

Bioeconomy & Low Carbon Technology Overview for February 2024

This summary of low carbon technology developments for February 2024 is based on the data and information collated by Gifford Consulting and presented on our website: [Gifford Consulting](#)

Highlights by Topic: February 2024

More information on these articles can be found on our website dashboards.

Biobased Chemicals

1. **Biobased Chemicals - Evonik:** Evonik launched the world's first industrial-scale facility for sustainable rhamnolipid biosurfactants in Slovakia. This plant marks a significant advancement in the production of environmentally friendly biosurfactants. The rhamnolipids produced are of exceptionally high quality, positioning Evonik uniquely in the market through its IP-protected, fermentation-based manufacturing process.
2. **Biobased Chemicals - Michelin, IFPEN, Axens:** In France, Michelin, IFPEN, and Axens unveiled the first industrial-scale demonstrator for bio-based butadiene production. Supported by ADEME, this project within the BioButterfly framework aims to replace petrochemical-derived butadiene with biomass-derived ethanol, marking a pivotal step toward establishing a bio-based synthetic elastomer industry.
3. **Biobased Chemicals - Covestro:** Covestro is advancing a groundbreaking process in Germany to produce aniline entirely from plant biomass at its Leverkusen site. By operating a special pilot plant, Covestro is moving closer to industrial-scale production of biobased aniline, used in making MDI for insulating foam, contributing to energy savings and CO2 footprint reduction in the construction industry.
4. **Biobased Plastics - Toray Industries:** Toray Industries partnered with Yoshida Co. to develop materials for Tanker bags using Ecodear N510, a 100% plant-based nylon fiber. This collaboration aims to incorporate biobased synthetic polymer content in line with ISO standards, enhancing the sustainability of Yoshida's Porter brand Tanker line.

Biobased Plastics

5. **Biobased Plastics - Braskem, Shell:** Braskem and Shell agreed to produce circular polypropylene from mixed plastic waste in the Netherlands. Shell will convert pyrolysis oils into virgin-quality feedstocks at its Moerdijk Chemicals Park, and Braskem will utilize these feedstocks in Germany.
6. **Biobased Plastics - Industry Challenges:** The oil-based plastics industry faces operational challenges as steam crackers, essential for transforming naphtha and gas into chemical building blocks, are running at loss-making capacities between 65% and 75%, significantly below the economical threshold. This is threatening the sector's viability.
7. **Biobased Plastics - Gulf Biopolymers Industries:** Gulf Biopolymers Industries developed plans to establish the first polylactic acid plant in the Middle East at Abu Dhabi's Khalifa Economic Zones, with a production capacity of 30,000 metric tons.

Biodiesel

8. **Biodiesel - BioAdvance:** BioAdvance indicated that it set to launch in Figueira da Foz a biodiesel plant, starting with an initial production capacity of 20,000 tons of biofuels per year. The facility plans to expand to 200,000 tons annually within a few years.

Biofuels

9. **Biofuels - Enerkem:** Enerkem is retiring its Enerkem Alberta Biofuels plant in Edmonton, Canada, after achieving its goal of scaling up its waste-to-biofuels technology. With over 15,000 hours of operation producing certified ethanol and methanol, the facility has proven the viability of Enerkem's innovative platform.
10. **Biofuels - S-OIL:** S-OIL started incorporating bio-based feedstocks, such as used cooking oil and waste plastic-based pyrolysis oil, into its refining processes in South Korea. This initiative enables the production of low-carbon biofuels and bio-based petrochemicals.
11. **Biofuels - Eni:** Eni announced that it is constructing three new facilities for hydrogenated biofuels production in Livorno, Italy. This project, part of Eni's decarbonization strategy, aims to increase bio-refining capacity significantly, supporting the company's goal to achieve carbon neutrality by 2050.
12. **Biofuels - Aemetis:** Aemetis unveiled a Five-Year Plan predicting significant revenue and EBITDA growth by 2028. The company expects a compound annual growth rate of 38% in revenues and 83% in EBITDA, driven by its expanding biofuels and renewable products portfolio.
13. **Biofuels - Neste Corp.:** Neste Corp. reported a significant increase in renewable diesel and sustainable aviation fuel (SAF) production in 2023. Renewable diesel production rose by over 15%, and SAF production surged by nearly 59%, highlighting Neste's growing impact on the sustainable fuel industry.

