

**SMALL BUSINESS INNOVATION RESEARCH (SBIR) AND
SMALL BUSINESS TECHNOLOGY TRANSFER (STTR)
FUNDING OPPORTUNITY ANNOUNCEMENT**



**ADVANCED RESEARCH PROJECTS AGENCY – ENERGY (ARPA-E)
U.S. DEPARTMENT OF ENERGY**

ENERGY STORAGE SBIR/STTR FOA

Announcement Type: Initial Announcement
Funding Opportunity No. DE-FOA-0000674
CFDA Number 81.135

FOA Issue Date:	April 2, 2012
Submission Deadline for Notice of Intent	5 PM ET, May 14, 2012
Deadline for Questions to ARPA-E-CO@hq.doe.gov :	5 PM ET, May 18, 2012
Submission Deadline for Full Applications:	5 PM ET, May 23, 2012
Submission Deadline for Replies to Reviewer Comments:	5 PM ET, June 20 26, 2012
Expected Date for Selection Notifications:	July 2012
Mandatory Webinar:	July 2012

- See Section I.E of the FOA for a list of Technical Categories of Interest.
- **Notices of Intent, Full Applications, and Replies to Reviewer Comments must be submitted through ARPA-E eXCHANGE** (<https://arpa-e-foa.energy.gov/>), ARPA-E’s online application portal (see Section IV.G.1 of the FOA). **ARPA-E will not review or consider applications submitted through other means.** For detailed guidance on using ARPA-E eXCHANGE, please refer to the “ARPA-E eXCHANGE User Guide” (<https://arpa-e-foa.energy.gov/Manuals.aspx>).
- Applicants are responsible for meeting each submission deadline. **Applicants are strongly encouraged to submit their applications at least 48 hours in advance of the submission deadline.** Once the application is submitted in ARPA-E eXCHANGE, Applicants may revise or update their application until the expiration of the applicable deadline.
- **Applicants should not wait until the last minute to begin the submission process.** During the final hours before the submission deadline, Applicants may experience server/connection congestion that prevents them from completing the necessary steps in ARPA-E eXCHANGE to submit their applications. **ARPA-E will not extend the submission deadline for Applicants that fail to submit required information and documents due to server/connection congestion.**
- **ARPA-E will not review or consider noncompliant applications** (see Section III.F.1 of the FOA), **including but not limited to incomplete applications and applications submitted after the deadline stated in the FOA.** In addition, ARPA-E will not review or consider nonresponsive applications (see Section III.F.2 of the FOA).

Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A.
Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

MODIFICATIONS

All modifications to the Funding Opportunity Announcement (FOA) are highlighted in yellow in the body of the FOA.

Mod. No.	Date	Description of Modifications
001	April 10, 2012	<ul style="list-style-type: none"> • Inserted page numbers at the top of pages iii – vi, 1-44. • Updated Appendix 2, Sample Response to “Other Sources of Funding Disclosure Form.”
002	May 16, 2012	<ul style="list-style-type: none"> • Changed the due date for Replies to Reviewer Comments to June 26, 2012. • Removed Section VI.B.11: Section VI.B.11 was intended to implement §316 of the Consolidated Appropriations Act, 2012. That section requires the recipients of Department of Energy grants in excess of \$1,000,000 to upgrade any lighting in their facilities that does not meet the incandescent efficiency standards set forth in 42 U.S.C. §6295. ARPA-E removed this section because §316 applies exclusively to grants, and thus should not be applied to any ARPA-E award, the vast majority of which are cooperative agreements. It does not apply to any other form of financial assistance. In the unlikely event that ARPA-E awards a grant (which have not been issued to date, and are not expected to be issued in the future), the requirement in §316 of the Consolidated Appropriations Act, 2012 would apply.
003	May 17, 2012	<ul style="list-style-type: none"> • Clarified the language in the Mod 002 Description, above, by removing the sentence “...and thus should not be applied to any ARPA-E award, the vast majority of which are cooperative agreements,” and inserting “It does not apply to any other form of financial assistance.”

Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A.
 Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

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REQUIRED DOCUMENTS CHECKLIST

Notices of Intent, Full Applications, and Replies to Reviewer Comments must be submitted through ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov/>), ARPA-E’s online application portal. ARPA-E will not review or consider applications submitted through other means. For detailed guidance on using ARPA-E eXCHANGE, please refer to the “ARPA-E eXCHANGE User Guide” (<https://arpa-e-foa.energy.gov/Manuals.aspx>). Required forms for Full Applications are available on ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov/>), including the SF-424, SF-424A, Business Assurances Form, and Other Sources of Funding Disclosure form. A sample response to the Other Sources of Funding Disclosure form is attached to this FOA as Appendix 2. Applicants must use the templates available on ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov/>), including the template for the Technical Volume of the Full Application, the template for the Technical Milestones section of the Technical Volume, the Summary Slide template, and the Reply to Reviewer comments template. A sample Summary Slide is attached to this FOA as Appendix 1.

<u>SUBMISSION</u>	<u>COMPONENTS</u>	<u>OPTIONAL/ MANDATORY</u>	<u>FOA SECTION</u>	<u>DEADLINE</u>
Notice of Intent	<ul style="list-style-type: none"> • Each Applicant must enter the following information into ARPA-E eXCHANGE by the stated deadline: <ul style="list-style-type: none"> ○ Project Title; ○ Lead Organization; ○ % of effort contributed by the Lead Organization; ○ The Project Team, including Principal Investigator for the Prime Recipient, Team Members, and Key Participants; ○ Technical Category (see Section I.E of the FOA); and ○ Abstract – The abstract provided should be 200 words in length, and should provide a truncated explanation of the proposed project. 	Mandatory	IV.B	5 PM ET, May 14, 2012
Full Application	<ul style="list-style-type: none"> • Each Applicant must submit a Technical Volume in Adobe PDF format by the stated deadline. The Applicant must use the fillable Technical Volume template available on ARPA-E eXCHANGE (https://arpa-e-foa.energy.gov/). The Technical Volume must include the following: <ul style="list-style-type: none"> ○ Award Category (0.5 pages max.) ○ Technical Category (0.5 pages max.) ○ Technical Approach (1 page max.) ○ R&D Tasks (3 pages max.) ○ R&D Strategy (18 pages max.) ○ Statement of Project Objectives (1 page max.) ○ Technical Milestones and Deliverables (9 pages max.) – the Applicant must use the Technical Milestones template available on ARPA-E eXCHANGE (https://arpa-e-foa.energy.gov/) ○ Budget Summary (3 pages max.) ○ Qualifications, Experience, and Capabilities (3 pages max. for each Personal Qualifications Summary) ○ Participating Organizations (1 page max.) ○ Prior Collaboration (1 page max.) ○ Management Plan (1 page max.) ○ Multi-Investigator Projects (2 pages max.) 	Mandatory	IV.C	5 PM ET, May 23, 2012

Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A.
 Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

	<ul style="list-style-type: none"> ○ Transition/Commercialization Strategy (4 pages max.) ○ Intellectual Property Strategy (no page limit) ● The Technical Volume must be accompanied by: <ul style="list-style-type: none"> ○ SF-424 (no page limit, Adobe PDF format); ○ SF-424A (no page limit, Microsoft Excel format); ○ Budget Justification Workbook (no page limit, Microsoft Excel format); ○ Summary for Public Release (1 page, Adobe PDF format); ○ Summary Slide (1 page limit, Microsoft Powerpoint format) – the Applicant must use the Summary Slide template available on ARPA-E eXCHANGE (https://arpa-e-foa.energy.gov); ○ Completed and signed Other Sources of Funding Disclosure Form (no page limit, Adobe PDF format); and ○ Completed and signed Business Assurances Form (no page limit, Adobe PDF format). 			
<p>Reply to Reviewer Comments</p>	<ul style="list-style-type: none"> ● Each Applicant may submit a Reply to Reviewer Comments in Adobe PDF format. This submission is optional. The Reply may include: <ul style="list-style-type: none"> ○ Up to 4 pages of text; and ○ Up to 2 page of images. 	<p>Optional</p>	<p>IV.D</p>	<p>5 PM ET, June 20, 2012</p>

