U.S. Department of Energy
Advanced Research Projects Agency – Energy

Request for Information (RFI)
DE-FOA-0002120

Pre-pilot and pilot R&D projects to scale, mature, and advance ARPA-E funded technologies

SUMMARY:

ARPA-E is seeking information to help frame a potential new funding opportunity for public-private partnerships supporting the further refinement, scaling, and piloting of successful ARPA-E technologies. The potential program would collaborate with investors and private sector partners to advance promising technologies developed under ARPA-E awards (both prior and ongoing) to pre-pilot and pilot R&D projects. The projects would need to demonstrate scalability, reliability, and manufacturability. Success of these scale-up/pilot projects will establish the path forward to continued private sector development and deployment of these transformational technologies. In addition to the energy-related benefits, this development would establish a new manufacturing base for energy technologies in the U.S.

Through this RFI, ARPA-E seeks to:

- Identify successful ARPA-E technologies that have established proof of concept and are ready for scaling R&D projects in manufacturability, reliability, etc.
- Identify the companies that propose to lead the next stage of development for these ARPA-E technologies.
- Gauge interest from potential investors and industry partners to support and participate in scale-up/pilot projects.
- Frame the structure and management for potential funding opportunities to support scale-up/pilot projects of ARPA-E technologies with investor and industry participation.
- Facilitate engagement between innovators and partners, specifically to make connections in advance of the ARPA-E Energy Innovation Summit in July 2019.

More detailed information follows on the background of the technology and competitiveness challenges ARPA-E seeks to address, the different groups of stakeholders ARPA-E hopes to engage, and the potential next steps for such a funding opportunity.

BACKGROUND:

ARPA-E's mission is to develop transformational energy technologies through wholly unique approaches to energy research and development in support of U.S. national security and economic competitiveness. ARPA-E funds the research and development of technologies to

build and maintain the U.S. technological lead in highly-competitive global energy markets, thus supporting American jobs and economic growth. ARPA-E's authorizing statute directs the Agency to develop linkages between its sponsored applied research and the marketplace.[1] These linkages are central to realizing the public's return on technology investments.

An enduring challenge to ARPA-E's mission is that even technologies that achieve substantial technical advancement under ARPA-E support are often stranded in their development path once ARPA-E funding ends (averaging $2.5M over three years). ARPA-E-funded technologies typically face significant remaining risks upon completion of an award's funding period. These risks include the translation of performance achieved at bench scale to commercially scalable versions of the technology, integration of the technology with broader systems, a lack of extended performance data, and validation of manufacturability and reliability of these new energy technologies. Experience across ARPA-E's diverse energy portfolios, and with a wide range of investors, indicates that pre-commercial scaling and pilot projects are critical to signaling to industry that performance and cost parameters can be met in practice. Success in these scale-up or pilot projects would enable investors and partners to justify substantial commitments of financial resources, personnel, production facilities, and materials to develop promising ARPA-E technologies into early commercial products.

The current gap in ARPA-E's support for further development and scaling of its most promising technologies carries a number of critical risks to the ARPA-E mission and U.S. policy objectives. Stranding promising ARPA-E-funded technologies in their development pathways leaves substantial intellectual property developed with American taxpayer dollars vulnerable to adoption by foreign competitors, who can and do capture it for continued development – and economic benefit – overseas. This harms national competitiveness, as U.S. industries often lose the lead on the development, scaling, and manufacturing of technologies necessary to compete in rapidly evolving global energy markets.

This RFI focuses only on scale-up, pre-pilot, or pilot projects of promising technologies that ARPA-E has funded and for which the piloting would substantially build upon innovations achieved under the original ARPA-E award. Eligible projects will be based upon inventions/technologies resulting under the original ARPA-E award with the intent to advance the innovation to practical application. Both active and alumni projects could be considered for funding under the potential program.

ARPA-E recognizes that new program features may be needed to fund these projects, as compared to typical ARPA-E research and development agreements. Envisioned as a public-private innovation collaboration, ARPA-E anticipates at least 50% cost share for these projects, as opposed to the 5%-20% cost share typical of ARPA-E research agreements. ARPA-E will

[1] ARPA-E's statutory mandate to identify and promote revolutionary energy technology also includes requirements to:

"Translate scientific discoveries and cutting-edge inventions into technological innovations" and accelerate "transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty." 42 CFR §16538(c)(2)(a-c)

consider the use of Other Transaction Authority (OTA)[2], which has been used similarly by other federal agencies to support pilot programming with greater flexibility than traditional Cooperative Agreements and Grants. In addition to higher financial commitments, ARPA-E will also:

- Require substantial US manufacturing of resulting technologies for use/sale worldwide, subject to reasonable waiver requests that may be submitted before, during, or after completion of the pilot effort.
- Seek teams with more diversified professional engineering and management capabilities needed for large projects, in contrast to typical ARPA-E projects which tend to focus heavily on bench-scale research or early small-scale proof-of-concept prototypes.
- Encourage engagement with industry stakeholders providing in-kind support to the pilot effort. These stakeholders could be potential customers, investment diligence organizations, project financiers, or others with the ability and interest to facilitate the translation of technology from the bench to commercial scale.

