

Bioeconomy & Low Carbon Technology Overview for August 2023

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This summary of the global bioeconomy and low carbon technology developments for August 2023 is based on the data and information collated by Gifford Consulting and presented on our website: <https://www.giffordconsulting.co.nz/>

Highlights: August 2023

1. EPA Final Rule Concerns: Industry stakeholders have requested that the EPA avoid using a recent final rule as a basis for future regulations under its authority. Stakeholders ask the EPA to consider several factors in future years, including feedstock availability, renewable fuel volumes by category, and new modelling options. The EPA has set volumes assuming no further Small Refinery Exemptions (SREs), as demonstrated by their recent denial of 26 SREs on July 14, 2023.
2. SFC Energy AG's Indian Manufacturing: In Germany, SFC Energy AG has initiated the manufacturing of hydrogen and methanol fuel cells at its site in New Delhi/Gurgaon, India, aimed at stationary and mobile hybrid power solutions.
3. Methanol Bunkering Training Program: A cooperation agreement seeks to ensure that crew on bunker tankers and bunker surveyors are prepared for large-scale methanol bunkering. Training is set to start in Singapore, with plans for global expansion in 2024.
4. Repsol's Biodiesel Production in Spain: Spanish oil company Repsol plans to invest \$133 million to convert a unit of its Puertollano plant to produce 200,000 tons of biodiesel per year from 2025, which will be sold at its service stations.
5. Sustainable Aromatic Monomers Supply Chain: Beckers is partnering with BioBTX and Symeres to establish a supply chain for sustainable aromatic monomers derived from plastic waste. BioBTX converts waste plastic into BTX, which Symeres then oxidizes into aromatic phthalic monomers for Beckers' resin production.
6. Fluidized Bed Gasification Technology: This technology dries sludge from 80% to 20% water content, which is then fed into the Aries gasifier. The process generates syngas for heat and power, and 5% of the original biosolid becomes bio fly-ash.
7. India's GOBARdhan Initiative: India's Union Government's GOBARdhan initiative aims to transform waste into wealth through a comprehensive government approach. It has stimulated investments and shown positive results in fostering an ecosystem for Compressed Biogas (CBG)/Biogas. The initiative includes a Unified Registration Portal launched on June 1, 2023.