EXECUTIVE SUMMARY

Federal Agency	Advanced Research Projects Agency – Energy (ARPA-E), U.S. Department of Energy (DOE)
FOA Title	Energy Storage SBIR/STTR FOA
FOA Type	Initial announcement for new FOA
FOA Number	DE-FOA-0000674
CFDA Number	81.135
FOA Issue Date:	April 2, 2012
Submission Deadline for Notices of Intent	5 PM ET, May 14, 2012
Deadline for Questions to ARPA-E-CO@hq.doe.gov:	5 PM ET, May 18, 2012
Submission Deadline for Full Applications:	5 PM ET, May 23, 2012
Submission Deadline for Replies to Reviewer Comments:	5 PM ET, June 20, 2012
Expected Date for Selection Notifications:	July 2012
Means of Submission	Notices of Intent, Full Applications, and Replies to Reviewer Comments must be submitted through ARPA-E eXCHANGE (https://arpa-e-foa.energy.gov/), ARPA-E’s online application portal (see Section IV.G.1 of the FOA). ARPA-E will not review or consider applications submitted through other means. For detailed guidance on using ARPA-E eXCHANGE, please refer to the “ARPA-E eXCHANGE User Guide” (https://arpa-e-foa.energy.gov/Manuals.aspx).
Total Amount to Be Awarded	Approximately \$13 million total in SBIR/STTR funding, including approximately \$11.5 million in SBIR funding and \$1.5 million in STTR funding
Award Categories	<p>ARPA-E has established two award categories for SBIR/STTR awards: (1) Combined Phase I/II awards, and (2) Combined Phase I/II/IIS awards. [Phase II Sequential (IIS) awards fund the continuation of work on technologies developed under Combined Phase I/II awards.]</p> <p>In evaluating applications for Combined Phase I/II and Combined Phase I/II/IIS awards, ARPA-E reserves the right to fund only Phase I or Phase I and Phase II of a proposed project. However, Applicants may not apply exclusively for a Phase I award. The maximum award amount for a Phase I award is \$225,000.</p> <p>Each application may be submitted to only one of the above award categories. However, Applicants may request both SBIR funding and STTR funding under the same award category, provided they meet the separate eligibility criteria for SBIR and STTR funding. For example, an eligible Applicant may request both SBIR funding <u>and</u> STTR funding under a Combined Phase I/II award.</p>
Anticipated Awards	<p>ARPA-E may issue one, multiple, or no awards under this FOA. Combined Phase I/II awards may be funded up to \$1,725,000. Combined Phase I/II/IIS awards may be awarded up to \$3,225,000.</p> <p>Phase I of Combined Phase I/II awards and Combined Phase I/II/IIS awards may be funded up to \$225,000. Phase II and Phase IIS of Combined Phase I/II awards and Combined Phase I/II/IIS awards may each be funded up to \$1,500,000.</p>
Types of Funding Agreements	Combined Phase I/II awards and Combined Phase I/II/IIS awards will be made through cooperative agreements. Phase I will be funded on a fixed-obligation basis. Phase II and Phase IIS will be funded on a reimbursement basis.

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 Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

Period of Performance	Combined Phase I/II awards may have a project period up to 36 months (3 years). Combined Phase I/II/IIS awards may have a project period up to 48 months (4 years).		
Eligible Applicants	SBIR	A Small Business Concern may apply as a Standalone Applicant or as the lead organization for a Project Team. If applying as a lead organization, the Small Business Concern must perform at least 66.7% of the effort in Phase I and at least 50% of the effort in Phase II and Phase IIS, as measured by the Total Project Cost.	
	STTR	A Small Business Concern may apply only as the lead organization for a Project Team. The Small Business Concern must perform at least 40% of the effort in Phase I, Phase II, and Phase IIS, as measured by the Total Project Cost. Please note that every Full Application for STTR funding must include at least one Research Institution as a member of the Project Team (i.e., as a Subrecipient to a Small Business Concern).	
Eligible Domestic Subrecipients	Research Institutions, including FFRDCs, nonprofit educational institutions, and nonprofit research organizations	SBIR	May apply as a member of a Project Team (i.e., as a Subrecipient to a Small Business Concern)
		STTR	Every Full Application for STTR funding must include at least one Research Institution as a member of the Project Team (i.e., as a Subrecipient to a Small Business Concern). The Research Institution(s) must perform at least 30% of the effort for Phase I, Phase II, and Phase IIS, as measured by the Total Project Cost.
	Nonprofits other than Research Institutions		May apply as a member of a Project Team for SBIR and STTR projects (i.e., as a Subrecipient to a Small Business Concern)
	For-profit entities, including Small Business Concerns		May apply as a member of a Project Team for SBIR and STTR projects (i.e., as a Subrecipient to a Small Business Concern)
	DOE/NNSA Government-Owned Government-Operated laboratories (GOGOs)		Not eligible to apply
	Non-DOE/NNSA GOGOs		May apply as member of a Project Team for SBIR and STTR projects (i.e., as a Subrecipient to a Small Business Concern)
	State, local, and tribal government entities		May apply as member of a Project Team for SBIR and STTR projects (i.e., as a Subrecipient to a Small Business Concern)
Eligible Foreign Subrecipients	May apply as a member of a Project Team (i.e., as a Subrecipient to a Small Business Concern). However, all work by foreign entities must be performed by subsidiaries or affiliates incorporated in the United States. The Applicant may request a modification or waiver of this requirement in the Business Assurances Form that is submitted with the Full Application.		
Cost Share Requirement	Phase I	None	
	Phase II	≥ 20% of the Total Project Cost for Phase II	
	Phase IIS	≥ 20% of the Total Project Cost for Phase IIS	
Number of Applications	Each Small Business Concern may submit no more than two (2) applications to this FOA. If a Small Business Concern submits two applications to this FOA, each application must be scientifically distinct.		
Agency Contact	See Section VII.A of the FOA for guidance on submitting questions to ARPA-E.		
Application Forms	Required forms for Full Applications are available on ARPA-E eXCHANGE (https://arpa-e-foa.energy.gov), including the SF-424, SF-424A, Business Assurances Form, and Other Sources of		

Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A. Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

	<p>Funding Disclosure form. A sample response to the Other Sources of Funding Disclosure form is attached to this FOA as Appendix 2. Applicants must use the templates available on ARPA-E eXCHANGE (https://arpa-e-foa.energy.gov), including the template for the Technical Volume of the Full Application, the template for the Technical Milestones section of the Technical Volume, the Summary Slide template, and the Reply to Reviewer comments template. A sample Summary Slide is attached to this FOA as Appendix 1.</p>
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I. FUNDING OPPORTUNITY DESCRIPTION

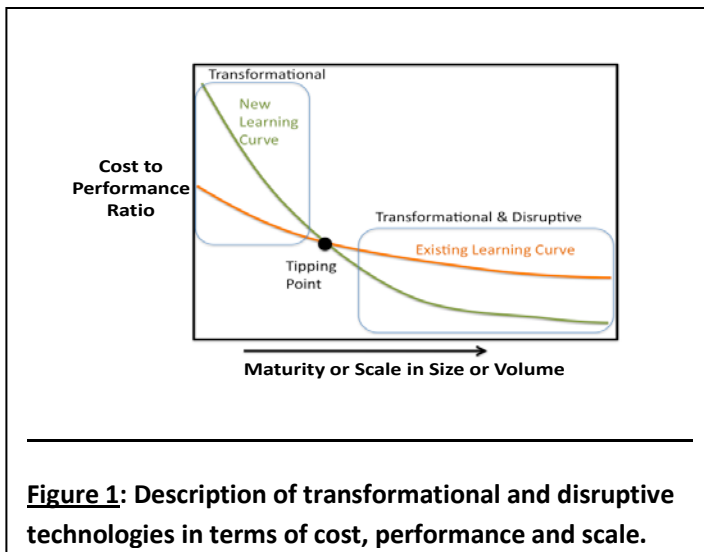
A. AGENCY OVERVIEW

The Advanced Research Projects Agency – Energy (ARPA-E) is an organization within the Department of Energy, chartered by Congress in the America COMPETES Act (Pub. L. No. 110-69) to support the creation of transformational energy technologies and systems through funding and managing Research and Development (R&D) efforts. Originally chartered in 2007, the Agency was first funded through the American Recovery and Reinvestment Act of 2009. Since that time, the Agency has funded over 180 projects totaling more than \$500 million across the entire energy technology landscape.¹

The mission of ARPA-E is to identify and fund research to translate science into transformational energy technologies that are too risky for the private sector and that, if successfully developed, will create the foundation for entirely new industries. Successful projects will address at least one of ARPA-E’s two Mission Areas:

1. Enhance the economic and energy security of the United States through the development of energy technologies that result in:
 - a. reductions of imports of energy from foreign sources;
 - b. reductions of energy-related emissions, including greenhouse gases; and
 - c. improvement in the energy efficiency of all economic sectors; and
2. Ensure that the United States maintains a technological lead in developing and deploying advanced energy technologies.

