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DOE's ARPA-E Awards \$35 Million To 15 Biofuel Projects



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MAY 17, 2021 **BY ERIN KRUEGER**

The U.S. Department of Energy's Advanced Research Projects Agency-Energy on May 14 awarded \$35 million to 15 research projects that aim to advance new technologies to decarbonize biorefinery processes used across the energy, transportation and agriculture sectors.

ARPA-E is a DOE agency that is tasked with advancing high-potential, high-impact energy technologies that are too early for private-sector investment. Projects funded through the agency aim to develop entirely new ways to generate, store and use energy. The 15 awards announced on May 14 were made through ARPA-E's "Energy and Carbon Optimization Synthesis for the Bioeconomy" (ECOSynBio) program, which aims to promote the use of advanced synthetic biology tools to engineer novel biomass conversion platforms and systems.

"Biofuel is a powerful tool in the clean energy toolkit that has immense potential to power our ships and airlines with zero carbon emissions," said Secretary of Energy Jennifer M. Granholm. "DOE is investing in research to reduce emissions and maximize the availability of efficient biofuel as we strive to reach President Biden's net-zero carbon goals."

According to the DOE, most biofuels are produced via fermentation processes, which create carbon as a byproduct. Some fermentation processes waste more than one-third of this carbon as CO₂ emissions, the agency said. As a result, there is a critical need to create new pathways for biofuel conversion that reduce carbon waste, prevent the loss of CO₂ emissions, and maximize the amount of renewable fuel a conversion process yields.

The 15 teams will work to optimize biofuel manufacturing through carbon optimized fermentation strains that avoid CO₂ waste; engineered organisms that can use a mix of difference sources of energy and carbon, and avoid evolving CO₂; biomass-derived sugar or carbon oxide gas fermentation with internal CO₂ recycling; cell-free carbon optimized biocatalytic biomass conversion and/or CO₂ use; and cross-cutting carbon-optimized bioconversion methods that have the potential for high-impact emissions reductions.

Awardees include:

LanzaTech Inc. - \$4.16 million: LanzaTech aims to enable direct conversion of CO₂ to ethanol at 100 percent carbon conversion efficiency to products. The company's team will develop a gas fermentation process that leverages renewable hydrogen to capture and fix CO₂ directly into fuels and chemicals.

National Renewable Energy Laboratory - \$2.84 million: NREL is working with Genomatica and DeNora to develop a biorefinery concept that uses electrochemically generated formate as a

universal energy carrier to facilitate a carbon optimized sugar assimilation fermentation to synthesize fatty acid methyl esters (FAME) without release of CO₂.

University of Wisconsin- Madison - \$3.42 million: The university aims to eliminate CO₂ release in the production of chemicals by integrating capabilities of two microorganisms. The first produces acetate from CO₂ and hydrogen, and the second upgrades acetate into higher-value products. CO₂ released during the upgrading process is recycled internally to produce more acetate.

Stanford University: \$2.58 million: The university seeks to replace carbon- and energy-inefficient unit operations for commodity chemical production with cell-free processes. Instead of releasing CO₂ into the atmosphere, the new approach will enable utilization of atmospheric CO₂ and glucose obtained from cornstarch to produce renewable fuels and chemicals.

University of Delaware – \$2.75 million: The university aims to develop a platform technology based on synthetic syntrophic consortia of *Clostridium* microbes to enable fast and efficient use of renewable carbohydrates to produce targeted metabolites as biofuels or chemicals.

University of California, Davis - \$1.57 million: UC Davis will engineer a novel microbial consortium approach to reach new 100 percent carbon conversion efficiency for aviation fuels. The proposed systems will use a heterotrophic production strain to convert sugar substrates into biofuels via a carbon conserving synthetic metabolism and will be co-cultured with a phototrophic strain engineered to be chemotrophic to enable CO₂ utilization and recycle CO₂ released during the sugar fermentation.

INvizyne Technologies Inc. - \$1.66 million: INvizyne will demonstrate the usefulness of a cell-free biocatalytic platform for carbonneutral production of several platform compounds that could be cost-competitive with petrochemicals.

University of California, Irvine - \$1.84 million: UC Irvine aims to develop a cell-free enzymatic process to improve the carbon yield associated with the use of carboxylic acids as biofuel and biochemical feedstock. Carboxylic acids could be produced in large quantities from food and industrial wastes and may serve as a more scalable and economical feedstock for biofuel and biochemical production. If successful, it will be the first biological platform to convert carboxylic acids into a broad range of fuels and commodities with greater than 100 percent carbon efficiency.

