Congressional Research Service

Informing the legislative debate since 1914

ARPA-E and the FY2016 Budget Request

Heather B. Gonzalez
Specialist in Science and Technology Policy

May 18, 2015

Congressional Research Service
7-5700
www.crs.gov
R43986

CRS REPORT
Prepared for Members and
Committees of Congress

c11173008

Summary

The Advanced Research Projects Agency–Energy, or ARPA-E, was established to "overcome the long-term and high-risk technological barriers in the development of energy technologies" (P.L. 110-69, §5012). Patterned after the widely lauded Defense Advanced Research Projects Agency (DARPA)—which played a key role in the development of critical technologies such as satellite navigation and the Internet—ARPA-E has supported more than 400 energy technology research projects since Congress first funded it in FY2009.

This budget and appropriations tracking report describes selected major items from the Administration's FY2016 budget request for ARPA-E and tracks legislative action on FY2016 appropriations to the agency. It also provides selected historical funding data. This report has been updated to include House-passed amounts for FY2016. It will be updated to include FY2016 Senate-passed amounts and final enacted FY2016 appropriations.

Overall, the Obama Administration has requested $325 million for ARPA-E in FY2016, a $45 million (16%) increase over the FY2015 enacted level of $280 million. The House-passed Energy and Water Development and Related Agencies Appropriations Act, 2016 (H.R. 2028) would provide $280 million to the energy agency in FY2016. With the exception of FY2013—when ARPA-E was subject to reductions as a result of certain rescissions and under the process commonly known as sequestration—Congress has funded ARPA-E at about $280 million since FY2012.

Contents

Tables

Contacts

The Advanced Research Projects Agency–Energy, or ARPA-E, was established to "overcome the long-term and high-risk technological barriers in the development of energy technologies" (P.L. 110-69, §5012). This budget and appropriations tracking report summarizes the Administration's FY2016 budget request for ARPA-E and tracks legislative action on FY2016 appropriations. It also provides selected (proposed) appropriations authorizations under consideration in the 114th Congress, historical funding data, and an overview of selected policy debates about the agency.

Table 1 summarizes authorized funding levels for ARPA-E under certain proposed, but not yet enacted, reauthorization measures under consideration in the 114th Congress. **Table 2** shows FY2014 current funding, FY2015 enacted funding, the FY2016 request, and FY2016 House-passed funding levels for ARPA-E. This table will be updated to include FY2016 Senate-passed amounts, as well as final enacted appropriations, when those numbers become available. For a longer perspective, **Table 3** provides ARPA-E authorizations, budget requests, and appropriations from FY2008 through the FY2016 request.

Appropriations to ARPA-E, which is part of the Department of Energy (DOE), are typically included in annual energy and water development and related agencies appropriations acts. (The Congressional Research Service tracks these acts each fiscal year. See the "Appropriations Status Table" on CRS.gov, at http://www.crs.gov/Pages/AppropriationsStatusTable.aspx.) ARPA-E's budget justifications are published on the agency's website at http://arpa-e.energy.gov/?q=arpa-e-site-page/arpa-e-budget.

ARPA-E: An Overview

Patterned after the widely lauded Defense Advanced Research Projects Agency (DARPA)—which played a key role in the development of critical technologies such as satellite navigation and the Internet—ARPA-E was established by the America COMPETES Act (P.L. 110-69) in FY2008. The agency received its first appropriations in FY2009: $15 million in regular appropriations and $400 million in American Recovery and Reinvestment Act (ARRA; P.L. 111-5) funding. The America COMPETES Reauthorization Act of 2010 (P.L. 111-358) amended and reauthorized ARPA-E's statutory authority, which is codified primarily at 42 U.S.C. 16538, and authorized appropriations to the agency through FY2013.

Although ARPA-E is relatively young by federal science agency standards, the agency asserts that its awardees already have produced significant scientific and technological gains. ARPA-E states that its awardees have

> developed a 1 megawatt silicon carbide transistor the size of a fingernail; engineered microbes that use hydrogen and carbon dioxide to make liquid transportation fuel; [and] pioneered a near-isothermal compressed air energy storage system.[1]

At the February 2015 annual ARPA-E Energy Innovation Summit, the agency announced that

[1] ARPA-E, "ARPA-E History," ARPA-E website, accessed April 7, 2015, at http://arpa-e.energy.gov/?q=arpa-e-site-page/arpa-e-history.