8. Industrial Hydrogen Valley in Finland: Neste Corporation, Gasgrid Finland Ltd, Helen Ltd, and Vantaa Energy Ltd have begun preliminary studies for the development of an industrial hydrogen valley in the Uusimaa region, Finland.
9. LyondellBasell's Stake in Stiphout Industries: LyondellBasell has acquired a 50% stake in Stiphout Industries B.V., a company involved in sourcing and processing post-consumer plastic packaging waste, operating a facility in Montfort, the Netherlands.
10. Enerkem and Technip Energies Collaboration: In Canada, Enerkem Inc. and Technip Energies have signed a memorandum of understanding, aiming to enter a Collaboration Agreement to expedite the deployment of Enerkem's technology platform for biofuels and circular chemical products from non-recyclable waste materials.
11. Wärtsilä Supplies Methanol-Fuelled Engines in UK: Finnish company Wärtsilä will provide methanol-fuelled auxiliary engines for French shipping company CMA CGM. These engines are designated for six 15,000 TEU container vessels being constructed at Dalian Shipbuilding yard in China. The order was booked in Q2 2023.
12. Imperial Oil's Renewable Diesel Project in Canada: Imperial Oil has commenced construction of the Strathcona Renewable Diesel project in Canada, designed to produce over one billion litres of renewable diesel annually from local feedstocks. This project could reduce greenhouse gas emissions by about three million metric tons per year, aligning with Canada's Clean Fuel Regulations. Production is expected to start in early 2025.
13. gr3n's Recycled PET Venture: gr3n has signed an MOU with shareholder Intecsa Industrial to establish a Joint Venture. They plan to build a manufacturing facility capable of producing 40,000 tons of virgin-like PET, with the EPC phase starting in Q4-2024 and operations commencing in 2027. gr3n's technology can process PET from various industries, including textile waste.
14. Sustainable Aviation Fuel Development in Thailand: Bangchak Corporation, based in Thailand, is focusing on developing sustainable aviation fuel (SAF) and is planning to establish a SAF production facility near its oil refinery in Bangkok's Phra Khanong district.
15. Lufthansa Group and HCS Group's SAF Partnership in Germany: The Lufthansa Group and HCS Group have signed a Letter of Intent to collaborate on the production and supply of SAF. Starting from 2026, HCS Group could supply Lufthansa with SAF made via Alcohol-to-Jet technology. The fuel will be produced at the HCS Group site in Speyer, Germany, aiming for an initial production volume of 60,000 metric tons of SAF per year.
16. UPM Biochemicals Acquires SunCoal Industries in Finland: UPM Biochemicals has acquired Germany-based SunCoal Industries, which has developed technologies to produce performance products from renewable materials. SunCoal's technology will be integrated into UPM Biochemicals' BioMotion™ Renewable Functional Fillers production at its biorefinery in Leuna, Germany.
17. Shandong Haike's SAF Production in China: Shandong Haike Chemical Co. Ltd, a Chinese refining and petrochemical company, has chosen Axens' Vegan technology to produce low carbon sustainable aviation fuel (SAF) by retrofitting existing assets. The technology can process various lipids, including waste, to produce renewable fuels, reducing greenhouse gas emissions by up to 80%.
18. Biodiesel Blending Increase in Indonesia: Indonesia has initiated nationwide blending of 35% biodiesel, up from the prior mandate of 30%, as reported by Tempo. The increment followed a limited rollout that began in February. This change was previously delayed due to high palm oil prices and the need for infrastructure investment. A levy on palm oil exports is collected to offset the cost difference between fossil diesel and biodiesel.

19. Spanish Consortium's Hydrogen-Ready Power Plant Contract: In Spain, RWE, a German utility, has signed a contract with the consortium of Técnicas Reunidas and Ansaldo Energia. They will develop a hydrogen-ready combined cycle power plant, aligning with RWE's decarbonization and energy transition plan.
20. Smartenergy's Green Hydrogen Project in Egypt: Swiss company Smartenergy plans to invest approximately \$1 billion to produce green hydrogen in Egypt, marking an expansion of the company's operations in the country.
21. Honeywell and ZFRT's Successful Pilot Plant Testing in Belgium: Honeywell and ZoneFlow Reactor Technologies (ZFRT) conducted successful pilot plant testing of the ZoneFlow Reactor in Belgium. The test confirmed at least a 15% increase in steam reforming capacity without increasing the maximum tube skin temperature or pressure drop, compared to conventional pellets.
22. Covestro's Climate Neutrality Ambition by 2035: Covestro is pushing various projects to cut greenhouse gas emissions generated in its production and throughout its supply chain to become operationally climate-neutral by 2035.
23. In-Forest Binwood Recovery Trials: Trials that began in 2018 with hauler crews are focusing on in-forest chipping, storage, drying, and biofuel contracts with local companies. Benefits include increased utilization of forest residues, reduced environmental risks, and better compliance with regulations.
24. Refine Holdings and NZ Bio Forestry MoU: Japan-based Refine Holdings and NZ Bio Forestry have signed an MoU outlining a joint research and commercial program. They aim to develop biochemicals from *Pinus radiata* for various markets including automotive and EV battery sectors.
25. DAC Used as Greenwashing by Oil and Gas Companies: Oil and gas companies are investing in Direct Air Capture (DAC) technology to remove CO₂ from the atmosphere, which is criticized as greenwashing that allows them to maintain societal licenses to operate without significantly altering their business models.
26. Bio-CNG Plants in India Using Napier Grass: Gruner Renewable Energy has signed an MOU with Bioenergy Germany to establish India's first bio-CNG plants, using Napier grass as feedstock. The companies aim to establish one hundred plants, with the world's largest one, capable of producing 56MW of power, set to be completed in Maharashtra in November.
27. Sales Drop for Beyond Meat: Beyond Meat, a vegan food firm, reported a significant sales drop. Net revenues fell by 30.5% for the three months to the end of June, compared to the same period a year earlier, amidst rising living costs affecting consumers.
28. BlackRock's New Zealand Renewable Energy Fund: US investor BlackRock, in collaboration with the New Zealand Government, has launched a \$2 billion investment fund to help New Zealand achieve 100% renewable electricity by 2030. The fund will invest in solar, wind, green hydrogen, battery storage, and EV charging projects. It represents BlackRock's first country-specific investment of this nature.
29. Sumitomo Chemical Partners with Conagen: In Tokyo, Sumitomo Chemical has partnered with Massachusetts-based synbio firm Conagen to develop biobased p-hydroxystyrene and its polymer. These compounds are essential in producing polymers, resins, chemicals, pharmaceuticals, and fragrances.
30. Montauk Renewables' Biogenic CO₂ for E-fuels: In Pennsylvania, Montauk Renewables and its subsidiary, Montauk Energy Holdings, have signed a Letter of Intent with EE North

