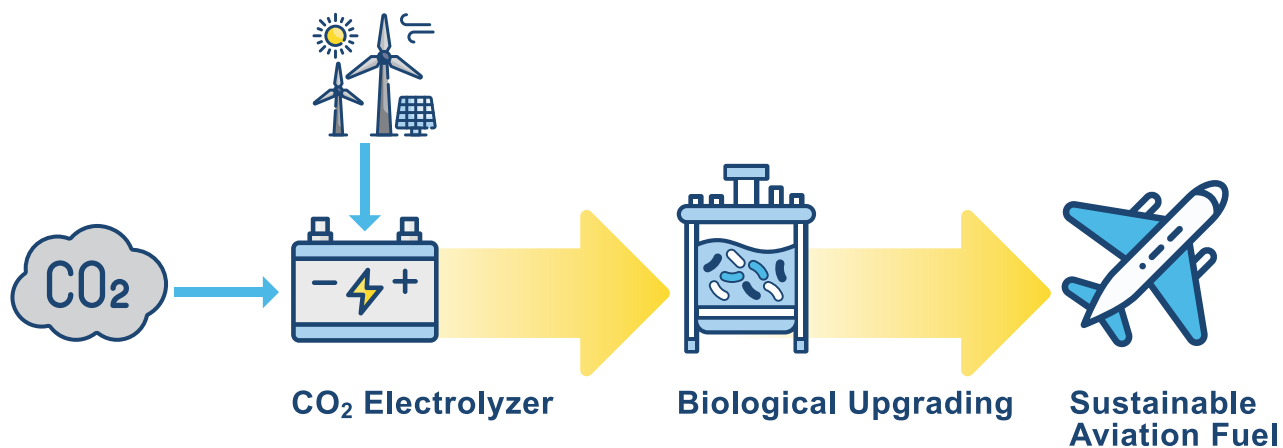


CO₂ Reduction and Upgrading for e-Fuels Consortium



An example process of how waste CO₂ from ethanol fermentation can be upgraded to sustainable aviation fuel. Image from the National Renewable Energy Laboratory (NREL).

Developing and De-Risking Technologies To Convert Waste Carbon Dioxide Into Fuels and Chemicals

The CO₂ Reduction and Upgrading for e-Fuels Consortium (CO₂RUE) is a collaboration of industry advisors and five national laboratories funded by the U.S. Department of Energy (DOE) Bioenergy Technologies Office.

CO₂RUE develops an integrated portfolio of technologies that use renewable electricity, catalysts, and microorganisms to upgrade waste carbon dioxide (CO₂) into e-fuels (a shorthand for electrofuels) and commodity chemicals.

CO₂RUE Approach

Millions of tons of waste CO₂ are emitted annually from biorefineries and industrial sites across the United States. CO₂RUE is focused on applying renewable electricity

to convert waste CO₂ into climate-friendly e-fuels and chemicals, which have dramatically lower land, water, and greenhouse gas (GHG) emission footprints compared to fossil fuels.

By implementing these methods, the consortium advances solutions for decarbonizing key economic sectors, such

as aviation, marine, chemical manufacturing, and heavy industry.

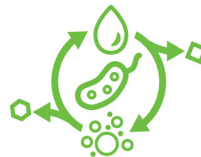
CO₂RUE Research Areas

CO₂RUE organizes its research and development (R&D) into three areas to lower technical and economic barriers to commercial-scale CO₂ reduction and upgrading technologies.



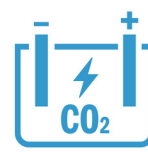
Analysis and Modeling

Understand how CO₂ conversion technologies might save water, reduce GHG emissions, and unlock social and economic opportunity.



Biological Upgrading

Research biological technology to upgrade carbon monoxide, hydrogen, and formate into chemical intermediates.



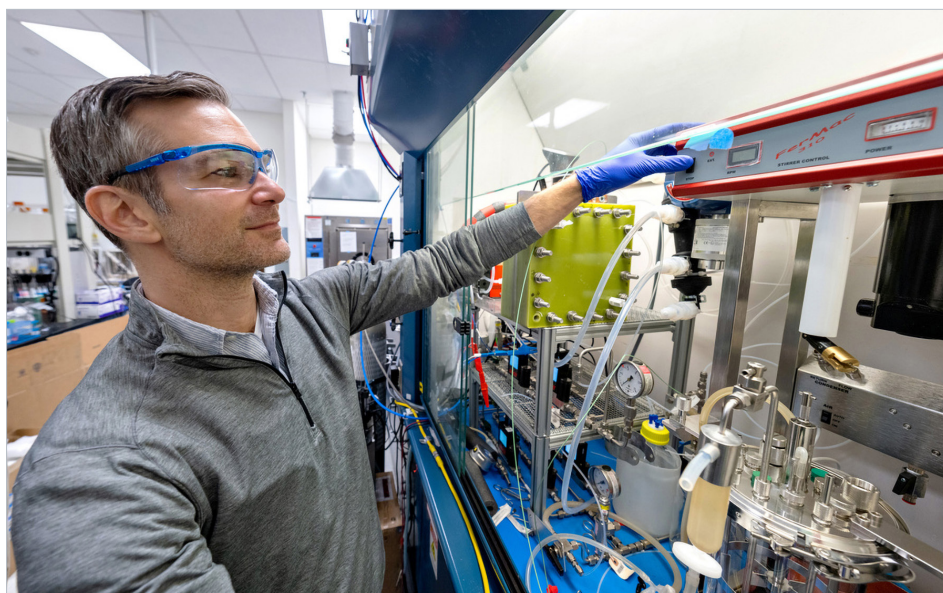
CO₂ Electrolysis

Study CO₂ electrolysis technology to improve the design, efficiency, and effectiveness of electrochemical conversion technologies.

CO₂RUE Goals

With support from industry, academia, and DOE national laboratories, CO₂RUE developed the following goals to guide this research:

- Support the Sustainable Aviation Fuel Grand Challenge goal of supplying 3 billion gallons of cost-competitive sustainable aviation fuel by 2030 and 35 billion gallons by 2050.
- Provide a strategic R&D vision for CO₂-to-fuels efforts and an integrated portfolio of relevant technologies.
- Enable CO₂ chemical production strategies capable of reducing 70% of GHG emissions.
- Enable efficient CO₂ conversion to intermediate streams via renewable electricity.
- Develop strategies for converting one-carbon (C₁) and two-carbon (C₂) intermediates to fuels and chemicals.
- Incentivize waste CO₂ utilization to increase carbon efficiency in the bioeconomy.
- De-risk technologies toward piloting and eventual commercialization.



A CO₂RUE molecular biologist works with an electrolyzer and fermentation reactor.
Photo by Werner Slocum, NREL.

- Develop project target metrics based on techno-economic analysis and life cycle assessment.

National Laboratories and Capabilities in CO₂RUE

The following DOE national laboratory capabilities are employed to reduce and upgrade waste CO₂ to e-fuels and commodity chemicals.



Learn More About CO₂RUE

Learn more about the CO₂ Reduction and Upgrading for e-Fuels Consortium, its partners, and its impact on the bioeconomy at www.energy.gov/eere/bioenergy/co2-reduction-and-upgrading-e-fuels-consortium.

For any inquiries about the consortium or how you can get involved please contact:

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For more information, visit: energy.gov/eere/bioenergy

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