ARPA-E funds applied research and development. ARPA-E exists to fund applied research and development, defined by the Office of Management and Budget as a “study (designed) to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met” and as the “systematic application of knowledge or understanding, directed toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements.” ARPA-E funds



¹ Information on ARPA-E’s projects is available at <http://arpa-e.energy.gov/ProgramsProjects/Programs.aspx>.

technology-focused applied research to create real-world solutions to important problems in energy production, distribution and use and, as such, will not support basic research, defined as a “systematic study directed toward fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications towards processes or products in mind.” While it is anticipated that in some instances some minor aspects of fundamental science will be clarified or uncovered during the conduct of the supported applied research, the major portion of activities supported by ARPA-E are directed towards applied research and development of new technologies.

While all technology-focused applied research will be considered, two instances are especially fruitful for the creation of transformational technologies:

- the first establishment of a technology upon recently elucidated scientific principles; and
- the synthesis of scientific principles drawn from disparate fields that do not typically intersect.

ARPA-E exists to support transformational, rather than incremental, research. Technologies exist on learning curves. Following the discovery of a technology, refinements to that technology and economies of scale that accrue as manufacturing and widespread distribution develop drive technology down that learning curve until an equilibrium price is found. While this incremental improvement of technology is important to the ultimate success of a technology in the marketplace, ARPA-E exists to fund transformational research – i.e., research that creates fundamentally new learning curves rather than moving existing technologies down their learning curves.

ARPA-E funded technology has the potential to be disruptive in the marketplace. The mere creation of a new learning curve does not ensure market penetration. Rather, the ultimate value of a technology is determined by the marketplace, and impactful technologies ultimately become disruptive — that is, they are widely adopted and displace existing technologies from the marketplace or create entirely new markets. Energy technologies typically become disruptive along the process to maturity rather than close to inception, and the maturation of nascent technologies often requires significant incremental development to drives the technology down its natural learning curve to its ultimate equilibrium price (see Figure 1 above). Such development might include modification of the technology itself, the means to produce and distribute that technology, or both. Thus, while early incarnations of the automobile were transformational in the sense that they created a fundamentally new learning curve for transportation, they were not disruptive, because of the unreliability and high cost of early automobiles. Continuous, incremental refinement of the technology ultimately led to the Ford Model T; as the first affordable, reliable, mass-produced vehicle, the Model T had a disruptive effect on the transportation market.

ARPA-E will not support technology development for extended periods of time; rather, ARPA-E supports the initial creation of technology. Following initial testing of the first prototype of a

device, a system, or a process, other Federal agencies and the private sector will support the further development necessary to bring the technology to market. While ARPA-E does not require technologies to be disruptive at the conclusion of ARPA-E funding, ARPA-E will not support technologies that cannot be disruptive, if successful. Examples of such technologies are approaches that require elements with insufficient abundances or high materials costs to be deployed at scale, or technologies that could not scale to levels required to be impactful because of, for example, physical limits to productivity.

ARPA-E will not support basic research aimed at discovery and fundamental knowledge generation, nor will it undertake large-scale demonstration projects of existing technologies.

ARPA-E is not a substitute for existing R&D organizations within the Department of Energy, but rather complements existing organizations by supporting R&D objectives that are transformational and translational. Applicants interested in receiving basic research financial assistance should work with the Department of Energy's Office of Science (<http://science.energy.gov/>). Similarly, projects focused on the improvement of existing technology platforms may be appropriate for support by the applied programs – for example, the Office of Energy Efficiency and Renewable Energy (<http://www.eere.energy.gov/>), the Office of Fossil Energy (<http://fossil.energy.gov/>), the Office of Nuclear Energy (<http://nuclear.energy.gov/>), and the Office of Electricity Delivery and Energy Reliability (<http://energy.gov/oe/office-electricity-delivery-and-energy-reliability>).

ARPA-E does not own or manage any laboratories. ARPA-E will accomplish its mission by funding scientists, engineers, and technologists outside ARPA-E to perform research with the purpose of enabling major technological advances that address its mission.

Recipients of ARPA-E awards may include a full range of R&D entities. ARPA-E encourages collaboration and the mix of complementary expertise to perform the proposed R&D objectives. This may be a single performer or team, may be one or more institutions, and may include operational experts along with the research team.

