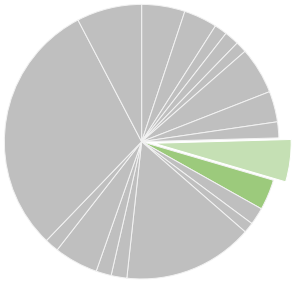
Federal Energy R&D: Advanced Manufacturing

BY COLIN CUNLIFF AND BATT ODGEREL | MARCH 2020

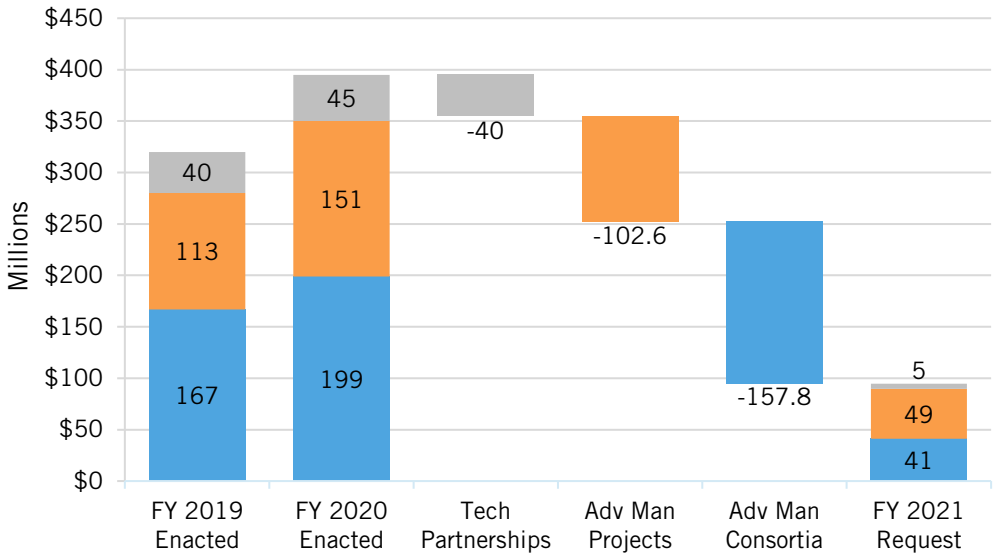
This briefing is part of a series on the U.S. energy budget. See: itif.org/energy-budget.



Manufacturing (light green)
Other Efficiency (green)
Energy R&D (light gray)

The Department of Energy's (DOE) Advanced Manufacturing Office (AMO) works to improve the energy efficiency and productivity of U.S. manufacturers by focusing research and development (R&D) on cross-cutting platform technologies relevant to manufacturing in multiple fields. A key goal is to ensure new energy technologies invented in the United States are also manufactured in the United States. AMO supports R&D through competitive funding opportunities designed to develop novel manufacturing technologies.[1]

Figure 1: The FY 2021 budget request would cut advanced manufacturing R&D by 76 percent[2]



What's at Risk

Employing over 12 million people across the nation, manufacturing plays an outsize role in the health of the U.S. economy because of both its impact on trade and innovation, and its large multiplier effect on other sectors. Accelerated innovation in both industrial processes that use energy and manufactured products used by the energy industry would strengthen U.S. manufacturing and hasten progress toward national economic, workforce, security, and climate goals. Market failures, however, lead to many gaps in the private-sector response to the manufacturing and climate innovation imperative, and have led to significant supply-chain weaknesses, regional hollowing out, and underinvestment in workforce education and training.

AMO helps address such market failures in several ways, with the goal of improving the energy productivity of U.S. manufacturing, reducing lifecycle energy and resource impacts of manufactured goods, and transitioning DOE-supported technologies and practices into U.S. manufacturing. Together, these efforts assist manufacturers in cutting energy costs, which has already been an important driver in the "reshoring" of manufacturing to the United States over the past decade.[3]

The Clean Energy Manufacturing Innovation (CEMI) Institutes are central to AMO's efforts to accelerate innovation in key technology areas: wide band-gap semiconductor manufacturing; carbon-fiber composite manufacturing; smart manufacturing; chemical process intensification; and sustainable manufacturing—with plans for a sixth institute in cybersecurity underway. The institutes were originally funded at $14 million per year for 5 years, with a requirement of at least a 50/50 cost-share from private-sector partners. DOE has adopted a five-year window for CEMI institutes to transition to other funding sources; however, comparable programs in other countries receive core institutional funding from the government on a permanent basis. ITIF has previously recommended that DOE provide ongoing funding, contingent on continued industry participation, beyond the initial five-year window.[4]

AMO has primarily focused on reducing the energy intensity of manufacturing. The Information Technology and Information Foundation (ITIF) and other research organizations have recommended expanding the mandate of AMO to include decarbonization of the industrial sector, which comprises about a quarter of global emissions, including many of the most difficult-to-decarbonize sources.[5] In the FY 2020 budget cycle, the Senate directed AMO to develop a series of sector-specific decarbonization roadmaps to guide R&D activities across DOE.[6] While encouraging, such a refocusing should be accompanied by a significant scale-up in funding—the industrial sector accounts for 22 percent of direct U.S. greenhouse gas emissions, but AMO accounts for only 6 percent of DOE's total applied energy research investments.[7]

Advanced Manufacturing R&D Subprograms

Unlike other DOE technology programs structured around technical focus areas, AMO subprograms are structured around modes of program implementation: individual R&D projects, collaborative R&D consortia, and technology partnerships.[8]

- **R&D Projects** focus on high-impact manufacturing technology and process challenges in areas such as advanced materials manufacturing for energy applications, improved energy-efficient process technologies, high-performance computing for manufacturing, additive manufacturing processes, roll-to-roll processing, wide bandgap power electronics, chemical and thermal process intensification, and structures used in extreme environments.