- America to deliver biogenic CO₂ from its Texas facilities for large-scale e-fuel production, such as e-methanol, starting in 2026 for 15 years upon final agreement.
31. DB Schenker and Hapag-Lloyd's Emission-Reduced Transport: In Germany, DB Schenker and Hapag-Lloyd have agreed to use waste- and residue-based biofuel for container transports. By the end of 2023, DB Schenker aims to avoid approximately 3,000 metric tons of CO₂e emissions. Hapag-Lloyd has introduced the Ship Green product for emission-reduced ocean transports.
 32. Clariant's MegaMax Catalyst for E-methanol Plant: European Energy has chosen Clariant's MegaMax catalyst for the world's largest e-methanol plant. MegaMax is favored due to its high activity and stability under CO₂-to-methanol conversion conditions.
 33. Biofuel Production from Forest Thinning in California: Allotrope Partners, Axens North America, and Sumitomo Corporation of Americas are studying commercial low-carbon biofuel production using woody biomass from forest thinning in California. This aims to reduce wildfire-induced carbon emissions and produce commercial-grade bioethanol.
 34. Germany's Hydrogen Power Plant Initiative: The German government plans to significantly expand the country's fleet of hydrogen power plants as part of its effort to decarbonize its power sector and ensure consistent climate-friendly energy supply.
 35. FQT's Wheat-Based MSC System in Iowa: Fluid Quip Technologies will provide the world's first wheat-based Maximized Stillage Co-products (MSC) system to Ensus UK Limited's ethanol facility in Teesside, showcasing the feedstock flexibility and efficiency of MSC.
 36. Arctic Paper's Biofuel Installation Upgrade in Sweden: Arctic Paper will invest SEK 285 million to expand and upgrade the biofuel installation at its mill in Grycksbo, Sweden. This investment is expected to yield annual energy savings of SEK 50 million and produce fifty kton of wood pellets valued at SEK 100 million annually.
 37. Origin Materials and Terphane's Sustainable Bio-polymer Films Partnership: Origin Materials and Terphane have announced a strategic partnership to produce sustainable, high-performance bio-polymer films. Terphane has signed a multi-year capacity reservation agreement to purchase advanced bio-polymer PEF for use in films.
 38. Amyris Inc. Bankruptcy Filing: Amyris Inc., a specialty renewable products developer, has filed for bankruptcy protection due to over \$1.3 billion in debt. The company plans to focus on R&D and biofermentation-derived sustainable ingredient development. Amyris is exiting the consumer business and marketing its remaining brands for sale. John Doerr, the largest stakeholder, will provide \$190 million in debtor-in-possession financing. If a solution with key stakeholders is not reached within 35 days, Amyris' assets will be auctioned in court. The analyst suggests no recovery is expected for common shareholders.
 39. Egypt's Green Hydrogen Plant Proposal: In the UAE, Egypt's Prime Minister Mostafa Madbouly has met with officials to discuss a proposal from a foreign firm to establish a large-scale green hydrogen plant in Egypt through direct foreign investments.
 40. Topsoe's Agreement with World Energy GH2: In Denmark, Topsoe has signed an agreement with World Energy GH2 to provide dynamic ammonia loop technology for Canada's renewable hydrogen project, Nujio'qonik. With a planned investment of \$12 billion, the project aims to produce 250,000 metric tons of renewable hydrogen annually using wind energy and is expected to begin production in 2025.
 41. Origin Materials and Proman Partnership: In California, Origin Materials, Inc. and Proman have announced a strategic partnership to produce low-carbon biofuels. The partnership

