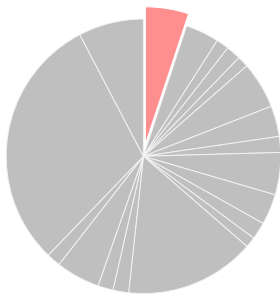




Federal Energy R&D: ARPA-E

BY COLIN CUNLIFF | APRIL 2019

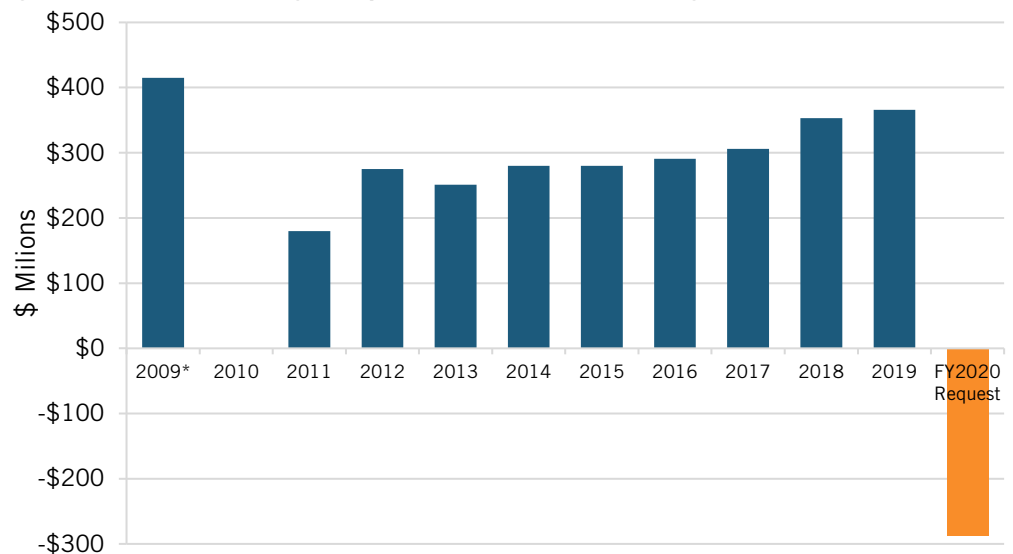
This briefing is part of a series on the U.S. energy budget. See: itif.org/energy-budget.



ARPA-E (pink)
Energy R&D (light grey)

Modeled after the highly successful Defense Advanced Research Projects Agency (DARPA), the Advanced Research Projects Agency-Energy (ARPA-E) advances high-potential, high-impact energy technologies that could radically improve U.S. economic prosperity, national security, and environmental well-being, but are too early for private-sector investment. Its grants help fund energy innovators who are developing technologies to solve critical cross-cutting, real-world problems in transportation, electricity, building, and other sectors.

Figure 1: The FY 2020 Budget Request Would Eliminate Funding for ARPA-E.¹



What's At Risk

Created by Congress in 2007, and funded for the first time in 2009, ARPA-E is an important new institution that has proven to be a valuable and versatile catalyst of energy innovation.² Compared with traditional R&D programs, ARPA-E was designed to focus more on the potential impact of the research that it funds. To qualify for ARPA-E funding, each program must explain how its success will change the global energy landscape, identify the key barriers to making such a change, and lay out a set of milestones and metrics for assessing progress.

ARPA-E's high-risk/high-reward ventures are already yielding big returns. As of February 2018, 74 ARPA-E projects had attracted more than \$2.6 billion in private-sector follow-on funding; 71 ARPA-E project teams had formed new companies to advance their technologies; and 109 ARPA-E projects had partnered with other government agencies for further development. Moreover, ARPA-E projects have generated 1,634 peer-reviewed journal articles, along with 248 new patents.³ According to a recent ITIF analysis, on average, firms funded by ARPA-E raise more private capital than other clean-energy start-up firms.⁴ The FY 2020 budget's proposed elimination of ARPA-E would therefore significantly undermine federal efforts to tackle urgent problems of energy supply, management, and use—and eliminate an important source of institutional innovation within DOE.

ARPA-E R&D Programs and Projects

ARPA-E funds are not bound by the technology-specific silos of DOE's applied-energy offices. Rather, ARPA-E's programs are developed by technical experts drawn from industry and academia who, during their three- or four-year terms as program managers, engage intensively with communities of researchers and innovators to create targeted, time-limited programs that seek to fill the "white space" of underexplored but potentially great ideas. In addition, ARPA-E holds open competitions every three years to bring to light promising ideas that might otherwise slip through the cracks between energy R&D programs.

