Council to construct 100-megawatt green hydrogen production facility at Saltend in Hull. The green hydrogen production facility at Saltend Chemicals Park, will provide up to 30% of the park's existing hydrogen demand.
104. **Hydrogen:** Saudi Arabia's ACWA Power Co has signed a MoU with the Tunisian government to study the potential for a large-scale project to export green hydrogen to Europe. The initial phase will have 2 GW of electrolyser capacity and 4 GW of renewable energy units and will be able to produce 200,000 tonnes per year of green hydrogen to be exported through the South2 Corridor hydrogen pipeline project, which is intended to connect Tunisia with Italy, Austria and Germany.

105. **Hydrogen:** The Walloon Administration in Belgium requested tenders for developing a hydrogen ecosystem in the Wallonia region, Belgium. The tender submissions need to address a comprehensive ecosystem where hydrogen production, storage and usage are all integrated. Ultimately this project will be model for other regions.
106. **Hydrogen:** Topsoe has formed an alliance with Swiss electrification and automation specialist ABB Ltd and US engineering major Fluor to build its Solid Oxide Electrolysis Cells (SOEC) factory in the US, Virginia. Topsoe intends to construct a 1-GW-plus factory in Chesterfield, Virginia, to manufacture SOEC electrolyzers for green hydrogen production. This project is still subject to a final investment decision.
107. **Hydrogen:** TotalEnergies SE and US industrial Gases and chemical company Air Products have signed a 15-year agreement, where Air Products will deliver 70,000 tonnes of green hydrogen a year starting in 2030 to TotalEnergies' Northern European refineries. This is the first long-term deal that TotalEnergies has signed following its call for tenders for the supply of 500,000 tonnes per year of green hydrogen to decarbonise its European refineries.
108. **Hydrogen:** White Summit Capital is intending to invest \$267 million in a Spanish green hydrogen and e-methanol plant in the port area of Gijon that will use carbon captured from local industry. The 50MW electrolysis plant will supply the facility that will produce 100,000 metric tons of green methanol annually. It is anticipated that commissioning will be in 2027. The electrolysis plant will eventually double to 100MW. The fuel is expected to supply the shipping industry from Gijon.
109. **Hydrogen:** Yara International ASA announced the opening of its 24-MW renewable hydrogen plant at Herøya Industrial Park, Norway. Yara International indicated that it has already delivered fertilisers made from green ammonia produced at the site to its customers.
110. **Hydrogen:** US private equity firm KKR & Co has agreed to invest up to EUR 400 million (\$ 429.2m) into the development and construction of primarily green hydrogen and ammonia projects as part of a new Power-to-X (P2X) joint venture with Spanish renewables firm Ignis. The new platform includes a range of projects including: 20 GW of P2X projects across Spain and other selected countries, as well as more than 10 GW of advanced and early-stage renewables in Spain. The new entity, IGNIS P2X, will develop green hydrogen, ammonia, e-methanol, e-fuels and sustainable aviation fuel (SAF) plants. It will target clients in the refining, steel, chemicals and fertiliser sectors, among other. It will use traditional renewables, largely wind and solar for the supply of electricity

Marine Fuels

111. **Marine fuels:** AD Ports Group, Transmar and Orascom Construction have signed an MoU for the development of a green methanol storage and export facility in Egypt. The facility will be located in the Suez Canal area. The addition of a facility in this area will provide bunkering solutions for mainliners that have ordered green methanol powered vessels and is aligned with AD Ports Group's overall decarbonization strategy.
112. **Marine fuels:** Enova SF this week awarded over NOK 1.2 billion (USD 113m/EUR 106m) in funding to more than a dozen projects for the delivery of hydrogen and ammonia-fuelled vessels. By providing financial support for these projects, Enova is helping establish demand for the fuels. The successful applications were from Hoegh

Autoliners, Amon Gas, Maris Fiducia, More Sjo, Napier and Halten Bulk and will assist in providing a total of nine hydrogen and six ammonia vessels.