- combines Origin's technology platform with Proman's global fuels capabilities and expertise.
42. Challenges of Scaling Bio-based Plastics Production: Despite the substantial market for bio-based plastics as a means of decarbonizing the chemical industry, scaling up production presents significant operational hurdles. Investors are advised to be cautious with emerging players like Origin until their technology platforms are successfully validated.
 43. SoCalGas Renewable Natural Gas Pilot Project: In California, Southern California Gas Co. (SoCalGas) has filed an application with the California Public Utilities Commission to develop a pilot project that converts organic waste, such as chipped wood and nut shells, into renewable natural gas (RNG).
 44. ADM and Phillips 66 Potential Joint Venture: In Minnesota, Archer Daniels Midland (ADM) is in discussions with Phillips 66 to create a joint venture. This venture may involve ADM placing its two remaining dry mill ethanol plants in Columbus, Nebraska, and Cedar Rapids, Iowa, into a collaboration for conversion to aviation biofuel from corn-based ethanol.
 45. Overview of Hydrogen Road Maps: Various countries are developing road maps for the implementation and scale-up of hydrogen as a key component of their future energy systems.
 46. Wallenius Wilhelmsen Vessels Order: In Norway, Wallenius Wilhelmsen has signed a letter of intent with Jinling Shipyard (Jiangsu) for four next-generation methanol dual fuel car and truck carriers, with options for eight more units. The first vessels are set to be delivered from the second half of 2026.
 47. Circle K HVO Expansion in Ireland: Circle K in Ireland is expanding the availability of HVO (Hydrotreated Vegetable Oil) renewable diesel to Cork, Tipperary, and Carlow, and plans to make HVO available along all national motorways, targeting areas with heavy goods vehicle traffic.
 48. Green Steel Transition in EU: The transition to green steel began two decades ago, and EU funding schemes have played a significant role in fostering innovation in steel technologies. The EU's Clean Steel Partnership aims to boost this development, although funding remains challenging to access.
 49. Babcock & Wicox BrightLoop Process: This is an innovative, scalable technology that can produce hydrogen from various feedstocks, including solid fuels like waste wood. It also produces isolated CO₂ streams for capture or use, and nitrogen for ammonia production.
 50. Global Bioenergies' New Plant Project: Global Bioenergies has adjusted its roadmap to focus on a larger production capacity plant targeting the cosmetics and sustainable aviation fuel markets. The new plant aims to produce 10,000 tonnes of isobutene and derivatives per year.
 51. U.S. Hydrogen Strategy & Tax Credit: Hydrogen is central to the Biden administration's climate strategy. A new tax credit aims to encourage cleaner hydrogen production methods, offering a reward of \$3 per kilogram of hydrogen produced with minimal greenhouse gas emissions. However, standardized accounting methods for these emissions are lacking.
 52. Coregas Hydrogen Refuelling Station in Australia: Coregas has installed Australia's first heavy vehicle hydrogen refuelling station in Port Kembla, NSW, capable of fueling up to ten trucks per day.
 53. Wood Beca Study in New Zealand: A joint project between the Government and Oji Fibre Solutions suggests that upgrading the mill could create two hundred jobs annually,