In this FOA, ARPA-E proposes to support Small Business Concerns, or Project Teams led by Small Business Concerns, for the purpose of translating transformational technologies into disruptive market opportunities in the small business sector of the U.S. economy.²

² A Small Business Concern is a for-profit entity that: (1) maintains a place of business located in the United States, operates primarily within the United States, or makes a significant contribution to the United States economy through payment of taxes or use of American products, materials or labor; (2) is an individual proprietorship, partnership, corporation, limited liability company, joint venture, association, trust, or cooperative; (3) is at least 51% owned and controlled by one or more individuals who are U.S. citizens or permanent residents; and (4) has, including affiliates, no more than 500 employees. Joint ventures and limited partnerships are eligible only if each entity to the venture or limited partnership is 51% owned and controlled by one or more U.S. citizens or permanent residents.

B. APPLICATION PROCESS OVERVIEW

The first step in applying to this FOA is the timely submission of a compliant Notice of Intent, which is required to obtain a Control Number. Next, Applicants must submit a Full Application by the deadline stated in the FOA. Following ARPA-E's review of Full Applications, Applicants will receive written comments from reviewers and have a brief opportunity to submit an optional Reply to Reviewer Comments. ARPA-E will then perform a down-select of Full Applications that may include discussions and/or site visits with those remaining Applicants. ARPA-E will select Full Applications for award negotiations from this pool of remaining Applicants. ARPA-E considers a mix of quantitative and qualitative criteria (see Sections V.A and V.B.1 of the FOA) in determining whether to select a Full Application for award negotiations.

Notices of Intent, Full Applications, and Replies to Reviewer Comments must be submitted through ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov/>), ARPA-E's online application portal (see Section IV.G.1 of the FOA). ARPA-E will not review or consider applications submitted through other means. Applicants must register with ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov/Registration.aspx>) in order to submit an application to this FOA. For detailed guidance on using ARPA-E eXCHANGE, please refer to the "ARPA-E eXCHANGE User Guide" (<https://arpa-e-foa.energy.gov/Manuals.aspx>).

Applicants are responsible for meeting each submission deadline. **Applicants are strongly encouraged to submit their applications at least 48 hours in advance of the submission deadline.** Under normal conditions (i.e., at least 48 hours in advance of the submission deadline), Applicants should allow at least 1 hour to submit a Notice of Intent or Full Application. In addition, Applicants should allow at least 15 minutes to submit a Reply to Reviewer Comments by the deadline stated in the FOA. Once the application is submitted in ARPA-E eXCHANGE, Applicants may revise or update their application until the expiration date of the applicable deadline.

Applicants should not wait until the last minute to begin the submission process. During the final hours before the submission deadline, Applicants may experience server/connection congestion that prevents them from completing the necessary steps in ARPA-E eXCHANGE to submit their applications. **ARPA-E will not extend the submission deadline for Applicants that fail to submit required information and documents due to server/connection congestion.**

ARPA-E will not review or consider noncompliant applications (see Section III.F.1 of the FOA), **including incomplete applications and applications submitted after the deadline stated in the FOA.** The following errors could cause an application to be deemed "incomplete" and thus noncompliant:

- Failing to comply with the form and content requirements in Section IV of the FOA;
- Failing to enter required information in ARPA-E eXCHANGE;

- Failing to upload required document(s) to ARPA-E eXCHANGE;
- Uploading the wrong document(s) or application(s) to ARPA-E eXCHANGE; and
- Uploading the same document twice, but labeling it as different documents. (In the latter scenario, an Applicant may have failed to submit a required document.)

ARPA-E urges Applicants to carefully review their applications and allow sufficient time for the submission of required information and documents.

ARPA-E will not review or consider nonresponsive applications (see Section III.F.2 of the FOA). Any “Applications Specifically Not of Interest,” as described in Section I.F of the FOA, will be deemed nonresponsive and will not be reviewed or considered.

1. NOTICES OF INTENT

Applicants must submit a separate Notice of Intent for each Full Application through ARPA-E eXCHANGE by the deadline stated in the FOA. Failure to comply with this requirement will render the Applicant’s Full Application ineligible for consideration (see Section III.F.1 of the FOA). Section IV.B of the FOA provides instructions on submitting a Notice of Intent.

Applicants should submit a Notice of Intent early in the FOA process. The Notice of Intent consists of a short abstract and basic information about the proposed project, such as project title, lead organization, percentage of work performed by the lead organization, the Project Team (including Principal Investigator for the Prime Recipient, Team Members, and Key Participants), and Technical Category.

ARPA-E will not review or consider noncompliant Notices of Intent.