113. **Marine fuels:** Evergreen Marine has ordered six Sub-Panamax methanol dual-fuel containerships to be built by China State Shipbuilding Corporation. Evergreen will pay \$52-58 million per 2,400 TEU vessel. The order for the six ships was placed on behalf of Italia Marittima S.p.A., a subsidiary of Evergreen Marine.
114. **Marine fuels:** NKT Eleonora will represent the next generation of cable laying vessels. Notably, it will be one of the world's first cable laying vessels designed to be able to run on methanol. NKT A/S produces low-, medium- and high-voltage power cable solutions and accessories, primarily focused on the European market. It is best known for its offshore high-voltage DC cables that are connecting offshore wind farms to onshore grids.
115. **Marine fuels:** Terntank has secured a grant agreement with CINEA – European Climate, Infrastructure and Environment Executive Agency for an e-Methanol xWind Solution, a project demonstrating the combination of foldable suction sails and a dual-fuel engine. The project will demonstrate the use of foldable suction sails and a dual-fuel engine on the first Hybrid Solution Plus series vessel, designed to fit one of the first coastal tankers in Europe using e-methanol as a main energy source in its operations.
116. **Marine fuels:** Vast Renewables Limited has received planning consent for Solar Methanol 1 (SM1), a concentrated solar thermal powered (CSP) methanol plant in Port Augusta, South Australia. The facility will produce 7,500 tonnes of green methanol annually, for the shipping industry. SM1 is a collaboration with Mabanft GmbH & Co. KG, combining proven technologies to produce green methanol. The project configuration includes a calcination plant at Calix which provides CO₂ from cement and lime production, an electrolysis plant for hydrogen production, and the methanol plant. The plant will be powered by VS1, a 30 MW / 288 MWh CSP facility using Vast's CSP v3.0 technology to provide renewable heat and electricity.

Market Development

117. **Market Development:** BP (BP.L), agreed to buy grain trader Bunge's (BG.N), 50% stake in Brazilian sugar and ethanol joint venture BP Bunge Bioenergia for \$1.4 billion to take advantage of growing demand for low-carbon biofuels. Following the completion of the deal, expected by the end-2024, BP will take full ownership of Bioenergia which has a production capacity of around 50,000 barrels a day of ethanol equivalent from sugarcane. The acquisition comes amid growing investor concern over BP's strategy after ratings agency S&P Global earlier this month revised down BP's credit outlook, citing slower than expected debt reduction. BP said the acquisition is expected to meet its return threshold for bioenergy of more than 15% and will be within its existing annual spending framework of around \$16 billion.
118. **Market Development:** Air Liquide SA has raised EUR 500 million (USD 542.6m) from a green bond sale to back projects related to the production of low-carbon hydrogen and low-carbon air gases and carbon capture. Air Liquide and its joint venture partner Siemens Energy AG, last November opened a gigawatt-scale electrolyser factory in Berlin, in preparation to ramp-up production to 3 GW annually by 2025.
119. **Market Development:** ISO 17025-accredited Beta Analytic, based in Miami, Florida, is a dedicated testing laboratory providing biogenic carbon testing by carbon-14 analysis. Carbon-14 analysis is performed using an Accelerator Mass Spectrometer (AMS)

instrument according to ASTM D6866 Method B to measure the percentage of biogenic (derived from biomass) carbon in a sample. Testing is applicable to biofuels, biogas, renewable natural gas (RNG), municipal solid waste (MSW) and other renewable fuels containing biomass components

120. **Market Development:** Neste welcomed the allowance of unrestricted sales of paraffinic diesel fuels according to the DIN EN 15940 fuel standard in Germany. The sale of unblended, 100% renewable diesel has previously only been allowed in specific market segments, such as in non-road vehicles and public transportation. This new approval allows for 100% renewable diesel to be sold and used in all markets in Germany. With this approval, Germany is following other EU countries such as Belgium, the Netherlands, Finland and Sweden where 100% renewable diesel at public fueling stations has long been available.
121. **Market Development:** Kemin Industries has acquired Archangel Inc., a company specializing in antimicrobials for fermentative biofuel production. With the acquisition of Archangel Inc., Kemin is further developing its portfolio of antimicrobial solutions with the NOVA EZL and NOVA EZP products that support biofuel production. The acquisition also transfers four full patent applications from Archangel to Kemin.

Methanol

122. **Methanol:** Glocal Green and Norwegian Hydrogen have entered into a collaboration agreement for large-scale production of bio-e-methanol. Glocal Green will focus on the production of bio-methanol, while Norwegian Hydrogen is focused on green hydrogen production. The two companies have come together and are working toward an optimal sized plant of about 100,000 metric tonnes annual production of bio-e methanol. Such a plant size will require around 80,000 tonnes of biomass and will produce 10,000 tonnes of green hydrogen.