- contribute over NZ\$566 million to GDP, and reduce greenhouse gas emissions by 65,000 tonnes of CO₂ equivalent per year.
54. Braskem and SCG Chemicals JV in Thailand: Braskem and SCG Chemicals have signed a joint venture agreement to produce bio-ethylene and commercialize l'mGreen bio-based polyethylene using EtE EverGreen technology, pending anti-trust clearance and a final investment decision.
 55. Lone Cypress Hydrogen Project in California: Lone Cypress Energy Services completed the FEED study for a hydrogen project at Elk Hills Field in Kern County, California, which involves a steam methane reformation plant with carbon capture, hydrogen liquefaction, and storage.
 56. Australia's Sustainable Aviation Fuel Roadmap: The roadmap indicates that Australia is in a strong position to develop a diversified portfolio of feedstocks for a domestic sustainable aviation fuel industry.
 57. Conagen and Sumitomo Chemical Collaboration: These companies are partnering to jointly develop p-hydroxystyrene (HS) and its polymer, poly p-hydroxystyrene (PHS), using a blend of biosynthesis, chemosynthesis, and polymerization. The products are 100% renewable carbon, marking a step towards sustainable production.
 58. U.S. DOE Funding for Carbon Capture: The U.S. Department of Energy is investing up to \$1.2 billion in two large-scale carbon capture facilities in Texas and Louisiana. These are the first of their kind in the U.S. and are part of President Biden's Bipartisan Infrastructure Law.
 59. Renewable Blended Hydrocarbons for Aviation: Sustainable Aviation Fuel (SAF) made from renewable feedstocks like corn ethanol reduces non-renewable CO₂ emissions. The renewable content in SAF is capped at 50% by the industry.
 60. Global Methanol Market Forecast: Canada's Emergen Research predicts that the methanol market will grow to \$44.82 billion by 2032, at a CAGR of 3.4%.
 61. M2X Energy's Methanol Plant: North Carolina-based M2X Energy's modular gas-to-methanol plant has produced its first methanol.
 62. Brazilian Food Processor Enters Fuel Market: Caramuru Alimentos in Brazil has started selling ethanol made from soybeans.
 63. Neste's Renewable Plastic: Finnish company Neste is collaborating with Japanese firms to produce renewable PET resin for beverage bottles, starting in 2024.
 64. Carbon Dioxide Management in Texas: Verde Clean Fuels and Carbon TerraVault JV HoldCo have agreed to work on carbon capture and sequestration in Texas.
 65. Large-scale Fermentation: LiDestri Foods and Fermentum, Inc. have announced a joint venture for large-scale precision fermentation.
 66. Green Methanol Project in Berlin: Berlin-based startup C1 is part of a €10.4 million project funded by the German government to produce green methanol for marine and aviation.
 67. Equatic's Carbon Removal: Equatic is developing a process that uses seawater electrolysis to capture and store CO₂ while producing hydrogen.
 68. Marathon Petroleum & Neste: The Martinez Renewable Fuels Facility in California, a joint venture between Marathon Petroleum and Neste, will use Topsoe's HydroFlex technology to convert bio-feedstock into renewable diesel.
 69. Lummus & Biohydrogen Tech in Texas: Lummus Technology and Biohydrogen Technologies are developing synthesis gas reactor technology primarily for blue hydrogen production.