Biogas

14. **Biogas - Gasum (Finland):** Finnish energy company Gasum announced that it is investing \$8.08 million to expand its biogas plant in Riihimäki, Finland. The project aims to introduce an advanced evaporation system for more efficient liquid removal from digestate, a byproduct of biogas production. This enhancement will not only improve operational efficiency but also enable the recovery of nitrogen as ammonium which will add further value to the process.
15. **Biogas - City of Long Beach (California):** The City of Long Beach, California, is negotiating with Bioenergy Devco to construct a facility for recycling food waste into organic soil amendment and renewable natural gas.
16. **Biogas - MAIRE's NextChem Tech and ENGIE:** NextChem Tech and ENGIE partnered to co-develop and commercialize a biomethane technology for converting dry biomass waste into synthetic methane. This collaboration will see NextChem Tech optimize and integrate both companies' proprietary technologies for global licensing, starting with the Salamandre project in Le Havre, France.
17. **Biogas - STX Group and BioValue (Netherlands):** STX Group and BioValue formed a financing partnership for the Groengas Cothen biomethane plant in the Netherlands, adding at least 80GWh of renewable natural gas capacity annually. This innovative model allows BioValue to

secure capital and retain ownership without fixed offtake prices, benefiting from STX Group's financial support and market access.

18. **BioGas - Gasum (Norway):** Gasum has inaugurated a new gas filling station in Kristiansand, Norway, expanding its liquefied biogas (LBG) infrastructure. The station, offers both compressed and liquefied biogas and will cater to corporate distributors and the public.

Biojet/SAF

19. **Biojet - Le Havre Facility:** A collaboration aims to establish a green hydrogen production site by Lhyfe in Le Havre, France, with over 100 tonnes per day capacity to supply e-SAF production by SAF+. This project intends to connect the industrial complex to the hydrocarbon transport network, facilitating e-SAF transport to airports in the Paris region and other parts of France.
20. **Biojet - Neste and Amelia:** Neste has partnered with French regional airline Amelia to supply blended Neste MY SAF, contributing to Amelia's greenhouse gas emission reduction goals. Since January 2024, Amelia has used SAF for flights departing from Amsterdam Airport Schiphol, with the Amsterdam to Strasbourg route being the first to exclusively benefit from SAF.
21. **Biojet - Jet Zero Australia and LanzaJet:** Jet Zero Australia has signed a license and engineering agreement with LanzaJet to develop Project Ulysses in North Queensland, using LanzaJet's ATJ technology to convert bioethanol into SAF and renewable diesel. This project, will produce 100 million liters of SAF per annum.
22. **Biojet - Velocys:** Following its privatization in January 2024, Velocys has received \$40 million in growth capital from a new consortium of investors. This funding will accelerate the delivery of Velocys' SAF technology to customer projects.
23. **Biojet - Rengo (Japan):** Rengo plans to invest \$133 million by 2027 in ethanol production from construction waste to provide a supply for sustainable aviation fuel (SAF). With Japan targeting 10% SAF consumption by 2030, this initiative seeks to overcome the country's feedstock limitations by utilizing construction waste.
24. **Biojet - SCOA (Japan):** SCOA will lead a Japanese investment consortium to fund the development of a project aimed at producing renewable fuels, including SAF. SCOA commits to a 20-year offtake for the fuels produced.
25. **Biojet - CVR (Texas):** CVR is exploring SAF production expansions in Wynnewood and Coffeyville, planning to solicit bids for offtake agreements to support the conversion of the Wynnewood renewable diesel unit to SAF and evaluating a larger project in Coffeyville for preliminary engineering and cost estimation.
26. **Biojet - Twelve:** Twelve's commercial-scale facility in Moses Lake, Washington, is under construction, set for completion by year-end. The facility will feature Twelve's OPUS technology, which converts CO₂ into hydrocarbons for products currently derived from fossil fuels.
27. **Biojet - Cepsa and Bio-Oils (Spain):** Cepsa and Bio-Oils are constructing the largest second-generation biofuels plant in southern Europe, capable of producing 500,000 tons of SAF and renewable diesel annually. This joint venture aims to double current production capacity, establishing a major renewable fuel complex in Europe.