- **R&D Consortia** bring together manufacturers, research institutions, suppliers, and universities in public-private R&D partnerships, each of which focuses on a specific set of challenges at the nexus of manufacturing and energy. AMO

consortia include the Manufacturing Demonstration Facility (MDF), which focuses on advanced manufacturing technologies to reduce energy and production costs; the Carbon Fiber Test Facility (CFTF); six CEMI institutes that focus on clean energy technologies; the Energy-Water Desalination Hub; and the Critical Materials Hub.[9]

- **Technical Partnerships** help small and medium-sized manufacturers improve their energy productivity and reduce waste and water use; demonstrate the viability of improved energy-management approaches; and promote combined heat and power and waste heat to power technologies to improve efficiencies and lower energy costs.

Key Elements of the FY 2021 Budget Proposal

- **Elimination of the CEMIs**, which could stall progress in key manufacturing challenges and put domestic manufacturers at a disadvantage to international competitors.

- **A 79 percent reduction in R&D Consortia**, including termination of the CEMIs, the Energy-Water Desalination Hub, and the Critical Materials Institute; reduced funding for the Oak Ridge MDF and CFTF; no funding for additive manufacturing nanocellulosic feedstock materials; and reduced funding for consortia led by universities and National Laboratories.

- **A 68 percent reduction in R&D Projects**, with a $91 million cut to manufacturing process R&D, including no funding for enhanced drying, wastewater, and chemical processes; reduced funding for the High-Performance Computing for Manufacturing (HPC4MFG) projects; and a $9 million cut to advanced energy storage research, including reduced funding for R&D on lithium ion-based battery manufacturing.

- **Elimination of 31 Industrial Assessment Centers and the Combined Heat-and-Power Technical Assistance Partnerships,** which provide technical assistance to small and medium-sized manufacturers to improve their energy productivity and reduce energy costs. Overall funding for the Technical Partnerships program would decline by 89 percent.

ENDNOTES

1. U.S. Department of Energy (DOE), "FY 2021 Congressional Budget Justification," Volume 3 Part 1, 161–162 (DOE Chief Financial Officer DOE/CF-0163, February 2020), https://www.energy.gov/sites/prod/files/2020/02/f72/doe-fy2021-budget-volume-3-part-1_1.pdf.
2. DOE, "FY 2021 Congressional Budget Justification," Volume 3 Part 1, 163.

3. Stephen Ezell, Robert Atkinson, and David M. Hart, "ITIF Comments Responding to Administration RFI for National Strategic Plan for Advanced Manufacturing" (Information Technology and Innovation Foundation, 2018), http://www2.itif.org/2018-comments-national-strategic-plan-advanced-manufacturing.pdf.
4. David M. Hart and Peter L. Singer, "Manufacturing USA at DOE: Supporting Energy Innovation" (Information Technology and Innovation Foundation, 2018), https://itif.org/publications/2018/05/16/manufacturing-usa-doe-supporting-energy-innovation.
5. Colin Cunliff et al., "Comments to the House Select Committee on the Climate Crisis" (Information Technology and Innovation Foundation, 2019), https://itif.org/publications/2019/11/22/comments-house-select-committee-climate-crisis.
6. S. Rept. 116-102, Energy and Water Development Appropriations Bill 2020, to accompany S. 2470, 86, https://www.appropriations.senate.gov/imo/media/doc/FY2020%20Energy%20and%20Water%20Development%20Appropriations%20Act,%20Report%20116-1021.pdf.
7. U.S. Environmental Protection Agency (EPA), "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2017" (EPA, 2019), https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2017; Colin Cunliff, "Senate Appropriations: Where the Rubber Meets the Road for Energy Innovation" (Information Technology and Innovation Foundation, 2019) , Table 1, https://itif.org/publications/2019/09/03/senate-appropriationswhere-rubber-meets-road-energy-innovation.
8. DOE, "FY 2021 Congressional Budget Justification," Volume 3 Part 1, 161–173.
9. The Manufacturing USA initiative refers to a network of 15 manufacturing institutes sponsored by the Department of Defense, the National Institutes of Standards and Technology, and DOE. The six Manufacturing USA institutes hosted by DOE are commonly called CEMI institutes.

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The Information Technology and Innovation Foundation (ITIF) is a nonprofit, nonpartisan research and educational institute focusing on the intersection of technological innovation and public policy. Recognized as the world's leading science and technology think tank, ITIF's mission is to formulate and promote policy solutions that accelerate innovation and boost productivity to spur growth, opportunity, and progress.

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