

Bioeconomy & Low Carbon Technology Overview for September 2023

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

Highlights: September 2023

Algae

1. Brilliant Planet uses a method where seawater is pumped through ponds, promoting continuous algae growth. The harvested algae is dried using solar energy and buried to keep the carbon captured for over 1,000 years.

Ammonia Production

2. Bion Environmental Technologies: In Indiana, Bion's Ammonia Recovery System has consistently achieved steady-state operations. This system produces a solution that forms the base of Bion's nitrogen fertilizers.
3. Uniper, ConocoPhillips, and JERA Americas: An agreement has been signed where Uniper will be a primary customer, receiving a low-carbon hydrogen/ammonia output from the others.

Biobased Chemicals

4. BASF will get long-term access to bio-based 1,4-butanediol from Qore. Qore will produce this chemical in Iowa. BASF will then offer derivatives like PolyTHF and THF, with commercial quantities expected in 2025.
5. GETEC Group in Germany will construct a plant to provide climate-neutral energy and utilities at the Zeitz Chemical and Industrial Park for CE Biobased Chemicals GmbH.
6. INEOS Styrolution: This company introduced a U.S.-made grade of sustainable polymers, which includes bio-based materials, now available in the Americas.
7. Lummus Technology and RWDC Industries: These companies are partnering to expand manufacturing and licensing of polyhydroxyalkanoates (PHA).
8. Pyran recently upscaled its production of 1,5 PDO and gathered data for a world-scale plant. RPD Technologies in Texas is believed to be the tolling partner.

9. Trillium, after securing funding in 2022, Trillium has constructed a pilot plant to produce acrylonitrile from glycerol. This plant will offer product samples for customer validation.
10. Bioplastics make up only 1% of global plastic production due to higher costs. However, they are growing at 14% annually and could reach 3% market share in five years.
11. Asahi Kasei uses a method where carbon dioxide and an electrolytic solution are used to produce ethylene.

Biodiesel

12. Germany's Chevron Renewable Energy Group: This company began the expansion of its biorefinery in Emden, which will broaden feedstock options for biodiesel production.
13. Universal Biofuels in India: The company expanded its biodiesel production capacity to 60 million gallons ahead of schedule.

Biofuels

14. California: Over half of the diesel used in California has been replaced with clean fuels in Q1 2023 due to the state's Low Carbon Fuel Standard.
15. POET in Indiana: POET has reopened and expanded a previously shut-down biorefinery in Cloverdale. It will produce 95 million gallons per year.
16. Clean Fuels Alliance America: A report estimates global used cooking oil (UCO) trade reached 3.7 billion gallons in 2022. This could grow to between 5 and 10 billion gallons by 2030.
17. Brazilian Petrobras is keen on repurchasing a refinery from Mubadala and is considering a biofuels partnership as a potential avenue.

Biogas

18. JBS Australia: JBS is building a system at its Scone Processing Plant that captures wastewater emissions and replaces its LNG consumption with renewable gas. This project is in partnership with Energy360.
19. In California, Terreva Renewables secured \$417 million for the expansion of its renewable natural gas platform.
20. In Finland, Rohe Solutions Oy initiates biogas liquefaction at the Hamina LNG terminal, set to commence in 2024.
21. France's ENGIE targets 10 TWh of biomethane production yearly by 2030.
22. Germany celebrates the opening of its most extensive integrated bio-LNG facility, BioEnergie Park Güstrow, a project by EnviTec Biogas AG.
23. Hyundai Motor Group in Korea aims to produce clean hydrogen from food waste.
24. Norsk Hydro in Norway seeks to replace fossil energy in its Sunndal aluminum plant using bioenergy, targeting a 20,000 metric tons CO2 reduction annually.
25. In Pennsylvania, ICDC and Air Liquide discuss a proposed RNG production facility using dairy waste.

