Federal Energy R&D: Bioenergy Technologies

BY COLIN CUNLIFF | APRIL 2019

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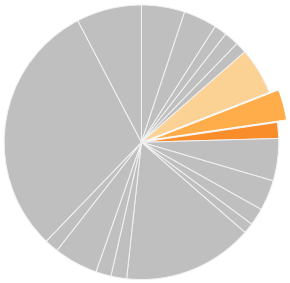
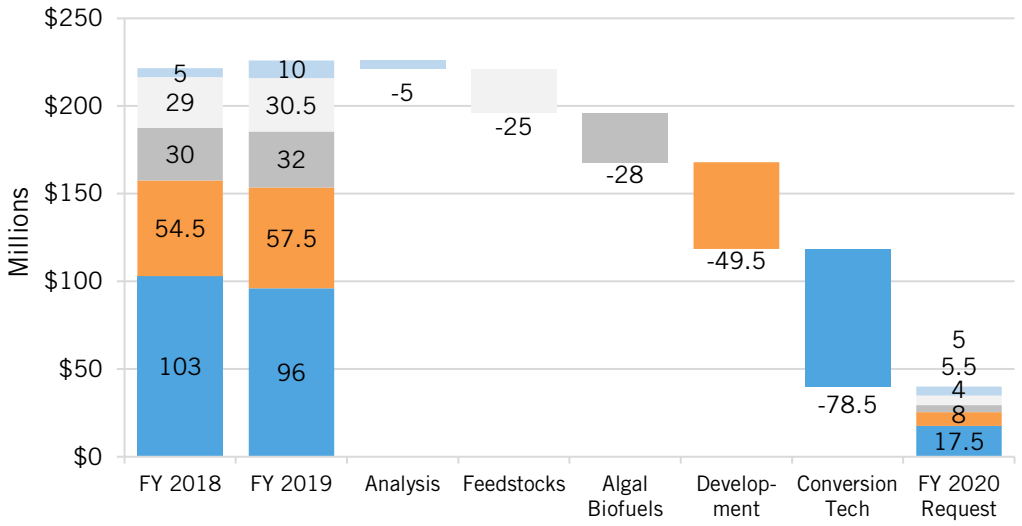


Bioenergy (orange)
Other Transportation (orange)
Energy R&D (light grey)

The Department of Energy's (DOE) Bioenergy Technologies Program (BETO) focuses on R&D to develop sustainable bioenergy technologies capable of producing price-competitive biofuels from nonfood sources of biomass such as wastes and agricultural residues, and energy crops like switchgrass and algae. The program's primary focus is on R&D to produce "drop-in" biofuels that are compatible with existing fueling infrastructure and vehicles across a range of transportation modes, including renewable gasoline, diesel, and jet fuels.[1]

Figure 1: The FY 2020 Budget Request Would Cut Bioenergy technologies R&D by 82 Percent[2]



What's At Risk

The United States has the resource potential to sustainably produce 1 billion dry tons of nonfood biomass resources by 2030 without disrupting agricultural markets for food and animal feed.[3] These resources could produce approximately 50 billion gallons of biofuels (25 percent of U.S. transportation fuels), 50 billion pounds of high-value chemicals and products, and 75 billion kWh of electricity (enough to power 7 million homes).[4] Algal biomass is an important kind of biomass due to its ability to grow quickly, use waste resources, and produce fuel precursors. Algal biofuels could potentially contribute up to 5 billion gallons per year—about 25 percent of the current jet-fuel market—by 2030.[5] And a number of bioenergy pathways, combined with carbon sequestration technologies, offer the potential to permanently remove carbon dioxide from the atmosphere and, resulting in net-negative emissions.[6]

Each of the bioenergy production and conversion targets within BETO was chosen to create new technology options that are more efficient than, and at least as affordable as, conventional technology. Achieving these targets will both improve transportation-energy affordability and take the United States one step closer to reaching its national goals in energy security, economic growth, and environmental stewardship. However, reductions in DOE R&D funding threaten to delay or even derail this progress.

Bioenergy Technologies R&D Subprograms

R&D in the Bioenergy program is distributed across these five subprograms:[7]

- **Feedstock Supply and Logistics** develops and improves strategies, technologies, and systems to provide consistent quality feedstock to biorefineries, while focusing on supply and logistics challenges to support further development of advanced biofuels. The Feedstock subprogram funds the Biomass Feedstock National User Facility at Idaho National Laboratory (INL), as well as the Feedstock Conversion Interface Consortium (FCIC), a consortium of eight national laboratories focused on feedstock handling, preprocessing, and conversion opportunities to reduce biofuel selling price.