Biomaterials

28. **Biomaterials - Petrochemical Industry:** The petrochemical industry's efforts to add oxygen to hydrocarbon-based raw materials highlights an opportunity for biobased chemical production. Biomass feedstock's inherent oxygen content offers a direct route to producing oxygenated chemical intermediates, potentially bypassing fossil-derived chemicals.

CO2 Removal

29. **CO2 Removal - Green Applications:** Various 'green' applications of carbon dioxide, including greenhouse growth enhancement and specific chemical feedstock uses, are being recognized for their environmental benefits. These applications, along with methods like dry ice blasting and enhanced oil recovery, demonstrate CO2's potential in eco-friendly practices.
30. **CO2 Removal - COLIPI:** COLIPI is pioneering a bioprocess that acts like a brewery for oils, utilizing CO2 from industrial emissions and agricultural by-products. Through fermentation by the world's fastest CO2-consuming bacteria in a specially designed bioreactor, it produces Climate Oil.
31. **CO2 Removal - Veolia (UK):** Veolia has initiated a site feasibility study for a pilot project in the UK to implement innovative carbon capture processes at energy recovery facilities. The project aims to produce green fuels, including e-Kerosene and e-Methanol, by capturing, extracting, and purifying CO2.
32. **CO2 Removal - EU Certification Framework:** The EU Council and European Parliament have agreed on a voluntary certification framework for carbon removals, setting high standards for industrial and agricultural carbon removal activities. This framework aims to promote and regulate carbon removal efforts across the EU.

E-Fuels

33. **E-fuels - EConnect Energy (Norway):** EConnect Energy is a crucial partner in "Project Green," led by APPL, to supply clean E-fuels like e-methanol and green ammonia in Africa.

Ethanol

34. **Ethanol - Innova Delta ADY:** Innova Delta ADY offers a non-GM yeast solution that allows ethanol plants to achieve operational performance comparable to those using advanced GM yeasts. This innovation delivers significant improvements in ethanol production, efficiency, and sustainability.
35. **Ethanol - U.S. Economy Impact:** Despite inflationary pressures, the U.S. ethanol industry continued to make a strong economic contribution in 2023. Boosted by rising demand for low-carbon ethanol and its co-products, the industry's resilience was highlighted in an annual economic impact analysis by ABF Economics for the Renewable Fuels Association.

Feedstock

36. **Feedstock - Drax Group (Texas):** Drax Group has partnered with Molpus Woodlands Group to secure sustainably sourced woody biomass for its BECCS operations in the US Southeast. Under the agreement, Drax may purchase up to 1 million green tons per year, supporting its renewable power generation and carbon removal goals.

37. **Feedstock - Fonterra (New Zealand):** Fonterra's Waitoa manufacturing site has cut its coal usage by 50% thanks to a new wood biomass boiler, part of Fonterra's initiative to reduce its Scope 1 & 2 emissions by 50% by 2030.
38. **Feedstock - USDOE/USDA Support:** Despite the ability of American farmers to respond to market demands, continued support for research into purpose-grown energy crops by the USDOE and USDA is deemed necessary. This research is vital for understanding crop yields, supply chains, and economic models to bridge the gap until the first harvest.
39. **Feedstock - Enviva:** Enviva faces financial difficulties after failing to make a \$24.4M bond payment, resulting from unmet expectations on market price rises for its purchased pellet stock. The interim CEO has attributed the losses to poor market price predictions.
40. **Feedstock - Plant Waxes:** Research by Texas A&M AgriLife Research and the College of Agriculture and Life Sciences is exploring the high wax production of bioenergy sorghum, potentially offering additional profit avenues for growers in industries like cosmetics, food coatings, and biofuels.

Food Technology

41. **Food Technology - Miruku:** New Zealand-based startup Miruku has secured an \$8 million NZD in Pre-Series A funding to advance its molecular farming technology. Miruku's 'dairy seed system' promises to revolutionize agricultural practices by producing novel dairy proteins and fats with crop seeds.