Plastic Recycling

123. **Plastic recycling:** Freepoint Eco-Systems Belgium NV and North Sea Port announced the signing of a long-term concession agreement for the development of Freepoint Eco-Systems' first advanced recycling facility for plastics in Europe. The facility will be situated in the Kluizendok site on the left bank of Ghent,-Terneuzen Canal, Belgium, within the port area of North Sea Port. Upon completion, the facility will operate as one of the largest plastic recycling facilities globally. The state-of-the-art facility will recycle end-of-life waste plastic, diverting it from incineration. The plant will have the capacity to recycle approximately 80,000 metric tons of waste plastic annually.

Policy

124. **Policy:** Global fossil fuel consumption and energy emissions hit all-time highs in 2023, even as fossil fuels' share of the global energy mix decreased slightly on the year, according to the industry's Statistical Review of World Energy.
125. **Policy:** In Australia, the Albanese Government is seeking views on ways to help kickstart Australia's low carbon liquid fuels (LCLF) industry, from farm and feedstock to bowser. Sustainable fuels will play an important role as global economies transform to net zero, and as part of the A\$22.7 billion Future Made in Australia package. LCLFs are a priority sector in the package, with initiatives identified to support the growth of new

industries to benefit communities and workers. Advanced biofuels (sustainable aviation fuel and renewable diesel) are compatible with existing fuel infrastructure and can be produced from feedstocks including municipal solid wastes and agricultural crops, some of which are currently exported.

126. **Policy:** The Institute for Energy Research reports that the biomass-based renewable fuel industry believed that if the renewable and biodiesel plants were built, the EPA would mandate their use. But this has not happened as the Biden administration encouraged, through its climate agenda, to electrify and to heavily incentivize wind and solar power. There is now an oversupply of domestic biomass-based diesel, which needs mandates from EPA as it is much more expensive to produce than petroleum-based diesel. Importers of biomass-based imports currently get tax credits, which exasperates the problem. Next year, federal tax credits will only support the domestic industry. In the meantime, U.S. biomass-based diesel plants are either shutting down or retooling back to petroleum-based diesel.

Pyrolysis

127. **Pyrolysis:** Aymium announced that it closed \$210 Million of financing to construct a biocarbon production facility in Williams, California. The facility will support the first large-scale continuous use of advanced biocarbon to replace coal in power generation in the world. Construction of the facility is scheduled to be completed in 2025. Aymium produces the only commercially demonstrated carbon-negative product for replacing coal in power generation. Aymium's renewable product is created through a non-combustion process that converts waste biomass to high purity biocarbon.
128. **Pyrolysis:** CHAR Technologies Ltd has started a production run of 500 tonnes of pelletized biocarbon at its Thorold facility. The pelletized biocarbon is destined for use at various heavy industrial facilities, including ArcelorMittal sites to fulfil a portion of the company's previously announced biocarbon offtake agreement.
129. **Pyrolysis:** Covestro Deutschland AG and Fraunhofer researchers have developed a technology to reclaim the substances originally used to make the polycarbonates. Using catalytic pyrolysis, plastic waste will be broken down into its components. Manufacturers can then use the raw materials to produce new plastics. The Fraunhofer team uses a rotary kiln for the pyrolysis step. which rotates as the recycled plastic is heated.

Recycling Plastic

130. **Recycling plastic:** Dow and Freepoint Eco-Systems Supply & Trading LLC announced an agreement for an estimated 65,000 metric tons per year of certified-circular, plastic waste-derived pyrolysis oil to produce new, virgin-grade equivalent plastics in Dow's U.S. Gulf Coast operations. Together, Dow and Freepoint Eco-Systems are building a recycling system that converts plastic waste into valuable materials. The pyrolysis oil will be produced at a new advanced recycling facility owned and operated by Freepoint Eco-Systems Eloy Recycling LLC, a Freepoint Eco-Systems affiliate. Once completed, the new advanced recycling facility, to be constructed in Arizona and will be ISCC Plus Certified.

Renewable Diesel

131. **Renewable Diesel:** Amtrak reported in its 2023 sustainability report that it replaced more than 2 million gallons of fossil fuel with renewable diesel on California's state-

supported Capitol Corridor, Pacific Surfliner and Amtrak San Joaquins passenger trains, reducing GHG emissions by around 63%.