26. Naturgy in Spain advances the country's first BioLNG project emphasizing waste recovery and decarbonization.
27. Spain's Granja La Carbona collaborates with CycleØ to transform manure into sustainable fertilizers using ammonia stripping technology.
28. In the UK, AstraZeneca partners with Future Biogas for a 15-year contract to supply biomethane gas and invests £100 million in energy efficiencies.
29. ENGIE in the UK acquires Ixora Energy Ltd, adding three biomethane production units to its portfolio.
30. Irizar's i6s Efficient coaches, fitted with Scania's LNG powertrain, are transitioning to LBG, targeting an 80% reduction in CO2 emissions.

Biojet

31. In Austria, OMV agrees to supply the Air France-KLM Group with 2,000 metric tons of Sustainable Aviation Fuel in 2023.
32. MEPs in Belgium pass a law for the uptake of sustainable aviation fuels, aiming to significantly increase the green fuel percentage by 2050.
33. In California, Aemetis obtains permission to establish a sustainable aviation fuel and renewable diesel plant in Riverbank.
34. Elyse Energy in France secures financing from Hy24 and Mirova for e-methanol and sustainable aviation fuels projects in France and Spain, set for 2027 and 2028.
35. France: VoltAero tested their electric-hybrid Cassio aircraft with 100% sustainable fuel by TotalEnergies using bioethanol from French vineyards.
36. Germany: DHL, HH2E, and Sasol will collaborate to expand sustainable aviation fuel production based on green hydrogen in eastern Germany.
37. Illinois: LanzaJet and Technip Energies enhance their partnership to deploy the LanzaJet Alcohol-to-Jet (ATJ) Process tech for producing sustainable aviation fuel.
38. Illinois: A Rabobank study predicts US sustainable aviation fuel production could surge to 2.2 billion gallons by 2026 and 34 billion gallons by 2050.
39. Texas: Cemvita Corp. and United Airlines signed an agreement for Cemvita to supply up to 1 billion gallons of SAF made from CO2 over 20 years.
40. Texas: Lummus Technology unveiled its process technology to transform ethanol into sustainable aviation fuel, aiming to decrease the aviation industry's carbon footprint.
41. Netherlands: Gunvor Group and VARO Energy will set up a large-scale SAF manufacturing site in Rotterdam with a capacity of 350,000 metric tons per year.
42. Aviation Emissions: The aviation sector annually uses 100 billion gallons of fossil fuels, producing significant CO2 emissions. Electrification and SAF are potential solutions.
43. SAF Challenges: SAF production needs to scale up, ensure a diversified feedstock supply, reduce costs, and deliver CO2 emission reductions. R&D and policy support are vital.

Biomaterials

44. Biorefinery: Aimed at producing sustainable fuels and plastics, the biorefinery will process 400,000 tons of bio-feedstocks annually using Eni's Ecofining™ process.

CO2 Removal

45. enaDyne: Their non-thermal plasma catalysis reactor extracts hydrocarbons from CO₂, producing sustainable fuels using a special patented ceramic electrode.
46. Occidental: A subsidiary will purchase Carbon Engineering Ltd. for about \$1.1 billion, closing expected by the end of 2023.
47. BASF: The facility will produce syngas and hydrogen using CO₂ off-gas and excess fuel gas.
48. Technology: A prototype cell combined potassium and zinc ions, requiring less energy and maintaining 95% capacity across several cycles.

E-Fuels

49. Luxembourg: Axens, Paul Wurth, and IFP Energies Nouvelles are co-developing the Reverse Water Gas Shift technology (RWGS) for e-fuel projects, converting CO₂ to renewable fuels and chemicals.
50. Lydian has developed an electric reactor for low-cost e-fuels production using captured CO₂ and renewable electricity. They are also venturing into producing carbon-negative industrial chemicals.
51. Electric Vehicles: There is a noticeable shift in global materials supply chains due to bold climate targets. The move towards a net-zero emissions economy is causing a "materials transition," and the report aims to present a comprehensive view of this change.

Ethanol

52. In Belgium, ePURE members (representing 85% of EU capacity) produced more food and animal feed than fuel in 2022.
53. In India, Krishak Bharati Cooperative is investing in three grain-based ethanol plants to produce ethanol from corn and broken rice.