Hydrogen

42. **Hydrogen - Stellantis (Milan):** Stellantis begun volume production of large-sized and mid-sized hydrogen fuel cell vans in Europe, expanding its range of zero-emission commercial vehicles and reinforcing its commitment to sustainable transportation solutions.
43. **Hydrogen - Plastic Omnium (Shanghai):** Plastic Omnium, through its joint venture PO-Rein1, is constructing a mega-plant in Shanghai to produce up to 60,000 high-pressure hydrogen vessels and storage systems annually for the Chinese commercial vehicle market by 2026.
44. **Hydrogen - TEAL Mobility:** Air Liquide and TotalEnergies launched TEAL Mobility, a joint venture aiming to develop a network of 100 hydrogen stations for heavy-duty trucks across major European corridors, creating the first transnational hydrogen network of its size under the TotalEnergies brand.
45. **Hydrogen - Lhyfe (Germany):** Lhyfe is establishing its hydrogen production plant in Brake, Germany, set to be the first in the region to supply green hydrogen to the broader market. The facility will produce up to 1,150 tons of green hydrogen annually, marking a significant step towards accessible renewable energy in northern Germany.
46. **Hydrogen - HNO International (Texas):** In Texas, HNO International, in collaboration with Element One Energy and PHC, is developing the world's first 500 kg per day green hydrogen production facility in Houston. Scheduled for completion in Q2 2024, this marks the start of HNO International's SHEP, aiming to produce, store, and dispense green hydrogen efficiently.
47. **Hydrogen - Maire Tecnimont (Italy/Portugal):** Maire Tecnimont's Tecnimont has secured a FEED contract from MadoquaPower2X for an integrated green hydrogen and ammonia plant in Sines, Portugal. This project involves a consortium including Madoqua Renewables, Power2X, and CIP.
48. **Hydrogen - Oulu Energy (Finland):** Oulu Energy plans to construct a 100 MW hydrogen production plant in Oulu, Finland. The project includes an electrolysis plant, carbon capture, and storage facilities, potentially producing methane or methanol.

49. **Hydrogen - Honeywell and ENEOS (Japan):** Honeywell is partnering with ENEOS to develop the world's first commercial-scale LOHC (liquid organic hydrogen carrier) project in Japan, facilitating long-distance hydrogen transport. This innovative solution leverages existing infrastructure.
50. **Hydrogen - Linde and OCI (Texas):** Linde will supply hydrogen to OCI's blue ammonia facility in Beaumont, Texas, producing blue hydrogen via natural gas auto thermal reforming and capturing over 1.7 MMtpa of CO2 emissions.
51. **Hydrogen - EnergyAustralia (New South Wales):** EnergyAustralia has launched Tallawarra B Power Station, the first dual-fuel capable natural gas/hydrogen plant in Australia. Set to operate on a blend of 5% green hydrogen by 2025, this initiative is a step towards the country's hydrogen industry development.
52. **Hydrogen - Caltrans (California):** Caltrans has committed \$127 million for six additional hydrogen-powered passenger trainsets from Stadler Rail, expanding North America's hydrogen-powered intercity train fleet. Expected to enter service in 2027, these trains support California's zero-emission vehicle goals, underlining advancements in clean transportation.
53. **Hydrogen – North West Hydrogen Alliance (NWAH) (UK):** The NWAH has released a manifesto for a leading hydrogen economy in Northwest England, advocating for a national hydrogen target of 20GW by 2035.
54. **Hydrogen - Singapore Hydrogen Cooperation Committee:** Following a collaboration agreement among key aviation and energy stakeholders, Singapore's hydrogen aviation working group is exploring hydrogen's role in decarbonizing aviation. This initiative reflects ongoing efforts to establish a viable hydrogen ecosystem for the aviation industry in Singapore.
55. **Hydrogen - OMV Petrom (Romania):** OMV Petrom announced financing for two green hydrogen production facilities at the Petrobrazi refinery, with a combined capacity of 55 MW. Supported by the Romanian Ministry of Energy, this €140 million investment supports Southeastern Europe's move towards green hydrogen production.