ARPA-E eXCHANGE automatically assigns a Control Number upon the submission of a compliant Notice of Intent. Once logged in to ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov/login.aspx>), Applicants may access their submissions by clicking the “My Submissions” link in the navigation on the left side of the page. Every application that the Applicant has submitted to ARPA-E and the corresponding Control Number is displayed on that page. If the Applicant submits more than one application to a particular FOA, a different Control Number is shown for each application. The Control Number must be included in the header of the Full Application and optional Reply to Reviewer Comments.

ARPA-E is using Notices of Intent to facilitate and expedite the merit review process. ARPA-E expects to receive a large number of applications, so it is essential that each application have a unique identifier. Notices of Intent also ensure that ARPA-E has sufficient reviewers in each Technical Category of interest.

2. FULL APPLICATION

Applicants must submit their Full Application by the deadline stated in the FOA. The assigned Control Number must be marked in the header of each component of the Full Application. However, Applicants may alter their project title or the composition of their Project Team between the submission of the Notice of Intent and the submission of the Full Application. Section IV.C of the FOA provides instructions on submitting a Full Application.

The Full Application consists of eight components, including the Technical Volume, Forms SF-424 and SF-424A, Budget Justification Workbook, Summary for Public Release, Summary Slide, Other Sources of Funding Disclosure Form, and Business Assurances Form. A Technical Volume template is provided as Appendix 3 to the FOA. A fillable version is available on ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov/>).

ARPA-E performs a preliminary review of Full Applications to determine whether they are compliant and responsive, as described in Section III.C of the FOA. ARPA-E will not review or consider noncompliant and/or nonresponsive Full Applications.

If selected for award negotiations, Applicants will be required to complete additional paperwork, including an Environmental Impact Questionnaire (see Section VI.B.6 of the FOA).

3. REPLY TO REVIEWER COMMENTS

Once ARPA-E has completed its review of Full Applications, reviewer comments on compliant and responsive Full Applications are made available to Applicants via ARPA-E eXCHANGE. Each Applicant will have access only to comments on its own application(s). Applicants may submit an optional Reply to Reviewer Comments, which must be submitted by the deadline stated in the FOA. The assigned Control Number must be marked in the header of the Reply. Section IV.D of the FOA provides instructions on submitting a Reply to Reviewer Comments. A Reply to Reviewer Comments template is provided as Appendix 4 to the FOA. A fillable version is available on ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov/>).

Applicants have approximately 4 calendar days from receipt of the reviewer comments to prepare and submit a Reply. The Reply to Reviewer Comments consists of four pages of text and two pages of visual displays of data.

ARPA-E performs a preliminary review of Replies to determine whether they are compliant, as described in Section III.F.1 of the FOA. ARPA-E will not review or consider noncompliant Replies. Submitting a Reply to Reviewer Comments is optional. ARPA-E will review and consider each compliant and responsive Full Application, even if no Reply is submitted or if the Reply is found to be noncompliant.

4. DOWN-SELECT PROCESS

Once ARPA-E completes its review of Full Applications and Replies to Reviewer Comments, it will perform a down-select of Full Applications. The Contracting Officer may invite certain Applicants to participate in a meeting with ARPA-E via webinar, videoconference, or conference call. In the alternative, the Contracting Officer may invite Applicants to meet in person at ARPA-E's offices, the Applicant's offices, or a mutually agreed upon location. The Contracting Officer may also arrange pre-selection site visits to certain Applicants' facilities. ARPA-E will not reimburse Applicants for travel and other expenses relating to pre-selection meetings and site visits.

The Contracting Officer may arrange one, multiple, or no pre-selection meetings and site visits. ARPA-E may select applications for funding and make awards without pre-selection meetings and site visits. Participation in a pre-selection meeting or site visit with ARPA-E does not signify that Applicants have been selected for award negotiations.

ARPA-E may obtain additional information through pre-selection meetings and site visits that will be used to make a final selection determination.

5. SELECTION FOR AWARD NEGOTIATIONS

ARPA-E carefully considers all of the information obtained through the application process and makes an independent assessment of each compliant and responsive Full Application based on the criteria and program policy factors in Sections V.A and V.B.1 of the FOA. ARPA-E may select or not select a Full Application for award negotiations. ARPA-E may also postpone a final selection determination on one or more Full Applications until a later date, subject to availability of funds and other factors. ARPA-E will enter into award negotiations only with selected Applicants.

Applicants are promptly notified of ARPA-E's determination. ARPA-E may stagger its selection determinations. As a result, some Applicants may receive their notification letter in advance of other Applicants. Please refer to Section VI.A of the FOA for guidance on award notifications.

