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DEPARTMENT OF  
ENERGY

Advanced Research  
Projects Agency-Energy  
Could Improve Its  
Collection of Information  
from Applicants

Statement of Frank Rusco, Director  
Natural Resources and Environment

U.S. Government Accountability Office

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ACCOUNTABILITY ★ INTEGRITY ★ RELIABILITY

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Chairman Broun, Ranking Member Tonko, and Members of the Subcommittee:

I am pleased to be here today to discuss our work on the Department of Energy's (DOE) Advanced Research Projects Agency-Energy (ARPA-E). As you know, in 2007, the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science (America COMPETES) Act established ARPA-E within DOE to overcome the long-term and high-risk technological barriers in the development of energy technologies.<sup>1</sup> ARPA-E borrows from the model of the Defense Advanced Research Projects Agency (DARPA), an agency created within the Department of Defense (DOD) in 1958 to direct and perform advanced research and development projects.

Since first receiving an appropriation in 2009 in the American Recovery and Reinvestment Act of 2009, ARPA-E has awarded \$521.7 million to universities, public and private companies, and national laboratories to fund 181 projects that attempt to make transformational—rather than incremental—advances to a variety of energy technologies, including high-energy batteries and renewable fuels.<sup>2</sup> Award winners must meet cost share requirements, through either in-kind contributions or outside funding sources.<sup>3</sup>

ARPA-E is required by statute to achieve its goals through energy technology projects that, among other things, accelerate transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty. At the same time, the Director of ARPA-E is required to ensure, to the maximum extent practicable, that ARPA-E's activities are coordinated with, and do not

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<sup>1</sup>Pub. L. No. 110-69, § 5012 (2007).

<sup>2</sup>ARPA-E has released a total of four funding announcements—meaning the agency was accepting project proposals for a set period of time—in April 2009, December 2009, March 2010, and April 2011. ARPA-E generally uses cooperative agreements to make funding awards, which involve the transfer of a thing of value to the recipient to carry out a public purpose authorized by law. Cooperative agreements differ from grants because substantial involvement is expected between ARPA-E and the recipient.

<sup>3</sup>The cost share requirement for award winners is generally at least 20 percent of total allowable costs, although under section 988(b)(3) of the Energy Policy Act of 2005, ARPA-E has reduced the cost share requirement for certain applicants, such as universities, to 5 percent or 10 percent for all of the funding rounds except the first. Award winners' cost share must be provided by a nonfederal source.

duplicate the efforts of, programs and laboratories within DOE and other relevant research agencies.

My testimony today focuses on the key findings and recommendations from a GAO report on ARPA-E being released today by the subcommittee.<sup>4</sup> For that work, you asked us to examine (1) ARPA-E's use of criteria and other considerations for making awards and the extent to which applicants identify and explain other private funding information, (2) the extent to which ARPA-E-type projects could have been funded through the private sector, and (3) the extent to which ARPA-E coordinates with other DOE program offices to avoid duplicating efforts.

We conducted this work in accordance with generally accepted government auditing standards. More detailed information on the scope and methodology from this work on which this testimony is based can be found in appendix I of the report.

In summary, the agency uses several selection criteria in making awards though its requirements for information on private sector funding could be improved. Also, our review suggests that most ARPA-E projects could not have been funded solely by the private sector. Finally, ARPA-E officials have taken steps to coordinate with other DOE offices to avoid duplication.

- ARPA-E uses four selection criteria—the impact of the proposed technology relative to the state of the art; the overall scientific and technical merit of the proposal; the qualifications, experience, and capabilities of the applicant; and the quality of the proposed management plan—in awarding funds. ARPA-E's eight program directors, who are generally scientists and engineers, create and manage funding programs for the agency and apply these selection criteria when reviewing applications. Of the 20 applications we reviewed for award selection criteria, all contained supporting information addressing the agency's four criteria. In addition to applying its four criteria, ARPA-E gives program directors discretion to use additional considerations to award funds to projects, including whether ARPA-E applicants received private funding. Identification in applications of sources of private funding and the extent to

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<sup>4</sup>GAO, *Department of Energy: Advanced Research Projects Agency-Energy Could Benefit from Information on Applicants' Prior Funding*, GAO-12-112 (Washington, D.C.; Jan. 13, 2012).