132. **Renewable Diesel:** Braya Renewable Fuels (Braya) has achieved commercial operations at its Come By Chance facility in Newfoundland and Labrador, Canada. Braya anticipates initial production capacity of 18,000 barrels per day of renewable diesel, with future plans to expand production capacity, add sustainable aviation fuel production capabilities and explore green hydrogen production. Cresta Fund Management (Cresta), a Dallas-based private equity firm, acquired a controlling interest in the once-idled petroleum refinery in November 2021 and, through this conversion project.
133. **Renewable Diesel:** Fulcrum BioEnergy has mothballed its Fischer-Tropic based biomass biofuel production facility outside Reno. Most of the staff have been laid off, production has been shut down, and it's unclear what the future holds for the plant. Although the plant was producing biocrude that was then refined by Marathon Petroleum, permitting for the facility was challenging and has led to several stop orders from authorities.
134. **Renewable Diesel:** Global Clean Energy Holdings' refinery conversion for the production of renewable diesel should begin the start-up phase this month however, there are doubts that the project that is a year behind and hundreds of millions of dollars over budget can make it to commissioning. The company has to restructure senior debt by the end of the month, Chevron has pulled out of its offtake agreement even if the company is challenging the withdrawal, and there are disputes over the EPC firms bills.
135. **Renewable Diesel:** Kinetics Technology (an integrated E&C solutions company based in Italy), along with NEXTCHEM (Sustainable Technology Solutions), has been awarded by HOLBORN Europa Raffinerie GmbH (HOLBORN) an Engineering, Procurement and Construction (EPC) project to develop an Hydrotreated Vegetable Oil (HVO) complex inside the existing HOLBORN's refinery in Hamburg, Germany. The plant will produce approximately 220,000 tons per year of renewable diesel and sustainable aviation fuel (SAF) using waste and residue feedstocks, as well as low carbon hydrogen.
136. **Renewable Diesel:** Topsoe is supplying its HydroFlex technology to Canadian startup Braya Renewable Fuels, who converted a former petroleum refinery to produce renewable diesel in Come By Chance, Canada. Braya has plans to increase capacity in phase two of the project and also produce sustainable aviation fuel The refinery in Come By Chance in Newfoundland and Labrador, Canada is now successfully operating and producing renewable diesel at design capacity.

Technology Development

137. **Technology Development:** Mitsubishi Heavy Industries (MHI) and NGK INSULATOR (NGK) are jointly developing two membrane dehydration systems to reduce cost and to optimize efficiency of manufacturing processes for bioethanol and e-methanol. In this project, MHI and NGK will begin developing two types of membrane dehydration systems, one for bioethanol and e-methanol. The membrane separation system developed for bioethanol will replace the conventional dehydration process, which consumes most of the energy in the bioethanol manufacturing process.

Textiles

138. **Textiles**: Brazilian pulp producer Suzano has agreed to acquire a 15% stake in Lenzing, a global supplier of cellulosic fibers for the textile and non-wovens industry, from B&C. The two shareholders also agreed to form a long-term syndicate that will hold a 52.25% stake in the company. Suzano is based in Brazil and is the world's largest market pulp producer. As part of the long-term partnership, Suzano has the option to acquire an additional 15% stake in Lenzing from B&C until the end of 2028. The agreement also provides for B&C remaining a committed long-term shareholder in Lenzing.

Company Summary – June 2024

Frequency of mention.

Company	Frequency
BASF	4
Covestro	2
Floreon	2
Neste	2
ABB	1
ACWA Power Co	1
AD Ports Group	1
AFYREN	1
Agrisound	1
Alfa Laval	1
Amtrak	1
ATH Bioenergy	1
Australian Government	1
Aymium	1
Bangkok Industrial Gas	1
Bank of Ireland	1
Beta analytic	1
BioBTX	1
Biokraft	1
Borealis	1
BP	1
Braskem	1
Braya Renewable Fuels	1
CABBI	1
Carbon Clean	1
Case IH	1
Ceres	1
CHAR Technologies	1
Total	111

Topics & Themes Summary– June 2024

Topics and themes- Top 10 (frequency of mention).

Category	Frequency
Hydrogen	23
Biobased chemicals	14
Biogas	14
Biofuels	9
Biojet	9
Ethanol	6
Marine fuels	6
Renewable diesel	6
Biotechnology	4
Pyrolysis	4
Biobased plastics	3
CO2 removal	3
Feedstock	3
Market Development	3
Policy	3
Ammonia production	2
Energy Transition	1
Gasification	1
Methanol	1
Plastic recycling	1
Textiles	1
Total	117