Feedstock

54. Orlen in Poland plans a significant investment in a rapeseed processing plant for biodiesel production.
55. A South Korean chemical firm is securing a deal for waste cooking oil to produce biobased aircraft fuels.
56. Food Technology: UPSIDE Foods in Illinois is setting up a commercial-scale cultivated meat plant, initially for chicken products, near a nature preserve and transport hubs.

Hydrogen

57. The New Zealand Hydrogen Aviation Consortium proposes a plan for liquid hydrogen-fueled aircraft on domestic routes, reducing carbon emissions.
58. ANGI Energy Systems collaborates with Nikola Corporation for hydrogen-powered commercial transportation.
59. Andritz will set up a 100 MW electrolysis plant in Austria for green hydrogen production.
60. Vale and H2 Green Steel consider developing green industrial hubs in Brazil and North America.
61. FuelCell Energy and Toyota complete a "Tri-gen system" in California producing renewable electricity and hydrogen.
62. TotalEnergies in France seeks tenders for green hydrogen production and collaborates with Air Liquide for green and low carbon hydrogen supply.
63. Indian Oil introduces the country's first green hydrogen fuel cell bus.
64. Mitsubishi Power in Japan announces the operation of Takasago Hydrogen Park, a comprehensive hydrogen validation facility.
65. South Korea: Hyundai Motor Group plans to produce clean hydrogen from biogas derived from food waste treatment. Collaborative MoU signed with Hyundai Motor, Kia, Hyundai E&C, and SL Corp aims to generate 216 kilograms of green hydrogen daily for two years.
66. Switzerland: Groupe E commissioned a green hydrogen production plant near the Schiffenen dam.
67. Netherlands: OCI Global will offtake green hydrogen from New Fortress Energy Inc. This deal will boost OCI Global's green ammonia production capacity in Texas to around 160,000 tons annually by 2025.
68. UK: Major aviation and renewable energy companies have formed the Hydrogen in Aviation alliance to drive zero-carbon aviation.
69. Australia: A report discusses strategies for building hydrogen vehicle refuelling infrastructure, comparing various storage, dispensing, and refuelling options.

Marine Fuels

70. Denmark: Maersk and Equinor reached an agreement to supply green methanol for Maersk's new methanol-enabled vessel from September 2023 to mid-2024.
71. Japan: Mitsui O.S.K. Lines introduced "HANARIA", Japan's first hybrid passenger ship using hydrogen and biodiesel, set to operate in Fukuoka Prefecture in April 2024.
72. South Korea: HMM tested sustainable marine biofuel on the 6,400TEU container ship HMM TACOMA in Busan.
73. UK: The Port of Tyne's study explores the creation of green shipping corridors for maritime decarbonization. Furthermore, Lloyd's Register Maritime Decarbonisation Hub's report identifies hydrogen-based fuels and biofuels as pivotal to shipping's future.

Market Development

74. Biogas (Connecticut): Veeder-Root and Total Meter Services launched the Biofuel Blending System for accurate biofuel blending at retail spots.
75. UCO (Clean Fuels Alliance America): A report reveals that global UCO trade touched 3.7 billion gallons in 2022. With enhanced biodiesel production, this figure could hit 5-10 billion gallons by 2030.
76. Biodiesel (Brazil): Spread reduction between imported diesel A and domestic biodiesel might encourage higher blending mandates, potentially reaching 15% by 2026.
77. Dev Cap: Non-recourse project finance for new tech infrastructure is emerging. Dev Cap bridges the gap between Venture Capital, Private Equity, and Infrastructure in the advanced bioeconomy realm.
78. Methanol (Japan): AGC Inc. and Mitsubishi Gas Chemical Company will study the production of methanol from CO2 emissions from AGC's glass production, aiming for commercialization by 2030.
79. Plastic Recycling: STEINERT and RE Plano are collaborating on a modern sorting facility in Bochum, using AI-based technology to sort challenging plastic fractions, emphasizing closed-loop systems.

