U.S. DEPARTMENT OF
ENERGY

Office of
ENERGY EFFICIENCY &
RENEWABLE ENERGY

Bioenergy Consortia: The Spirit of National Laboratory Collaboration

The U.S. Department of Energy's (DOE's) national laboratories collaborate on cutting-edge research and development (R&D) projects through the use of multi-lab consortia. DOE's Office of Energy Efficiency and Renewable Energy's Bioenergy Technologies Office (BETO) funds bioenergy industry consortia across the United States.

Up to 10 DOE national laboratories participate and collaborate on R&D projects at different consortia:

- Argonne National Laboratory (ANL)
- Idaho National Laboratory (INL)
- Lawrence Berkeley National Laboratory (LBNL)
- Lawrence Livermore National Laboratory (LLNL)
- Los Alamos National Laboratory (LANL)
- National Energy Technology Laboratory (NETL)
- National Renewable Energy Laboratory (NREL)
- Oak Ridge National Laboratory (ORNL)
- Pacific Northwest National Laboratory (PNNL)
- Sandia National Laboratories (SNL)

Bioenergy consortia leverage the unique R&D skills and collaborative spirit of each DOE national laboratory. *Photos by Dennis Schroeder, NREL.*

Each bioenergy consortium is devoted to advancing technologies needed to drive the expansion of sustainable, cost-effective, and scalable fuels and products made from renewable carbon resources.

This overview includes descriptions of each bioenergy consortium and lists their affiliated labs.

Agile BioFoundry Consortium

The Agile BioFoundry is a consortium of seven DOE national laboratories that operate as a distributed biofoundry in collaboration with industry and academia to explore targeted R&D outcomes, accelerate innovation, and adopt new biomanufacturing methods. This work supports BETO's goals to develop sustainable aviation fuels and decarbonize energy-intensive industries through the use of synthetic biology, new microbial host organisms, and market transformation through the transfer of intellectual property and biomanufacturing technologies.

Affiliated Labs:
ANL | LBNL | LANL | NREL | ORNL | PNNL | SNL

Learn more at agilebiofoundry.org.

Algae Technology Educational Consortium

The Algae Foundation launched the Algae Technology Educational Consortium (ATEC) project, recognizing algal production will provide a sustainable source of biomass for bio-based products, feed, fuel and foods creating high quality jobs for an educated workforce. A partnership between academic institutions, national research laboratories, and industry leaders, ATEC's goal is to develop novel educational programs to strengthen industry workforce capabilities, by focusing on the skills needed to support the commercialization of algal products.

Affiliated Lab:
NREL

Learn more at algaefoundationatec.org.

An NREL researcher works on a project for the Co-Optima initiative. *Photo by Dennis Schroeder, NREL.*

Bio-Optimized Technologies to Keep Thermoplastics out of Landfills and the Environment

Supported by both BETO and the DOE Advanced Materials and Manufacturing Technologies Office, Bio-Optimized Technologies to keep Thermoplastics out of Landfills and the Environment (BOTTLE™) is focused on developing strategies for recycling today's plastics and creating tomorrow's plastics to be recyclable by design. BOTTLE's vision is to deliver selective, scalable technologies to enable cost-effective recycling, upcycling, and increased energy efficiency.

Affiliated Labs:
ANL | LANL | NREL | ORNL | SLAC

Learn more at bottle.org.

Bioprocessing Separations Consortium

The Bioprocessing Separations Consortium platform unites the unique abilities of six DOE national laboratories to explore targeted R&D outcomes, such as developing cost-effective, high-performing separations technologies that are coordinated with challenges relevant to industry.

Affiliated Labs:
ANL | LBNL | LANL | NREL | ORNL | PNNL

Learn more at bioesep.org.

Chemical Catalysis for Bioenergy Consortium

The Chemical Catalysis for Bioenergy Consortium (ChemCatBio) unites the unique abilities of seven DOE national laboratories to address challenges related to the catalytic upgrading of intermediates from both high- and low-temperature processes.

ChemCatBio R&D projects accelerate the development of new biofuel catalysts and make improvements to existing catalytic systems.

Affiliated Labs:
ANL | LANL | NETL | NREL | ORNL | PNNL | SNL

Learn more at chemcatbio.org.

CO_2 Reduction and Upgrading for E-Fuels Consortium (CO_2RUe)

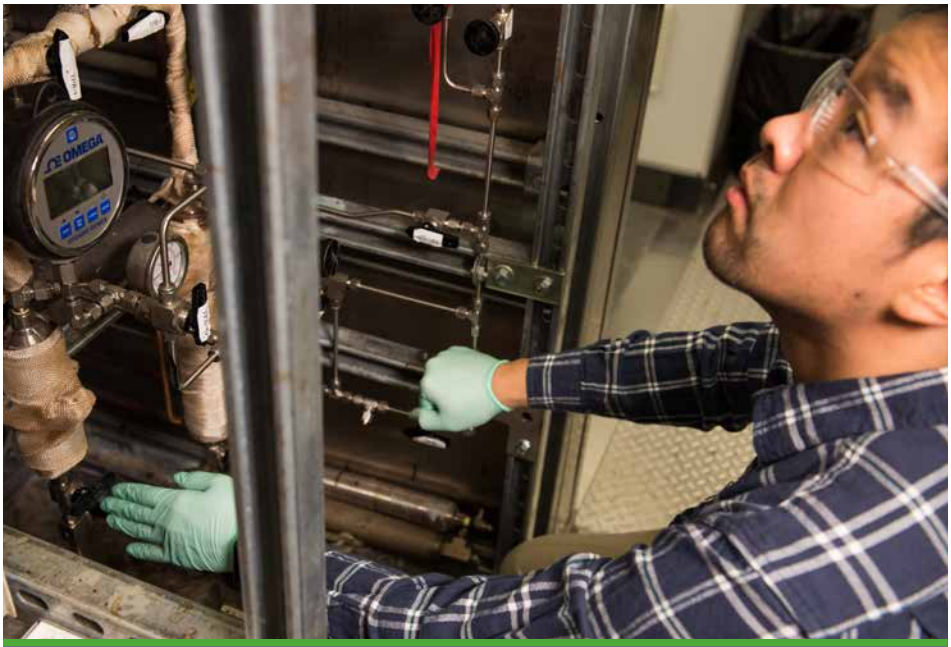
The CO_2RUe Consortium develops and derisks advanced technologies that use renewable electricity to convert carbon dioxide into electrofuels - or e-fuels - and commodity chemicals. CO_2RUe is working towards using renewable electricity to convert waste CO_2 from biorefineries and industrial sites across the United States into climate-friendly e-fuels, which has a dramatically lower carbon footprint compared to fossil fuels.