70. CO₂-based Chemicals in Abu Dhabi: Masdar, Mitsubishi Chemical, and INPEX are studying the feasibility of producing commercial-scale polypropylene from CO₂ and green hydrogen.
71. Energy Cane for Aviation Fuel in Brazil: GranBio aims to promote energy cane as a feedstock for sustainable aviation fuel in Brazil.
72. Record Corn Oil Yields in Wisconsin: Fluid Quip Technologies has helped Ace Ethanol achieve record distillers corn oil yields.
73. Braskem & SCG Joint Venture: Braskem and SCG Chemicals are forming a joint venture to produce bio-ethylene and bio-based Polyethylene.
74. Neste's Singapore Refinery: Neste has restarted its expanded Singapore refinery for renewable diesel production, aiming for full operation by year-end.
75. Monarch Energy in Louisiana: Monarch Energy is considering building a \$426 million facility in Ascension Parish, Louisiana.
76. Bio-LNG in Sweden: Biokraft's new liquefaction plant in Sweden delivered its first batch of bio-LNG for trucking in northern Europe.
77. SABIC in Ohio: Saudi company SABIC is offering bio-based versions of various Noryl resin grades, which are certified under International Sustainability & Carbon Certification (ISCC) Plus, to help meet sustainability goals. These bio-based versions have comparable properties to their fossil-based counterparts.
78. NewHydrogen in California: NewHydrogen has partnered with UC Santa Barbara to develop a thermochemical method for efficient water splitting to produce cheap green hydrogen. The technology, called NewHydrogen ThermoLoop, aims to become a high-efficiency, low-cost green hydrogen producer.
79. Syngenta Seeds and Sustainable Oils in Illinois: The companies have signed a deal to sell Camelina seed, which is a low-carbon feedstock for sustainable aviation fuel, renewable fuels, and sustainable animal feed.
80. Heidelberg Materials in Canada: Mitsubishi Heavy Industries has installed a compact CO₂ capture system at Heidelberg's cement plant in Edmonton, helping to capture and manage carbon emissions.
81. Max Planck Institute: Researchers have developed an artificial metabolic pathway that uses electricity to produce ATP, an energy-rich biochemical compound. This represents an innovative approach to a sustainable, climate-neutral bioeconomy.
82. Technip Energies in France: Awarded a significant contract by bp to develop a hydrogen production unit at its Kwinana biorefinery in Western Australia. The unit will support the production of sustainable aviation fuel and biodiesel.
83. Neste, LyondellBasell, Biofibre, and Naftex in Finland: The companies have created a value chain that combines bio-based polymers with natural fibers for manufacturing construction elements, aiming to store carbon and combat climate change.
84. Sugar Valley Energy in California: Collaborating with STARS Technology to deploy advanced hydrogen production technology at a planned biorefinery in Imperial Valley, covering ethanol, bioelectricity, biogas, and wastewater treatment.
85. EEL Biofuels in Hong Kong: Announced a revolutionary algae-based biofuel technology that is scalable, commercially viable, and carbon-neutral, aiming to significantly reduce the carbon footprint of transportation and energy sectors.
86. Norsk Hydro in Norway: Plans to replace fossil energy with bioenergy in its Sunndal aluminum plant, potentially reducing CO₂ emissions by 20,000 metric tons per year. They have signed a letter of intent to purchase biomethane pending certain conditions.

87. Axens, Paul Wurth, IFP Energies Nouvelles in Luxembourg: Signed a co-development agreement to optimize Reverse Water Gas Shift (RWGS) technology for converting CO2 to renewable fuels and chemicals.
88. LG Chemicals in South Korea: Plans to secure a long-term agreement with a global supplier of waste cooking oil to produce bio-based aircraft fuels.

Conclusions – (based on the above bullet points): August 2023

In the realm of renewable energy and sustainability, industry stakeholders are advocating for careful consideration of various factors in future regulations by the Environmental Protection Agency (EPA). They emphasize feedstock availability, renewable fuel volumes, and innovative modelling options. The EPA's decision to set volumes based on the assumption of no further Small Refinery Exemptions (SREs) is evidenced by recent SRE denials. Germany's SFC Energy AG has taken a step towards hybrid power solutions by manufacturing hydrogen and methanol fuel cells in New Delhi, India. This initiative caters to both stationary and mobile applications. Maritime operations are also witnessing progress as a cooperative effort in Singapore prepares crew members and bunker surveyors for large-scale methanol bunkering, with global expansion planned for 2024.

Spanish oil company Repsol plans to invest \$133 million to transform a Puertollano plant into a biodiesel production facility by 2025, contributing around 200,000 tons annually to its service stations. Collaboration among Beckers, BioBTX, and Symeres aims to create a supply chain for sustainable aromatic monomers from plastic waste. This involves converting waste plastic into BTX and further oxidizing it into aromatic phthalic monomers for resin production. These developments reflect the diverse initiatives shaping renewable energy and sustainability across sectors.