The Wyss Institute at Harvard University - \$2.99 million: Harvard University seeks to produce

reduced carbon compounds from gas feedstocks, such as hydrogen, oxygen, carbon monoxide and CO₂.

University of Minnesota – Twin Cities - \$1.11 million: The University of Minnesota will design a cell-free biocatalytic system that will reduce CO₂ efficiently into formate, a C1 feedstock, with energy supplied from electricity. This project aims to develop a robust bioelectrocatalytic technology platform that will deliver a portable CO₂ capture technology and formate as a stand-alone chemical or for integration into longer chain chemical products.

Massachusetts Institute of Technology – \$2.11 million: MIT has engineered the oleaginous yeast *Yarrowia lipolytica* to produce biodiesel-like lipids and alkanes. MIT proposes to reduce or eliminate CO₂ generation during lipid production by engineering *Y. lipolytica* with the enzymes necessary to generate reducing equivalents from hydrogen, formic acid, or methanol, and installing a carbon conserving equivalent to glycolysis, called nonoxidative glycolysis.

Ohio State University: \$1.61 million: The university is designing, modeling, and constructing synthetic microbial consortia consisting of three bacterial species to maximize carbon conversion and butanol production with a 100% theoretical product yield from glucose and zero or negative CO₂ emissions, aided by the addition of electrochemically reduced formate.

ZymoChem Inc. – \$1.05 million: XymoChem has created fermentation processes that convert sugars into polymer precursors using microorganisms with novel enzyme-based pathways that avoid the loss of the sugar's carbon as CO₂. During this project, ZymoChem aims to develop next-generation bioprocesses that combine inexpensive metal catalysts for converting electricity and CO₂ into formate, and electricity-compatible fermentation systems that enable microbes to co-utilize formate and sugars for the production of valuable chemicals.

University of Washington – \$1.66 million: The university aims to develop cell-free platforms that produce functional multi-enzyme systems that will enable the cost-effective bioconversion of CO₂ into industrial chemicals. The team will create a self-assembling system that electrochemically regenerates formate-reducing equivalents in real time and assimilates formate into malate, an industrially relevant di-acid, without carbon loss. The proposed system will capture CO₂ in the process of making malate at a cost competitive with more carbon-intensive microbial bioproduction.

ZymoChem Inc. - \$3.18 million: ZymoChem aims to develop carbon- and energy-efficient

production phases of a bioprocess.

Additional information on the funded projects is available on the ARPA-E website.

Related Stories

DOE announces up to \$23 million to propel renewable chemicals and fuels



BY U.S. DEPARTMENT OF ENERGY

January 14, 2025

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The U.S. Department of Energy Bioenergy Technologies Office (BETO) announced up to \$23 million in funding to support research and development (R&D) of domestic chemicals and fuels from biomass and waste resources.

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DOE issues notice of intent to fund research and development to advance biofuels and bioproducts



BY U.S. DEPARTMENT OF ENERGY

December 20, 2024

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BY ERIN VOEGELE

August 22, 2024

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Sens. Sherrod Brown, D-Ohio, and Pete Ricketts, R-Neb., in August introduced the Renewable Chemicals Act, a bill that aims to create a tax credit to support the production of biobased

ChemCatBio launches survey to learn about community response to new biorefining projects

BY ERIN VOEGELE



May 21, 2024

CHEMICALS BUSINESS POLICY

The Chemical Catalysis for Bioenergy Consortium, a consortium of the U.S. DOE's Bioenergy Technologies Office, has launched an effort that aims to gather community input on the development of new biomass processing facilities.

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USDA celebrates second National Biobased Products Day

**BY USDA**

March 08, 2024

POLICY BUSINESS CHEMICALS

USDA on March 8 celebrated the second annual National Biobased Products Day, a celebration to raise public awareness of biobased products, their benefits and their contributions to the U.S. economy and rural communities.