Affiliated Labs:
ANL | LBNL | LLNL | NREL | ORNL

Learn more at energy.gov/eere/bioenergy/co2-reduction-and-upgrading-e-fuels-consortium.

Consortium for Computational Physics and Chemistry

The Consortium for Computational Physics and Chemistry (CCPC) platform unites the unique abilities of five DOE national laboratories to explore



In an ongoing partnership with LanzaTech, PNNL is working to convert waste gases, such as carbon monoxide from steel mills, into jet fuel. *Photo by Andrea Starr, PNNL.*

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state-of-the-art computational modeling of fundamental physical and chemical processes.

New fundamental insight and models developed by the CCPC will accelerate R&D and aid in the design of advanced catalysts, enzyme systems, and reactors.

Affiliated Labs:
ANL | NETL | NREL | ORNL | PNNL

Learn more at cpcbiomass.org.

DISCOVR Consortium

The DISCOVR (Development of Integrated Screening, Cultivar Optimization, and Verification Research) consortium enhances algae productivity through screening of promising algae strains and implementation of effective cultivation strategies to accelerate the development of algal biofuels and bioproducts.

Affiliated Labs:
LANL | NREL | PNNL | SNL

Learn more at discovr.labworks.org.

Feedstock-Conversion Interface Consortium

Researchers in the Feedstock-Conversion Interface Consortium (FCIC), funded through September 2024, conducted research to quantify, understand, and manage biomass variability from the field to downstream conversion. The consortium sought to understand how feedstock composition, structure, and behavior impact overall biorefinery performance.

Affiliated Labs:
ANL | INL | LBNL | LANL | NETL | NREL | ORNL | PNNL | SNL

Learn more at energy.gov/fcic.

Co-Optimization of Fuels & Engines Initiative

The Co-Optimization of Fuels & Engines (Co-Optima) initiative, jointly funded by BETO and the Vehicle Technologies Office from fiscal years 2015 to 2021, worked to advance the underlying science needed to develop fuel and engine technologies that will work in tandem to achieve significant efficiency and emissions benefits.

Co-Optima focused on identifying and developing new high-performance biofuel blendstocks that can increase energy affordability and diversify fuel options, while reducing life cycle emissions from the transportation sector and improving the value proposition for bio-based fuels.

Affiliated Labs:
ANL | INL | LBNL | LLNL | LANL | NREL | ORNL | PNNL | SNL

Learn more at energy.gov/fuel-engine-co-optimization.

Examples of ongoing bioenergy consortia R&D at DOE national laboratories:

- **Argonne National Laboratory** performs X-ray absorption spectroscopy characterization using the lab's Advanced Photon Source to identify changes in the overall coordination environment and oxidation states in a catalyst under working conditions.
- **Idaho National Laboratory** develops tools to quantify and understand ranges and sources of feedstock variability from molecular to bulk scale. Researchers quantify the extent of variability as a function of biomass storage, harvesting, and as a result of environmental factors (e.g., drought).
- **Lawrence Berkeley National Laboratory** develops machine learning algorithms and integrates automated infrastructure to create more effective Design-Build-Test-Learn cycles, leading to more effective R&D.
- **National Renewable Energy Laboratory** accelerates development of electrochemical CO_2 conversion technologies by developing scalable methodologies to prepare tailored nanoparticle catalysts to enable production of fuels and chemicals through electrocatalytic conversion of CO_2.
- **Oak Ridge National Laboratory** worked on a multiscale simulation that incorporated biomass particle properties, reaction kinetics, and fluid dynamics to predict net bio-oil yields at the reactor scale, generating results in line with experimental observations.
- **Los Alamos National Laboratory** designs and validates cells that work as biosensors to target and produce molecules of interest, such as muconic acid, which is a building block for bioplastics.
- **Pacific Northwest National Laboratory** is developing separation methods to remove nitrogen from wastewater sludge hydrothermal liquefaction biocrudes. Nitrogen removal ensures that subsequent processing steps can be run under milder conditions, resulting in reduced costs for producing renewable fuels.
- **Sandia National Laboratories** study how algal performance deteriorates when exposed to pests and predators under bio-contained, climate-controlled systems at the laboratory to 1,000 liter scales.

Researchers operate a catalytic fast pyrolysis reactor system used to produce bio-oil.
Photo by Dennis Schroeder, NREL.

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For more information, visit:
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