PURPOSE AND NEED FOR INFORMATION:

The purpose of this RFI is solely to solicit input for ARPA-E's consideration, and to inform the possible formulation of future ARPA-E projects or programs intended to support advanced development, scaling, and piloting of technologies funded by ARPA-E.

The upcoming ARPA-E Energy Innovation Summit (July 8-10, 2019 in Aurora, CO) will offer an opportunity for technology developers, investors, and partners to engage with ARPA-E. The responses to this RFI will be helpful in facilitating connections between these stakeholders. In preparation for the Summit, ARPA-E intends to create a limited-access web portal to share non-proprietary information about candidate technologies that would be eligible for the potential scale-up/pilot project program. (The web-based list will be referenced below as the "Candidate Technology List.") Potential investors and partners could view the technologies and companies on this list and make connections in advance of the Summit. To be included on this list, a company must have the rights to a technology that was reported as a subject invention on the original ARPA-E award, and the original ARPA-E project must have substantially met project milestones. ARPA-E-supported companies on the list would also be invited to submit support material (e.g., a pitch deck) for potential investors or partners to view. Responses to this RFI will help inform the scope, content, and form of the Candidate Technology List, and will also identify potential investors and partners who would like to access the List.

ARPA-E will not provide funding or compensation for any information submitted in response to this RFI, and ARPA-E may use non-confidential information submitted to this RFI without any attribution to the source. This RFI provides ARPA-E funding program awardees and alumni an opportunity to contribute facts, data, information, and

[2] 42 CFR §16538(f)

projections regarding the readiness of ARPA-E-funded technologies to be demonstrated at a relevant scale, with the ultimate objective of accelerating along the path to commercial development.

TARGETED GROUPS FOR RFI:

ARPA-E is seeking information on this potential new program from three stakeholder groups:

1. **ARPA-E-SUPPORTED TECHNOLOGY DEVELOPERS.** This includes prior ARPA-E awardees whose research has achieved compelling proof-of-concept or bench-scale results for their targeted energy technologies (as documented through the report of at least one Subject Invention under the original award). These organizations could include the original research team, or could also include new team members licensed to commercialize inventions/technologies resulting from prior ARPA-E award. (I.e., if an original ARPA-E award to a University yielded a promising technology, and the rights of the related inventions have been licensed to a startup company, either the University and/or the startup company are encouraged respond to this RFI.)
2. **POTENTIAL INVESTORS IN COMPANIES DEVELOPING ARPA-E-FUNDED TECHNOLOGIES.** Investors interested in building companies to develop (and ultimately commercialize) ARPA-E-funded inventions/technologies. These investors could include, but are not limited to, traditional venture capitalists, corporate strategic investors, impact investors and philanthropic organizations.
3. **INDUSTRY STAKEHOLDERS.** This includes industry stakeholders interested in working with ARPA-E, its innovators, and outside investors to pilot ARPA-E technologies at a meaningful scale in an application-relevant environment. These stakeholders need not have a financial stake or formalized partnership with ARPA-E technology developers or investors (mentioned in 1 and 2 immediately above), but could contribute valuable insights and in-kind support to the technical challenges of scale-up, integration, or deployment of new energy technologies in the market.

Please carefully review the REQUEST FOR INFORMATION GUIDELINES below. Please note, in particular, that the information you provide will be used by ARPA-E solely for program planning, without attribution. **THIS IS A REQUEST FOR INFORMATION (RFI) ONLY. THIS NOTICE DOES NOT CONSTITUTE A FUNDING OPPORTUNITY ANNOUNCEMENT (FOA). NO FOA EXISTS AT THIS TIME.**

REQUEST FOR INFORMATION GUIDELINES:

No material submitted for review will be returned, and there will be no formal or informal debriefing concerning the review of any submitted material. ARPA-E may contact respondents to request clarification or seek additional information relevant to this RFI. All responses provided will be considered, but ARPA-E will not respond to individual submissions or publish publicly any response or a compendium of responses. **Respondents should not include any information in their response to this RFI that might be considered proprietary or confidential** (except, as provided below, protective markings for your identity if appropriate). However, respondents should indicate in their responses if additional confidential or proprietary

information exists that would be helpful to ARPA-E in assessing respondents' demonstration project requirements. ARPA-E may contact respondents to request clarification or seek additional information relevant to this RFI. In addition, Respondents may request in their responses that that their corporate/individual identities remain confidential to protect, as proprietary information, that they are considering investments as outlined in this RFI. ARPA-E protects proprietary information to the maximum extent permitted by law.

Depending on the responses to this RFI, ARPA-E may consider the rapid initiation of one or more funded collaborative scale-up/pilot project(s) to accelerate along the path towards commercial deployment of the energy technologies described generally above.