> [a]t least 30 ARPA-E project teams have formed new companies to advance their technologies and more than 37 ARPA-E projects have partnered with other government agencies for further development. Additionally, 34 ARPA-E projects have attracted more than $850 million in private-sector follow-on funding after ARPA-E's investment of approximately $135 million and several technologies have already been incorporated into products that are being sold in the market. To date, ARPA-E has invested approximately $1.1 billion across more than 400 projects through 23 focused programs and two open funding solicitations (OPEN 2009 and OPEN 2012).[2]

News reports indicate that ARPA-E also has cancelled 21 projects[3]—an expected outcome for this type of agency, which is designed to support high-risk, high-reward research that sometimes produces unanticipated (positive and negative) results. Monitoring progress and recommending termination of research projects are express statutory responsibilities of ARPA-E program directors.[4]

Appropriations Authorizations

Appropriations authorizations to ARPA-E, which were last enacted in the America COMPETES Reauthorization Act of 2010 (P.L. 111-358), expired in FY2013. Members of the 114th Congress have introduced measures to reauthorize provisions from P.L. 111-358, including provisions that authorize appropriations to ARPA-E. An analysis of these bills may be found in CRS Report R43880, *The America COMPETES Acts: An Overview*, by Heather B. Gonzalez. **Table 1** summarizes funding levels for ARPA-E under these various reauthorization measures.

Table 1. ARPA-E Funding Levels Under Selected, Proposed Reauthorization Acts

Dollars in Millions, Rounded

Bill Title	Bill Number	Disposition	Proposed ARPA-E Appropriations Authorizations				
			FY2016	FY2017	FY2018	FY2019	FY2020
America COMPETES Reauthorization Act of 2015	H.R. 1806	reported from House Committee	140.0	140.0	—	—	—
America Competes Reauthorization Act of 2015	H.R. 1898	referred to House Committee	325.0	341.3	358.3	376.2	395.0

Source: H.R. 1806, as reported by the House Committee on Science, Space, and Technology; and H.R. 1898, as introduced.

[2] ARPA-E, "ARPA-E Announces Start-up Companies, Strategic Partnerships and Private Sector Funding at 2015 Innovation Summit," press release, February 9, 2015, at http://arpa-e.energy.gov/?q=news-item/arpa-e-announces-start-companies-strategic-partnerships-and-private-sector-funding.

[3] Jeff Tollefson, "Radical Energy Ideas Secure Private Funds," *Nature*, vol. 518 (February 19, 2015), pp. 286-287.

[4] 42 U.S.C. 16538(g)(2)(B).

FY2016 Budget Request and Appropriations

The Obama Administration has requested $325 million for ARPA-E in FY2016, a $45 million (16%) increase over the FY2015 enacted level of $280 million. In keeping with its historical practice, the agency expects to use its FY2016 appropriations to support between 7 and 10 focused funding opportunity announcements (FOAs). Each FY2016 FOA would provide approximately $10 million to $40 million in funding for programs that focus on specific technical barriers in a specific energy area.[5]

ARPA-E groups its projects into two broad categories: transportation systems and stationary power systems. Project types can vary widely within these categories. In general, ARPA-E anticipates that the focus in FY2016 will be on transportation fuels and feedstocks; energy materials and processes; dispatchable energy; and sensors, information, and integration. The annual ARPA-E budget justification also contains a line item for program direction, which includes salaries and benefits, travel, support services, and related expenses.

As passed by the House on May 1, 2015, the Energy and Water Development and Related Agencies Appropriations Act, 2016 (H.R. 2028) would provide $280 million to ARPA-E in FY2016. This amount is $45 million (-14%) less than the FY2016 request. Congress has funded ARPA-E at approximately $280 million since FY2012—with the exception of FY2013, when the process commonly known as sequestration (as well as enacted rescissions) reduced the agency's funding level to about $250 million. (See **Table 3**.)