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Minneapolis, MN

North American SAF Conference & Expo 2026 In

MINNEAPOLIS CONVENTION CENTER | MINNEAPOLIS, MINNESOTA

Serving the Global Sustainable Aviation Fuel Industry Taking place in September, the North American SAF Conference & Expo, produced by SAF Magazine, in collaboration with the Commercial Aviation Alternative Fuels Initiative (CAAFI) will showcase the latest strategies for aviation fuel decarbonization, solutions for key





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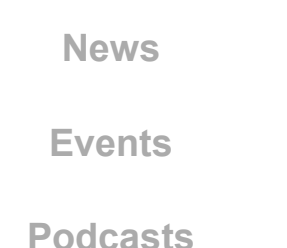

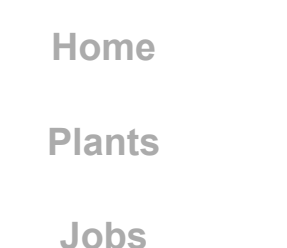
Now in its 19th year, the event will bring together more than 25 countries and industry academics in t


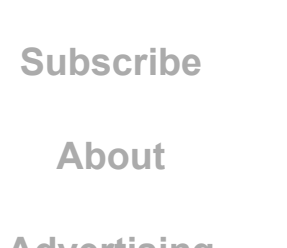

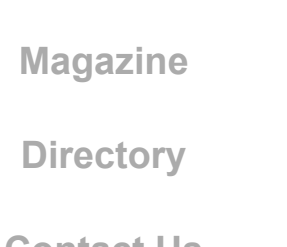
industry challenges, and highlight the current opportunities for airlines, corporations networking opportunities, and fuel producers.[View More](#)

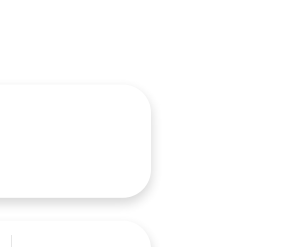
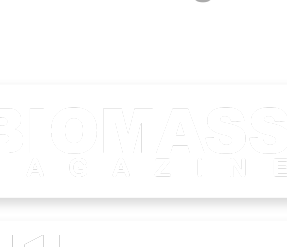
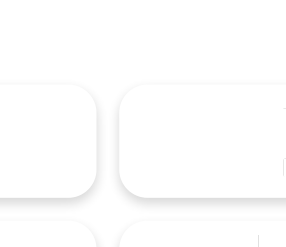
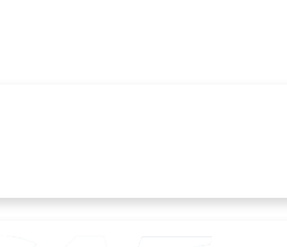
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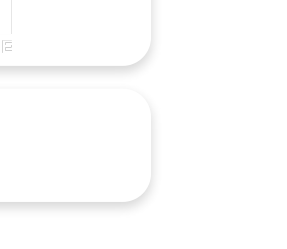

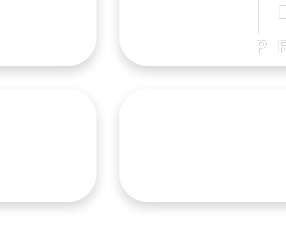
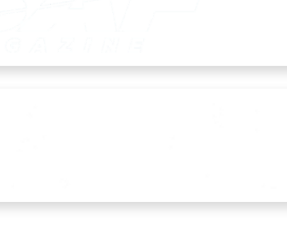
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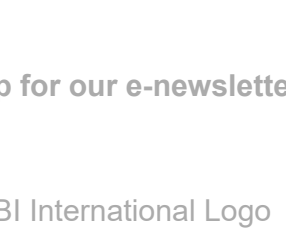
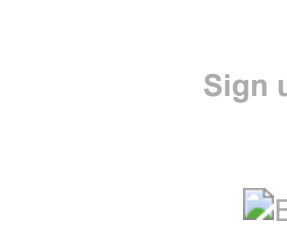


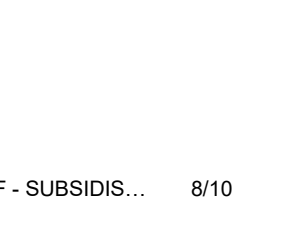
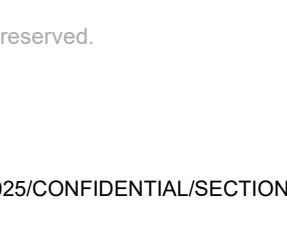
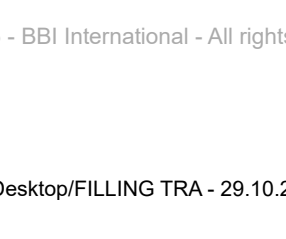




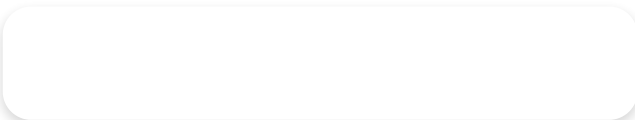




















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