Responses to this RFI should be submitted in PDF format to the email address ARPA-E-RFI@hq.doe.gov by **5:00 PM Eastern Time on ~~May 29, 2019~~ June 20, 2019.** Emails should conform to the following guidelines:

- Please insert "Response to RFI DE-FOA-0002120 - <your organization name>" in the subject line of your email. If appropriate, note in bold if the identity of you or your organization is confidential, and provide a brief explanation.
- In the body of your email, include your name, title, organization, type of organization (e.g., university, non-governmental organization, small business, large business, federally funded research and development center (FFRDC), government-owned/government-operated (GOGO)), email address, and telephone number. Again, if appropriate, note in bold if any of this information is confidential, and provide a brief explanation.
- Responses to this RFI are limited to no more than 5 pages in length (12-point font size).
- Other questions or inquiries that do not include an RFI response should be emailed to ARPA-E-CO@hq.doe.gov.

As stated above, ARPA-E seeks input from interested and informed representatives of three groups: (1) developers of ARPA-E-supported technologies; (2) potential investors in companies developing ARPA-E-supported technologies; and, (3) industry stakeholders interested in participating in the scale-up or piloting of ARPA-E-supported technologies. Respondents in each of these groups are encouraged to provide information as detailed below.

(1) ARPA-E-SUPPORTED TECHNOLOGY DEVELOPERS:

- A brief summary of the technology developed with ARPA-E funding, including the FOA and award number under which the development occurred, as well confirmation of a Subject Invention report filing with ARPA-E/iEdison.
- A description of the target application, including discussion of first customer performance requirements.
- The current status of development activities highlighting advances that have occurred since the end of the original ARPA-E award (if the award has ended), as well as additional work required to bring the technology to readiness for a commercially-relevant pre-pilot or pilot scale.

- The anticipated scale and scope of activities necessary to advance the technology toward commercial adoption, including identification and brief discussion of any future technical challenges and the anticipated post-pilot investment required to bring the technology to scale.
- A description of the organization, the team, and its capabilities, including a candid assessment of any essential development, procurement, engineering, or management limitations.
- Specifically to prepare for engagement at the ARPA-E Summit in July 2019:
    - Would your team like to arrange meetings with potential partners and investors at the Summit?
    - Would your team wish to be included on the above-referenced "Candidate Technology List" and allow potential investors or partners to review project information?

(2) POTENTIAL INVESTORS IN COMPANIES DEVELOPING ARPA-E TECHNOLOGIES:

- A brief description of your organization, including the sectoral focus of your investments, the stage of investment typically undertaken (e.g., seed, Series A, etc.), and your investment motivation (e.g., impact, financial, strategic, philanthropic).
- Specific energy technology or market areas of interest, and a brief description of the strategic value your team brings to portfolio companies.
- A summary of insights derived through investment experience in energy and/or hard-tech companies with particular emphasis on how to structure a pilot project to obtain data and information to advance a technology and company toward commercial deployment.
- A summary of your thoughts on management structure of a public/private pilot project to balance the interests of the public, represented by ARPA-E, with that of your organization as a private investor.
- Additional supported activities that should be emphasized in moving from bench-scale through pilot to maximize the investability and commercial potential of the technology at the conclusion of the scale-up/pilot project.
- Recommendations to ARPA-E on the structure of project selection and management of ARPA-E funded scale-up/pilot projects to better facilitate transition to private sector funding and leadership.
- Best practices for due diligence assessments of promising energy technologies, and the companies/entities that control the technologies.
    - What technical abilities will you have and need for this purpose?
    - What information will you need from ARPA-E awardees (e.g., technical, commercial, intellectual property rights) to assess which companies warrant further exploration?
    - (Note: ARPA-E can provide factual information about the progress/results of the research, but may not "endorse" an awardee/its research results.)
- Specifically to prepare for engagement at the ARPA-E Summit in July 2019:

- Would you like to meet at the ARPA-E Summit with companies who have successfully demonstrated proof-of-concept on prior ARPA-E awards?
- Would you like to access the "Candidate Technology List" referenced above?
- How can ARPA-E best facilitate the "matchmaking" process to help you identify and assess the most relevant and promising ARPA-E companies and technologies for your portfolio?

(3) INDUSTRY STAKEHOLDERS:

- A brief description of your organization emphasizing your motivation to engage in scale-up/pilot projects of ARPA-E technologies and the resources and insight you might bring to potential piloting efforts.
- Specific energy technology or market areas of interest.
- For potential customers of the ARPA-E technology, please identify your willingness to participate in or to provide facilities to host a pilot project.
- Describe the nature of support you might be able to provide to the effort.
- Recommendations to ARPA-E on the structure of project selection and management of ARPA-E funded scale-up/pilot projects to better facilitate transition to private sector funding and leadership
- Specifically to prepare for engagement at the ARPA-E Summit in July 2019:
  - Would you like to meet at the ARPA-E Summit with companies who have successfully demonstrated proof-of-concept on prior ARPA-E awards?
  - Would you like to access the "Candidate Technology List" referenced above?
  - How can ARPA-E best facilitate the "matchmaking" process to help you identify the most relevant ARPA-E companies and technologies for your organization?

TOPICS NOT OF INTEREST:

ARPA-E is not interested technologies that will be demonstrated for use in non-energy applications. Only submissions relating to technologies developed with support from ARPA-E funding will be considered for further support.