Policy Updates

80. The EU Commission's draft regulation requires e-fuels for new combustion engine vehicles to be climate-neutral by 2035.
81. In North Dakota, major associations are urging the Biden administration to use the DOE's GREET model for GHG reductions in sustainable aviation fuel tax credits.
82. The Philippines and Brazil are collaborating to boost sugarcane and ethanol production in the Philippines.
83. The EU's RefueEU aviation rules aim to progressively increase the use of sustainable aviation fuels to achieve 70% usage by 2050.
84. India's Global Biofuel Alliance seeks to boost global biofuel uptake through various strategies, serving as a platform for collaboration and knowledge sharing.
85. Treasury estimates the cost of buying overseas credits to be between \$3.3b and \$23b by 2030.
86. EU's upcoming legislation on CCS aims to focus on unavoidable emissions, with CCS being a key technology in the EU's Net-Zero Industry Act.
87. A recent auction for carbon credits by the Environment Ministry was not fully subscribed due to available credits in the secondary market and concerns about forestry-generated credits.

Recycling & Renewable Updates

88. NOVA Chemicals is developing a recycling facility in Connersville, targeting to produce over 100 million pounds of rPE by 2026.
89. Aramco, TotalEnergies, and SABIC have successfully converted plastic waste into ISCC+ certified circular polymers in Saudi Arabia.

90. The increasing market share of rPET may lead to higher prices and supply pressures, given its recyclability and preference over other resins.
91. Braskem and Vitol S.A. will collaborate on circular feedstock derived from plastic waste in Denmark.

Renewable Diesel

92. Ampol in Australia will test renewable diesel with Hanson as its partner.
93. Neste has expanded its renewable fuels supply in Southern California in collaboration with Vopak.
94. Mitsui & Co. will invest in a renewable diesel production business in Portugal with Galp SGPS.
95. A new unit will use Topsoe's technology to produce renewable diesel and SAF, marking Topsoe's 50th HydroFlex™ reference globally.

Textiles

96. MycoWorks, in South Carolina, has initiated production at its facility, focusing on producing Reishi™, a leather alternative that rivals calfskin leather in quality.

Overview –September 2023 (based on the above bullet points):

Policy and Environmental Measures:

A significant pivot towards green policies is evident across various regions. The EU Commission's draft highlights a move towards climate-neutral e-fuels for new combustion engine vehicles by 2035. This step, combined with the RefuelEU aviation rules, underscores the EU's commitment to drastically reduce greenhouse gas emissions. While the EU aims for a 70% sustainable aviation fuel use by 2050, North Dakota's major associations are pushing the Biden administration for better GHG reduction metrics for sustainable aviation fuels. In parallel, a collaborative initiative between the Philippines and Brazil seeks to augment sugarcane and ethanol production. However, challenges persist, such as the estimated cost of overseas credits, which the Treasury pegs between \$3.3b and \$23b by 2030. The EU's upcoming CCS legislation, a part of its Net-Zero Industry Act, emphasizes focusing on genuine, unavoidable emissions. Furthermore, a recent carbon credit auction in New Zealand fell short due to secondary market dynamics and concerns surrounding forestry-generated credits.

Recycling, Renewables, and Sustainable Innovations:

The drive towards recycling and sustainability is gaining momentum globally. NOVA Chemicals has announced an ambitious plan to develop a recycling facility targeting to produce vast quantities of recycled polyethylene by 2026. Aramco has made a pioneering effort, TotalEnergies, and SABIC in Saudi Arabia, converting plastic waste into certified circular polymers. Market trends suggest a surge in demand for rPET due to its recyclability, which could lead to supply challenges. Collaborative efforts, like the partnership between Braskem and Vitol S.A., are emerging to address circular feedstock from plastic waste. In the renewable diesel space, various organizations, from Ampol in Australia to Mitsui & Co. in Portugal, are investing and expanding their capacities. Neste's partnership with Vopak is a notable effort to expand renewable fuel supplies in Southern California.

