



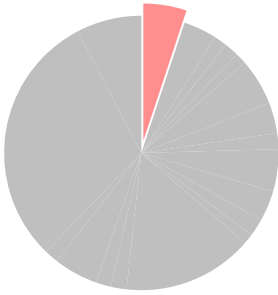
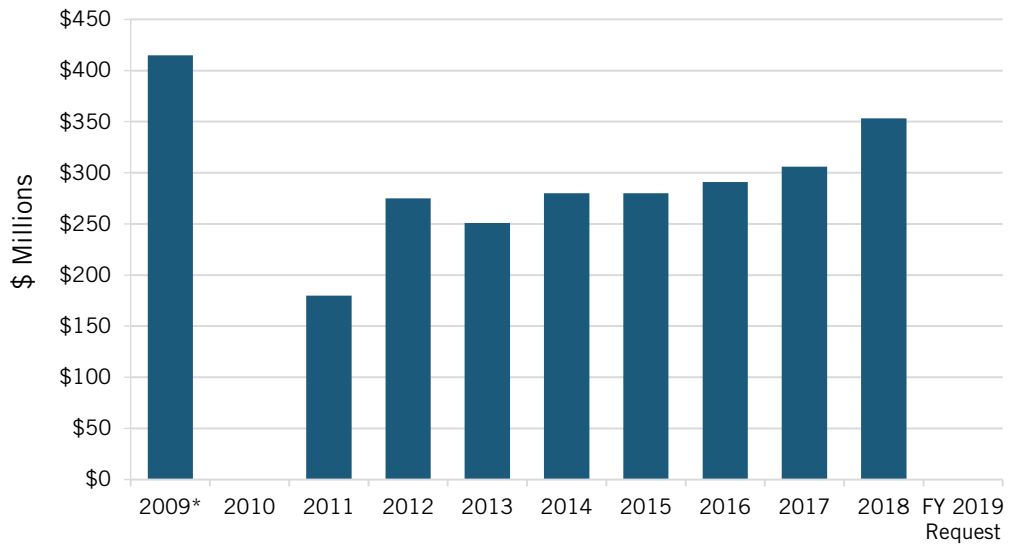
Federal Energy R&D: ARPA-E

BY DAVID M. HART AND COLIN CUNLIFF | APRIL 2018

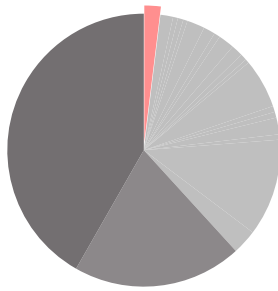
This briefing is part of a series on the U.S. energy budget. See: itif.org/energy-budget.

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.

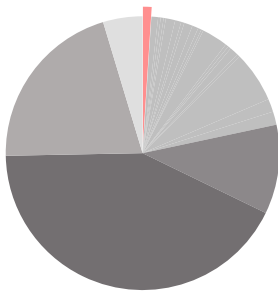
Figure 1: The FY 2019 Budget Request Would Eliminate Funding for ARPA-E¹



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



ARPA-E & Energy R&D
Basic Science R&D
Defense R&D



ARPA-E & Energy R&D
Basic Science R&D
Defense R&D
Environ Mngmt
Other

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 2019 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.⁵

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 270 projects across 32 active programs, which are broadly organized into four areas: electricity generation, efficiency and emissions, transportation and storage, and grid and grid storage.⁶ These projects provide a sense of ARPA-E's accomplishments:

- Primus Power is commercializing a zinc-based flow battery that has the potential to provide power to the grid at a such a large scale that it could compete with natural-gas-powered peaker plants. Primus deployed its first system to Marine Corps Air Station Miramar in 2015, and has raised over \$100 million in venture funding.⁷
- 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.⁸
- An ARPA-E-funded research team at the University of Virginia is currently developing a new type of wind-turbine blade. Inspired by palm-tree leaves, the blades are designed to better withstand the intense stresses from operating in windy offshore locations. The group will test a prototype at DOE's testing center in Colorado in the summer of 2018.⁹

Key Elements of the FY 2019 Budget Proposal

The FY 2019 budget request would eliminate ARPA-E.

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.
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).
3. ARPA-E, “The Advanced Research Projects Agency-Energy: Overview,” <https://www.arpa-e.energy.gov/sites/default/files/ARPA-E-Fact-Sheet-03292018.pdf>.
4. Ibid.
5. 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).
6. ARPA-E, accessed March 7, 2018, <https://arpa-e.energy.gov/?q=program-listing>.
7. 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).
8. 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.
9. Brad Plumer, “Kelp Farms and Mammoth Windmills Are Just Two of the Government’s Long-Shot Energy Bets,” *New York Times*, March 16, 2018, <https://www.nytimes.com/2018/03/16/climate/arpa-e-summit.html>.

ABOUT THE AUTHORS

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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 one of the world’s leading science and technology think tanks, 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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