which that funding might support the proposed projects can help provide program directors with assurance that ARPA-E funds do not overlap with private investment. We identified 18 out of 121 award winners through ARPA-E's first three funding rounds that had received some prior private sector investment, and ARPA-E took steps to identify and understand how this funding was related to proposed projects. During the first two funding rounds, ARPA-E required that applicants identify relevant private investors if the applicant believed these funds were related to the proposed project. When applicants provided little prior funding information, ARPA-E's program directors spent time and resources to determine the extent of such funding for proposed ARPA-E projects. According to our review of ARPA-E data from the first three rounds of funding, the agency reduced requested award amounts by 5 percent or more on 31 out of 121 projects, for a total of \$59 million below total requested award amounts for these rounds.<sup>5</sup> Beginning with the third funding round, ARPA-E began requiring that applicants explain why private investors were not willing to fund proposed projects. However, ARPA-E did not provide applicants with guidance, such as a sample response, to assist them in completing this requirement, and responses were generally limited. Some applicants provided general information about prior research but did not specifically explain why private investors would not support their projects. One applicant included a letter from its venture capital investor to explain why the investor was not willing to fund the work proposed to ARPA-E, an approach the National Institute of Standards and Technology uses as a check in its funding applications for advanced research but that ARPA-E currently does not use. Also, ARPA-E officials said that they have considered but have not used venture capital data to identify applicants with prior private investors. Examining such data allowed us to quickly cross-check applicants' prior private funding.

- Our review suggests that most ARPA-E-type projects could not be funded solely by private investors. This finding is based on our interviews with representatives of venture capital firms and our analysis of subsequent funding received by contingently selected APRA-E applicants—those applicants that met ARPA-E's

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<sup>5</sup>ARPA-E can reduce the proposed project scope to fund only what the program directors consider to be the transformational part of the project to avoid funding applied research or development work that would be outside ARPA-E's program goals.

selection criteria but were not selected for an award.<sup>6</sup> The representatives we spoke with from six venture capital firms indicated that they generally do not fund the types of projects that ARPA-E looks to fund for three reasons.

- First, venture capital firms generally do not fund projects that rely on unproven technological concepts or lack working prototypes demonstrating the technology. Data from ARPA-E on award winners show that 91 out of 121 ARPA-E projects from the first three funding rounds had technological concepts that had not yet been demonstrated in a laboratory setting.<sup>7</sup>
- Second, venture capital firm officials told us that they focused closely on the timeliness of investment returns, with one firm noting that the industry tended to invest in technologies that could be commercialized in less than 3 years and that would potentially exhibit exponential market growth in approximately 5 to 7 years. However, we found that nearly all of the 13 ARPA-E award winners and most of the 22 contingently selected applicants we spoke with estimated that their projects were 3 or more years away from potential commercialization.<sup>8</sup>
- Third, venture capital firms may not be comfortable investing in new energy technologies, noting the historical lack of successful venture capital investments in these types of projects. Venture representatives said that venture firms were more comfortable investing in software companies or other businesses with higher potential profit margins and less costly product development than new energy technologies.

The 18 award winners we identified as having received prior private venture capital told us that with the ARPA-E funding, they were generally able to pursue the development of energy technologies with greater scientific or technical uncertainty

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<sup>6</sup>According to ARPA-E officials with whom we spoke, these applicants would have been selected for an award had additional funds been available.

<sup>7</sup>These data showed that most ARPA-E award winners were at or below technology readiness level (TRL) 3. TRL 3 represents a level where potential technologies are still unproven.

<sup>8</sup>On the basis of the initial testing of our questions, we determined that these estimates may be optimistic, given that respondents are invested in attempting to bring a technology to market as soon as possible.

than they had when they were working with their private funding. About two-thirds of these award winners told us that the ARPA-E funding has allowed them to develop prototypes or to prove basic technology concepts on more advanced ideas than their prior work—6 of these award winners said this was for completely new research and 7 said it was for major advancements to prior research. A few of these award winners also told us they were able to work on projects with outstanding scientific research questions that private investors would not have funded. Five of these award winners reported that they would likely have been able to pursue some research similar to their ARPA-E projects, but it would have taken years longer without ARPA-E funding. In addition, officials from two public companies we spoke with that were awarded ARPA-E money told us that although their companies had internal resources devoted to research and development, they were not able to internally fund the projects they proposed to ARPA-E for two following reasons. First, existing product lines placed heavy demands on their internal research and development budgets, and there is continuous pressure from existing customers and competitors to improve existing products. Second, these companies told us that internal investments had to meet minimum investment return thresholds, and that ARPA-E-type projects were not able to meet these thresholds.<sup>9</sup> In addition, we found that few contingently selected applicants found funding from private investors or public sources. Eighteen of the 22 ARPA-E contingently selected applicants we interviewed sought funding after being turned down for ARPA-E funds. Of the 18 that sought funding elsewhere, 13 submitted project proposals to government sources, such as other DOE offices, the National Science Foundation, or nonprofit academic research institutes, and the remaining 5 submitted proposals to private investors such as venture capital firms.<sup>10</sup> As of September 2011, we found that 2 out of the 22 contingently selected applicants secured funding from venture capital firms for work

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<sup>9</sup>Officials from one company told us that the rate of return on investment required by its management was at least 20 percent per year.