Textiles and Sustainable Materials:

The textile industry is also witnessing transformative changes. MycoWorks, based in South Carolina, is on the verge of a significant scale-up. With its proprietary technology, Fine Mycelium™, the company aims to produce Reishi™, a high-quality leather alternative that can compete with the revered calfskin leather. This development marks an exciting phase in sustainable material production, aligning with the global shift towards eco-friendly alternatives across industries.

Companies: Significant Contributions – September - 2023

1. EU Commission: Drafted regulations ensuring climate-neutral e-fuels for new vehicles by 2035 and introduced the RefuelEU aviation rules.
2. NOVA Chemicals: Announced an investment to develop a mechanical recycling facility aiming to produce substantial quantities of recycled polyethylene by 2026.
3. Neste: Partnered with Vopak to expand renewable fuel supplies in Southern California, showing commitment to renewable diesel and sustainable aviation fuel.
4. MycoWorks: Initiated production of a leather alternative, Reishi™, using proprietary technology, Fine Mycelium™, matching the quality of calfskin leather.
5. Aramco, TotalEnergies, and SABIC: Jointly converted plastic waste into certified circular polymers in Saudi Arabia.
6. Braskem and Vitol S.A.: Collaborated to utilize circular feedstock derived from plastic waste.
7. Clean Fuels Alliance America, American Soybean Association, National Oilseed Processors Association, U.S. Canola Association: Urged the Biden administration to adopt a refined GHG reduction model.
8. Ampol: Announced a renewable diesel trial in Australia, marking a step forward for renewable energy in the region.
9. Mitsui & Co.: Partnered with Galp SGPS, S.A. in Portugal to invest in renewable diesel and sustainable aviation fuel production.
10. Galp SGPS, S.A.: Collaborated with Mitsui & Co. for renewable diesel and sustainable aviation fuel production in Portugal.
11. PT Kilang Pertamina Internasional (PT KPI): Aiming to convert bio-feedstock into SAF and renewable diesel using Topsoe's HydroFlex™ technology.
12. Philippines and Brazil Governments: Collaboratively looking to boost sugarcane and ethanol production in the Philippines.
13. SATORP: A joint refinery by Aramco and TotalEnergies that processed the plastic waste derived oil.
14. PETROKEMYA: A SABIC affiliate that utilized the plastic waste derived oil to produce circular polymers.
15. Topsoe: Provided the HydroFlex™ technology to convert bio-feedstock into renewable diesel.
16. Vopak: Collaborated with Neste to enhance the availability of renewable fuels in Southern California.
17. Hanson: Partnered with Ampol for a renewable diesel trial in Australia.
18. WPU – Waste Plastic Upcycling A/S: Facilities in Denmark to be utilized by Vitol to supply Braskem with pyrolysis oil from plastic waste.
19. Treasury (EU): Highlighted the financial implications of environmental credits and their potential cost.
20. Environment Ministry (New Zealand): Hosted a carbon credit auction, shedding light on the dynamics of the carbon credit market.

Company Ranking – September 2023

Rank	Company Name	Frequency
1	EU	4
2	LG Chem	2
3	Hyundai	2
4	Clean Fuels Alliance USA	2
5	TotalEnergies	2
6	Engie	2
7	BASF	2
8	Norsk Hydro	1
9	Axens	1
10	Group E	1
11	EnviTec Biogas	1
12	NOVA Chemicals	1
13	Chevron Renewable Energy Group	1
14	Veeder-Root	1
15	Terreva Renewables	1

Topic & Theme Ranking – September 2023

Rank	Topic	Frequency
1	Hydrogen	15
2	Biojet (SAF)	14
3	Biogas	11
4	Policy	9
5	Biofuels	4
6	Recycling plastic	4
7	Marine fuels	4
8	CO2 Removal	4
9	Market Developments	4
10	Biobased chemicals	4
11	Renewable Diesel	3
12	E-fuels	2
13	Feedstock	2
14	Biodiesel	2
15	Biobased plastics	2

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