- **Advanced Algal Systems** supports R&D of algal-biomass production and logistics systems, with a focus on improving capabilities to predict, breed, and select the best-performing algal strains, harvest algae at high-throughputs, and extract and convert algal biomass components into fuels.

- **Conversion Technologies** R&D focuses on converting biomass feedstocks into "drop-in" transportation fuels and co-produced bioproducts and explores both biological and thermochemical conversion pathways.

- **Advanced Development and Optimization (ADO)** collaborates with the Vehicle Technologies program on the Co-Optimization of Fuels & Engines (Co-Optima) initiative to develop biofuels and engines that are co-optimized to enable higher efficiency and performance.

- **Strategic Analysis and Cross-cutting Sustainability** provides quantitative analysis to inform BETO decisions regarding the future direction and scope of its R&D portfolio.

Key Elements of the FY 2020 Budget Proposal

- **An 86-percent reduction in the Advanced Development and Optimization R&D**, including discontinuation of all demonstration-scale biorefinery projects, as well as a discontinuation of research and testing of wood heaters, renewable energy production from urban and suburban wastes, and co-processing of biofuel intermediates in petroleum refineries. Funding for Co-Optimization of Fuels and Engines (Co-Optima) and systems R&D would be greatly reduced.

- **An 88-percent reduction in Advanced Algal Systems**, including a discontinuation of funding to capture CO_2 directly from the atmosphere, and substantial reductions in funding for algae research at DOE national labs such as the Development of Integrated Screening, Cultivar Optimization, and Validation Research (DISCOVR), a consortium of four national laboratories that focuses on increasing algal productivity and resilience.

- **An 82-percent reduction in Conversion Technologies R&D,** including substantial funding reductions for the three national lab consortia: the Agile BioFoundry, the Chemical Catalysis for Bioenergy (ChemCatBio) consortium, and the Bioprocessing Separations consortium. Funding for the research, development and testing of bio-derived products, automation systems for bioreactors, lignin valorization, and conversion of wet wastes to liquid fuels and renewable natural gas would also be reduced, and no funding would be provided for competitive solicitations for research with industry and academia.

- **A 78-percent reduction in Feedstock Supply and Logistics R&D,** including the elimination of funding for facility upgrades at the INL Biomass Feedstock National User Facility and no new competitive funding opportunities for biomass feedstock research. Funding for the FCIC and other national lab research to improve feedstock handling, preprocessing, and conversion, as well as harvest logistics and biomass densification, would be greatly reduced.

- **A 45-percent reduction in Strategic Analysis and Crosscutting Sustainability R&D**, including the elimination of funding for bioenergy sustainability research that addresses knowledge gaps related to food security, air, land, and water resources.

ENDNOTES

1. DOE, "FY 2020 Congressional Budget Justification" Volume 3 Part 2, 51 (DOE Chief Financial Officer DOE/CF-0153, April 2019), https://www.energy.gov/sites/prod/files/2019/04/f61/doe-fy2020-budget-volume-3-part-2_0.pdf.
2. The FY2020 budget for EERE would use $353 million in prior year (FY 2018 and FY 2019) balances to fund FY2020 programs. Thus the numbers shown in the figure underestimate the magnitude of cuts included in the proposed budget. Department of Energy, "FY 2020 Congressional Budget Request: Budget in Brief," (DOE CFO, March 2019), p 3, https://www.energy.gov/sites/prod/files/2019/03/f60/doe-fy2020-budget-in-brief.pdf; DOE, "FY 2020 Congressional Budget Justification" Volume 3 Part 2, 54.
3. DOE, "U.S. Billion Ton Report," (Washington, D.C.: DOE, 2016), https://energy.gov/sites/prod/files/2016/12/f34/2016_billion_ton_report_12.2.16_0.pdf.
4. DOE, "FY 2020 Congressional Budget Justification" Volume 3 Part 2, 51.
5. Ryan Davis, et al., "Renewable Diesel from Algal Lipids: An Integrated Baseline for Cost, Emissions, and Resource Potential from a Harmonized Model," Argonne National Laboratory, ANL/ESDA/12-4 (2012), http://greet.es.anl.gov/publication-algae-harmonization-2012.

6. Daniel L. Sanchez et al., "Chapter 5: Hybrid Biological and Engineered Solutions," in *Building a New Carbon Economy: An Innovation Plan* (Carbon180 and the New Carbon Economy Consortium) https://carbon180.org/s/ccr02innovationplanFNL.pdf; and Colin Cunliff, "An Innovation Agenda for Deep Decarbonization: Bridging Gaps in the Federal Energy RD&D Portfolio" 40-43 (Information Technology and Innovation Foundation, November 2018), http://www2.itif.org/2018-innovation-agenda-decarbonization.pdf.
7. DOE, "FY 2020 Congressional Budget Justification" Volume 3 Part 2, 51-66.

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