LCA

56. **LCA - Renewable Carbon Products:** The life cycle assessment community is striving for fair comparisons between products derived from crude oil and those from biomass, CCU, and recycling. Critics argue that renewable carbon-based products face stricter scrutiny compared to crude oil, highlighting the need for more granular and transparent LCA practices.

Marine fuels

57. **Marine Fuels - Masdar and CMA CGM (UAE):** Masdar and CMA CGM entered a Strategic Supply Partnership to explore long-term offtake contracts for green maritime fuels, aiming to supply CMA CGM vessels and advance the decarbonization of the maritime industry in line with global emission reduction goals.
58. **Marine Fuels - VARO Energy and Orim Energy (Netherlands):** VARO Energy and Orim Energy are planning to partner to supply biofuels to shipping customers in the Rotterdam and ARA region, supporting the maritime industry's decarbonization in Northern Europe. This initiative aligns with the IMO's targets to significantly reduce shipping's GHG emissions by 2050.

59. **Marine Fuels-& Eidesvik Offshore (Norway):** Eidesvik Offshore collaborates with Agalas to construct a Construction Support Vessel (CSV) featuring methanol engines and a battery hybrid system, aiming to become the world's most environmentally friendly vessel within its operational segments for subsea and offshore wind tasks.
60. **Marine Fuels - Vopak (Singapore):** Vopak has launched 40,000 cubic meter biofuels blending capacity at its Sebarok terminal in Singapore, enhancing its biofuel blending services via a dedicated pipeline system. This strategic move, supported by customer commitments, positions Vopak favorably in the bustling bunkering activities near Singapore's eastern anchorage.

Market Development

61. **Market Development - KoBold Metals:** KoBold Metals, backed by Bill Gates and Jeff Bezos, announced the discovery of a potentially major high-grade copper deposit, indicating significant strides in mineral exploration and the potential for impactful resource development.
62. **Market Development - Biofuels Industry:** Despite reduced M&A activity in 2023 amid challenging market conditions, the biofuels sector continues to attract substantial investment, driven by a policy environment focused on decarbonizing liquid fuels and the anticipation of strategic M&A.
63. **Market Development - Investment Strategies:** The disparity between investors' long-term security demands and buyers' shorter commitment preferences challenges project financing. Success hinges on aligning debt service capabilities with offtake agreements and achieving attractive internal rates of return for equity investors.
64. **Market Development - Renewable Identification Numbers (RINs):** RINs generation (in the US) increased in January 2024, indicating a growing contribution of renewable fuels to the energy mix, and reflecting the Renewable Fuel Standard's ongoing impact on fuel standards and its substitution for fossil-based fuels.
65. **Market Development - EU Biofuels Strategy:** The EU's lack of a concrete roadmap for biofuels, especially in aviation, highlights strategic uncertainties. Despite ReFuelEU Aviation legislation, the EU's biofuel production capacity and the future role of biofuels in transportation remain unclear, contrasting with more decisive actions in the US.
66. **Market Development - Neste:** Neste updates its Green Finance Framework to align with best practices, supporting renewable and circular projects through significant green financing. This strategic move underscores Neste's commitment to sustainability and innovation in renewable resources.

Methanol

67. **Methanol - BASF and Envision Energy:** BASF is collaborating with Envision Energy to advance e-methanol production, leveraging innovative catalyst technology for converting green hydrogen and CO₂.
68. **Methanol - Linde and Celanese:** Linde supplies Celanese with captured CO₂ for methanol production, showcasing a collaborative effort to produce methanol with lower carbon intensity, leveraging clean hydrogen and CO₂ capture technologies.

69. **Methanol - Lake Charles Methanol:** Lake Charles Methanol announced a \$3.2 billion blue methanol manufacturing plant, turning natural and renewable gas into methanol while capturing CO₂.

Plastic Recycling

70. **Plastic Recycling - Rumpke and Eastman:** Rumpke and Eastman are partnering to recycle hard-to-recycle PET packaging waste using molecular recycling, turning this waste into virgin quality polyesters.
71. **Plastic Recycling - CARBIOS:** CARBIOS' technology enhances PET circularity, processing 50,000 tons of post-consumer PET waste annually, offering an efficient solution for recycling coloured PET bottles, food trays, and textiles into new materials.