Table 2. ARPA-E Appropriations, FY2014-FY2016
(budget authority in $ millions, rounded)

	FY2014 Current	FY2015 Enacted	FY2016 Request	FY2016 House	FY2016 Senate	FY2016 Final
Transportation Systems	100.8	126.0	118.3	—		
Stationary Power Systems	151.2	126.0	177.5	—		
Program Direction	28.0	28.0	29.3	28.0		
ARPA-E (Total)	**280.0**	**280.0**	**325.0**	**280.0**		

Source: FY2016 ARPA-E congressional budget justification, available at http://arpa-e.energy.gov/sites/default/files/ARPA-E%202016%20Budget.pdf; and H.R. 2028, as passed by the House. As with past practice, Congress does not typically specify funding for items marked with a "—."

Historical Funding

Table 3 shows ARPA-E authorizations of appropriations, budget requests, and appropriations since the agency was first authorized in 2008.

[5] In some years, ARPA-E releases "focused" FOAs, which target specific, defined technical needs. This appears to be the strategy planned for FY2016. In other years, the agency releases "open" FOAs, which "identify high-potential projects that address the full range of energy-related technologies." FY2015 was an open FOA year. More information is available at http://arpa-e.energy.gov/?q=programs/apply-for-funding.

Table 3. ARPA-E Authorizations, Budget Requests, and Appropriations, FY2008-FY2016

(budget authority in $ millions, rounded)

Fiscal Year	Authorization	Budget Request	Appropriation
2008	300.0	—	—
2009	such sums	—	15.0[a]
2010	such sums	0.0	0.0
2011	300.0	300.0	179.6
2012	306.0	550.0	275.0
2013	312.0	350.0	250.6
2014	—	379.0	280.0
2015	—	325.0	280.0
2016	—	325.0	—

Source: FY2009 to FY2016 annual ARPA-E and DOE congressional budget justifications; available at http://arpa-e.energy.gov/?q=arpa-e-site-page/arpa-e-budget, and http://energy.gov/budget-performance.

a. ARPA-E received $15.0 million in regular appropriations in FY2009 and $400 million in one-time appropriations through the American Recovery and Reinvestment Act (ARRA, P.L. 111-5).

Policy Issues and Observations

ARPA-E is a comparatively new addition to the federal research and development (R&D) portfolio. Given the nature of R&D, which can take decades to produce widely recognized or transformative results, it may be many years before ARPA-E's ultimate impact is fully understood.

Some early concerns about the agency focused on perceived differences between ARPA-E and the DARPA model. These include differences in the markets for defense and energy-related products. DARPA, for example, has a built-in customer (the U.S. military), which ARPA-E does not have. Further, some analysts have argued that industrial relationships and characteristics of the energy sector (including powerful incumbent firms and the wide array of energy-dependent products) have the potential to stop the dissemination of disruptive innovations. It is not clear whether these early concerns have become actual challenges for ARPA-E, or whether ARPA-E has been able to adjust and respond to its unique position. It is also possible that factors perceived (rightly or wrongly) as key to the success of DARPA may not be as important to the success of ARPA-E.

Other early congressional concerns focused on whether ARPA-E would compete with, duplicate, or otherwise undermine other DOE research units, such as the Office of Science, and on whether the agency would focus too closely on late-stage technology development and commercialization activities that some policymakers perceive as best left to the private sector.[6] The Government

[6] Chairman Paul Brown, in U.S. Congress, House Committee on Science, Space, and Technology, Subcommittee on Investigations and Oversight, "Opening Statement," *A Review of the Advanced Research Projects Agency—Energy*, (continued...)

Accountability Office investigated such concerns in 2012 and found that ARPA-E had taken steps to avoid duplication with other DOE offices and that "most ARPA-E projects could not have been funded solely by the private sector."[7]

Author Contact Information

Heather B. Gonzalez
Specialist in Science and Technology Policy
hgonzalez@crs.loc.gov, 7-1895

(...continued)

hearings, 112th Cong., 2nd sess., January 24, 2012.

[7] Testimony of U.S. Government Accountability Office (GAO) Natural Resources and Environment Director Frank Rusco, in U.S. Congress, House Committee on Science, Space, and Technology, Subcommittee on Investigations and Oversight, "Department of Energy: Advanced Research Projects Agency-Energy Could Improve Its Collection of Information from Applicants (GAO-12-407T)," *A Review of the Advanced Research Projects Agency—Energy*, hearings, 112th Cong., 2nd sess., January 24, 2012, available at http://www.gao.gov/products/GAO-12-407T.