ARPA-E currently funds 261 projects across 38 active programs, which are broadly organized into four areas: electricity generation, efficiency and emissions, transportation and storage, and grid and grid storage.⁵ These projects provide a sense of ARPA-E's accomplishments:

- Primus Power, which sells zinc bromide flow batteries, was named one of the prestigious 2019 Global Cleantech 100 companies and has raised almost \$100 million in equity investment. It recently upgraded its system deployed as part of a microgrid at Marine Corps Air Station Miramar and was reported to have some 7 megawatts of firm orders.⁶
- Foro Energy has developed a unique system for transmitting high-power laser light over long distances via fiber-optic cables for the purpose of ablating or welding materials. Potentially 10 times more economical than conventional hard-rock-drilling technologies, these "laser-assisted drill bits" could provide an effective way to gain access to the U.S. energy resources currently locked under hard-rock formations.⁷
- An ARPA-E-funded research team lead by Clemson University in South Carolina is developing resilient sorghum varieties that will be optimized for energy biomass production on land in the Southeast not suitable for food production.⁸

Key Elements of the FY 2020 Budget Proposal

ARPA-E would be completely eliminated. Additionally, the budget would rescind \$287 million of previously appropriated funding, taking advantage of the fact that ARPA-E has been slow to spend funds appropriated by Congress for FY 2018 and FY 2019. The Government Accountability Office found that the Trump administration had deliberately and unlawfully withheld ARPA-E from spending its FY 2017 appropriation, and this pattern may have been repeated in the last two years.⁹ The Natural Resources Defense Council (NRDC) found that, as of December 10, 2018—more than two months after the end of fiscal year 2018—ARPA-E had been unable to spend some \$280 million (79 percent) of its \$353 million FY 2018 research budget, and had not even begun to spend its FY 2019 RD&D budget.¹⁰

ENDNOTES

1. In 2009, ARPA-E received \$15 million in regular appropriations and \$400 million in one-time funding pursuant to the American Recovery and Reinvestment Act. The FY 2020 budget proposes eliminating ARPA-E and rescinding \$287 million in previously-appropriated funding. Department of Energy, “FY 2020 Congressional Budget Request: Budget in Brief,” (DOE CFO, March 2019), p 10, <https://www.energy.gov/sites/prod/files/2019/03/f60/doe-fy2020-budget-in-brief.pdf>.
2. David M. Hart and Michael Kearney, “ARPA-E: Versatile Catalyst for U.S. Energy Innovation” (Washington, D.C.: Information Technology and Innovation Foundation, November 2017), <http://www2.itif.org/2017-arpae-energy-innovation.pdf>.
3. ARPA-E, “ARPA-E Impact,” <https://arpa-e.energy.gov/?q=site-page/arpa-e-impact>, accessed March 19, 2019; see also National Academies of Science, Engineering and Medicine (NASEM), Committee on Evaluation of the Advanced Research Projects Agency-Energy (ARPA-E), Board on Science, Technology, and Economic Policy, “An Assessment of ARPA-E” (Washington, D.C.: National Academies Press, 2017).
4. Hart and Kearney, “ARPA-E: Versatile Catalyst for U.S. Energy Innovation.”
5. ARPA-E, accessed March 19, 2019, <https://arpa-e.energy.gov/?q=program-listing>.
6. Cleantech Group, “Global Cleantech 100: Leading Companies and Themes in Sustainable Innovation,” (CleanTech Group, 2019), <https://i3connect.com/gct100/the-list>; Julian Spector, “The Great Flow Battery Roundup of 2019,” GTM Squared, January 25, 2019, <https://www.greentechmedia.com/squared/storage-plus/the-great-flow-battery-roundup-of-2019?checkout#checkout>.
7. National Academies of Science, Engineering and Medicine (NASEM), Committee on Evaluation of the Advanced Research Projects Agency-Energy (ARPA-E), Board on Science, Technology, and Economic Policy, “An Assessment of ARPA-E” (Washington, D.C.: National Academies Press, 2017) C-18.
8. “ARPA-E Impacts: A Sampling of Project Outcomes, Volume III,” Ed. By Yanzhi Ann Xu, (ARPA-E, 2018), p 41, <https://arpa-e.energy.gov/sites/default/files/documents/files/ARPA-E-Impact-Book-Volume-3-Final-May10.pdf>.
9. U.S. Government Accountability Office (GAO), “Impoundment of the Advanced Research Projects Agency-Energy Appropriation Resulting from Legislative Proposals in the President’s Budget Request for Fiscal Year 2018,” (GAO, December 12, 2017), <https://www.gao.gov/products/B-329092>.
10. Jackie Wong and Madhur Bloor, “DOE Stalls Clean Energy R&D: Risking Jobs & Competitiveness,” (Natural Resources Defense Council, December 10, 2018), <https://www.nrdc.org/experts/jackie-wong/doe-stalls-clean-energy-rd-risking-jobs-competitiveness>.

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