Policy

72. **Policy - New Mexico:** New Mexico's Clean Transportation Fuels Standard aims to reduce transportation fuel carbon intensity by 20% by 2030 and 30% by 2040.
73. **Policy - Singapore:** Singapore mandated sustainable aviation fuel usage for all departing flights from 2026, aiming for a 1% SAF target, escalating to 3-5% by 2030.
74. **Policy - UAE:** The UAE identified the need for Gulf countries to produce sustainable aviation fuel to support greener flights and secure a position in the global SAF market, including Emirates Airline

Pyrolysis

75. **Pyrolysis - Pryme:** Pryme successfully initiated production at its first manufacturing facility with production of "first oil" on January 19th, 2024. This marks the start of production and the first phase of development of the company's Rotterdam based plant, Pryme One.

Renewable Diesel

76. **Renewable Diesel - Colonial Oil Industries:** Colonial Oil Industries partnered with Neste, TICO, and Gateway Terminals to offer renewable diesel in the Southeast US.
77. **Renewable Diesel - Come By Chance Refinery:** The Come By Chance refinery will transition to renewable diesel production, backed by Cresta Fund Management.

Companies: Significant Developments: February – 2024

1. **Neste:** Neste is actively expanding its renewable and circular solution projects, including refinery expansions in Singapore and Rotterdam, and a joint operation in Martinez. The company has focused on aligning its financing activities with market best practices through its Green Finance Framework, supporting sustainable energy solutions.
2. **Linde:** Linde is involved in supplying carbon dioxide for methanol production and developing a blue hydrogen production facility in Beaumont, TX.
3. **Eidesvik Offshore:** Eidesvik Offshore, in collaboration with Agalas, is going to build a Construction Support Vessel (CSV) with methanol engines and a battery hybrid system, aiming to create the world's most environmentally friendly vessel within its operating segments.

4. **Vopak:** Vopak commissioned new capacity for biofuel blending at its Sebarok terminal in Singapore. The company has converted its pipeline system to support dedicated biofuel blending services, highlighting its role in facilitating the use of cleaner marine fuels.
5. **HNO International:** HNO International, alongside Element One Energy and Pneumatic and Hydraulic Company (PHC), is planning to develop a green hydrogen production facility in Houston, Texas. This project is part of HNO International's Scalable Hydrogen Energy Platform (SHEP), focusing on efficient green hydrogen production.
6. **Maire Tecnimont:** Maire Tecnimont's subsidiary Tecnimont has been awarded a contract to develop an integrated green hydrogen and ammonia plant in Sines, Portugal, in collaboration with MadoquaPower2X.
7. **Oulu Energy:** Oulu Energy has announced plans to build a 100 MW hydrogen production plant in Finland, aiming for carbon neutrality by 2030. The project includes an electrolysis plant and facilities for carbon capture and storage, further processing into methane or methanol.
8. **Honeywell:** Honeywell is partnering with ENEOS in Japan to develop a commercial-scale Liquid Organic Hydrogen Carrier (LOHC) project, focusing on the long-distance transportation of clean hydrogen. This collaboration aims to support the use of hydrogen across various industries.
9. **BASF:** BASF, in collaboration with Envision Energy, is developing technology for the conversion of green hydrogen and CO2 into e-methanol. This initiative underscores BASF's commitment to sustainable energy solutions and the advancement of green chemical processes.
10. **Rumpke and Eastman:** Rumpke Waste & Recycling and Eastman have partnered to address the plastic waste crisis through molecular recycling. Rumpke will supply hard-to-recycle PET packaging waste to Eastman's molecular recycling process, turning this waste into virgin quality polyesters and advancing circular economy efforts for plastics.

Companies – February 2024

Feature companies (top 6) and frequency of mention

Company	Frequency
Neste	3
Linde	2
BioAdvance	2
Gasum	2
Lhyfe	2
Oulu Energy	2

Topics & Themes– February 2024

Feature topics and themes (top 10) and frequency of mention

Topic	Frequency
Hydrogen	18
Biojet/SAF	13
CO2 Removal	6
Biofuels	6
Biobased plastics	6
Methanol	4
Biogas	4
Feedstock	4
Market Development	4
Marine fuels	4

Prepared with the assistance of ChatGPT