The landscape of bio-based plastics production faces operational challenges despite its potential to decarbonize the chemical industry. Companies like SoCalGas in California are exploring initiatives to convert organic waste into renewable natural gas. Archer Daniels Midland (ADM) and Phillips 66 are considering a joint venture for converting ethanol into aviation biofuel, aligning with the drive towards greener aviation. As the momentum for hydrogen grows, various countries are creating roadmaps for its integration into their energy systems. Circle K expands the availability of HVO renewable diesel in Ireland, targeting regions with heavy goods vehicle traffic. The EU's Clean Steel Partnership supports green steel innovation through funding schemes.

Initiatives also extend to hydrogen production methods, with Babcock & Wilcox's BrightLoop process generating hydrogen from various feedstocks while producing isolated CO2 streams. Global Bioenergies shifts its focus towards larger-scale production for the cosmetics and aviation fuel markets. The US Hydrogen Strategy introduces a tax credit to incentivize cleaner hydrogen production methods. Carbon capture facilities funded by the US Department of Energy are a crucial step in reducing emissions. Collaboration between Conagen and Sumitomo Chemical aims to produce sustainable renewable carbon products. These developments collectively contribute to the advancement of renewable energy and sustainable practices.

Companies: Significant Contributions – August - 2023

1. SoCalGas (California): Pilot project converting organic waste into renewable natural gas for CO2 reduction.
2. Archer Daniels Midland (ADM) and Phillips 66: Joint venture exploring ethanol-to-aviation biofuel conversion for sustainable aviation and bioeconomy growth.

3. Wallenius Wilhelmsen: Methanol dual fuel carriers for cleaner maritime transport, aligning with emissions reduction.
4. Circle K (Ireland): Expanding availability of HVO renewable diesel, targeting heavy goods vehicle traffic for greener transport.
5. Braskem and SCG Chemicals: Joint venture producing bio-based polyethylene, contributing to the growth of renewable materials in the bioeconomy.
6. US Department of Energy: Investing in carbon capture facilities to significantly reduce CO2 emissions and enhance sustainability efforts.
7. Coregas (Australia): Installing the first heavy vehicle hydrogen refueling station, promoting cleaner transportation.
8. Conagen and Sumitomo Chemical: Collaborating on bio-based products, advancing sustainable solutions and the bioeconomy.
9. Neste: Restarting its Singapore refinery for renewable diesel production, supporting CO2 reduction.
10. Masdar, Mitsubishi Chemical, and INPEX: Exploring commercial-scale polypropylene production from CO2 and green hydrogen, contributing to sustainable materials.
11. NewHydrogen: Partnering with UC Santa Barbara to develop efficient water splitting for cheap green hydrogen production, addressing CO2 removal.
12. Lummus Technology and Biohydrogen Technologies: Developing synthesis gas reactor technology, advancing carbon capture and cleaner energy.
13. C1 (Berlin): Green methanol project contributes to cleaner marine and aviation fuels, supporting CO2 reduction.
14. Equatic: Developing seawater electrolysis for CO2 capture and hydrogen production, promoting sustainable energy solutions.
15. SABIC: Offering bio-based resin grades, promoting the use of sustainable materials in the bioeconomy.

Company Ranking – August 2023

Rank	Company	Frequency (Number of Articles for Month)
1	Neste	5
2	Origin Materials	4
3	Braskem	3
4	Circle K	2
5	US Government	2
6	SABIC	2
7	Coregas	2
8	Fluid Quip Technologies	2
9	Wallenius Wilhelmsen	2
10	Gruner Renewable Energy	2
11	Sumitomo Chemicals	2
12	US Government	2
13	C1	2

Topic & Theme Ranking – August 2023

Rank	Category	Frequency (Number of Articles for Month)
1	Hydrogen	16
2	Biojet	9
3	CO2 Removal	7
4	Market Development	6
5	Biobased chemicals	6
6	Feedstock	5
7	Biofuels	5
8	Plastic recycling	3
9	Renewable Diesel	3
10	Biogas	3
11	Methanol	3
12	Policy	2
13	E-fuels	2
14	Marine fuels	2
15	Food Technology	2

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