<sup>10</sup>One of the 5 contingently selected applicants that sought funding from a private investor also sought public funding.

that was very similar to their ARPA-E project proposals.<sup>11</sup> We also found that 4 contingently selected applicants secured funding from a government or nonprofit source for their projects.<sup>12</sup> The 4 contingently selected applicants that secured funding from a government or nonprofit source modified their ARPA-E proposals to be more focused on basic science research, rather than on developing a commercial technology.

- According to ARPA-E officials and documents, agency officials have taken steps to coordinate with other DOE offices in advance of awarding ARPA-E funds to help avoid duplication of efforts. These coordination efforts can be categorized into three areas: (1) prefunding coordination, (2) coordination of application reviews, and (3) participation in official DOE coordination groups. For prefunding coordination, ARPA-E officials told us that program directors engage with officials from related DOE offices in advance of announcing the availability of ARPA-E funds. For example, ARPA-E officials told us that directors use the workshops and other meetings to identify research areas that other DOE offices are not working on, and the other DOE officials provide insights on funding areas where they are not active. For coordination of application reviews, some ARPA-E program directors told us that they have recruited officials from other DOE offices to review applications submitted to ARPA-E and that these officials made up as many as one-third of the reviewers for one director. ARPA-E has also used application reviewers from other federal agencies, such as the Department of Defense. One program director told us that these reviewers have also helped avoid funding projects similar to those potentially funded elsewhere. Finally, ARPA-E is also a participant in official DOE coordination groups. For example, ARPA-E is a participant in DOE's SunShot Initiative within the Solar Energy Technologies Program. The SunShot Initiative is an effort to coordinate solar energy research across DOE's Office of Science, four national laboratories, the

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<sup>11</sup>In addition, our review of venture capital funding data for the other 11 contingently selected applicants with whom we did not speak did not show that any had received venture capital funding since not being awarded ARPA-E funds.

<sup>12</sup>Three contingently selected applicants that submitted proposals to government or nonprofit sources were still awaiting responses at the time of our review.



National Science Foundation, and ARPA-E, with the goal of achieving costs of \$1 per watt for solar-generated electricity. Additionally, the ARPA-E Director created the Panel of Senior Technical Advisors (PASTA), which is a group of high-level DOE managers that meet periodically to discuss current and future DOE research efforts. ARPA-E officials told us that PASTA is an attempt to avoid duplicating efforts within DOE. PASTA meeting attendees have included officials from DOE's applied and basic science offices. We were not able to directly evaluate the effectiveness of ARPA-E's efforts to coordinate with other DOE offices. Nevertheless, on the basis of our interviews with ARPA-E award winners and contingently selected applicants, we found that 4 award winners and 2 contingently selected applicants had received prior funding from other DOE offices.<sup>13</sup> According to these award winners and contingently selected applicants, the prior funding was either for more proven technologies or was focused on more basic or foundational research than was the ARPA-E funded project.

On the basis of these findings we recommended that ARPA-E:

- provide guidance with a sample response to assist applicants in providing information on sources of private funding for proposed ARPA-E projects,
- require that applicants provide letters or other forms of documentation from private investors that explain why investors are not willing to fund the projects proposed to ARPA-E, and
- use venture capital funding databases to help identify applicants with prior private investors and to help check information applicants provide on their applications.

ARPA-E commented on a draft of the report being released today and concurred with these recommendations.

Chairman Broun, Ranking Member Tonko, and Members of the Subcommittee, this concludes my prepared statement. I would be pleased to respond to any questions that you may have.

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<sup>13</sup>These award winners included those in our nonprobability sample of 13, as well as the 18 we identified with VentureDeal data.

## **GAO Contact and Staff Acknowledgments**

For questions about this statement, please contact Frank Rusco at (202) 512-3841 or [ruscof@gao.gov](mailto:ruscof@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement. Individuals making key contributions to this statement include Tim Minelli, Assistant Director; Karen Keegan; Rob Marek; and Jeanette Soares. Key contributors for the work that this testimony is based on are listed in appendix V of the report being released today.