C. SBIR/STTR PROGRAM OVERVIEW

The Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs are Government-wide programs authorized under Section 9 of the Small Business Act (15 U.S.C. § 638). The objectives of the SBIR program are to (1) stimulate technological innovation in the private sector, (2) strengthen the role of Small Business Concerns in meeting Federal R&D needs, (3) increase private sector commercialization of innovations derived from Federal R&D activities, (4) foster and encourage participation by socially and economically disadvantaged and women-owned Small Business Concerns, and (5) improve the return on investment from Federally funded research and economic benefits to the Nation. The objective

of the STTR program is to stimulate cooperative partnerships of ideas and technologies between Small Business Concerns and partnering Research Institutions through Federally funded R&D activities.³

ARPA-E administers a joint SBIR/STTR program in accordance with the Small Business Act and the SBIR and STTR Policy Directives issued by the U.S. Small Business Administration (SBA).⁴ ARPA-E provides SBIR/STTR funding in three phases (Phase I, Phase II, and Phase IIS).

D. PROGRAM BACKGROUND

This program seeks to fund the development of transformational technologies that reduce the barriers to mass adoption of electrical energy storage for stationary and transportation applications.

1. STATIONARY

Emerging challenges in integrating renewable generation and highly variable loads with the existing electrical grid has motivated the development of low-cost stationary energy storage technology which could transform the U.S. electric power grid industry.⁵ Electric energy storage separates generation capacity and variable demand in space and time, with potential applications ranging from long-duration bulk energy storage to short-duration power quality and frequency regulation balancing.⁶ Traditionally, electric energy storage was developed to increase base-load demand by shifting bulk energy produced when loads are low at night to when demand is high during the day. The incumbent technology for storage is pumped hydropower, which increases generation asset utilization from base-load resources, such as nuclear or coal generators. New opportunities for the application of electrical energy storage have emerged with the high-penetration variable non-dispatchable renewable generation sources such as wind and solar, and changes in distribution feeder load profiles, for example local clusters of high-throughput electric vehicle charging stations. In addition, the increase in deployment of distributed renewable generation enabled by low-cost photovoltaics creates a potential need for storage resources at the perimeter of the grid, including low-cost storage on the consumer side of the meter to convert intermittent distributed generation assets into reliable low-cost power and to avoid peak loads on the centralized grid.

³ Research Institutions include FFRDCs, nonprofit educational institutions, and other nonprofit research organizations owned and operated exclusively for scientific purposes. Eligible Research Institutions must maintain a place of business in the United States, operate primarily in the United States, or make a significant contribution to the U.S. economy through the payment of taxes or use of American products, materials, or labor.

⁴ See 67 Fed. Reg. 60072 (Sept. 24, 2002); 70 Fed. Reg. 74926 (Dec. 16, 2005).

⁵ Boston Consulting Group, "Revisiting Energy Storage: There is a Business Case" (2011), www.bcg.com/documents/file72092.pdf.

⁶ Electric Power Research Institute, "Electricity Energy Storage Technology Options: A White Paper Primer on Applications, Costs and Benefits", Product ID: 1020676 (2010), www.epri.com.

In 2010, the Advanced Research Projects Agency-Energy (ARPA-E) initiated the Gridscale Rampable Intermittent Dispatchable Storage (GRIDS) program to specifically focus on the development of transformational approaches to low-cost, scalable, high-capacity storage technologies that, if successful, have the potential to meet requirements for regulating reserve capacity relative to intermittent power ramp events on the grid.⁷ Since this time, new scientific advances have been reported that may enable use-driven research and development towards the ubiquitous deployment of low-cost stationary energy storage systems.⁸ In addition, issues related to the high-penetration of renewable resources in specific regions of the U.S. power grid have become a serious consideration, potentially limiting the ability to add additional renewable generation assets.⁹ This research and development funding announcement is motivated by both new, use-driven research opportunities derived from technical requirements contained in the previous GRIDS solicitation and the emergence of new challenges for the electric grid.

The specific new opportunities in stationary storage presented in this solicitation are

- (1) Low-cost storage for electric distribution systems supporting high local-penetration of electric vehicles (EVs) with high-throughput charging demands; and
- (2) Low cost storage for both residential and commercial customer-side of the meter applications.

2. TRANSPORTATION

The widespread deployment of cost-effective electrified light-duty vehicles represents a tremendous opportunity for dramatic reductions in U.S. oil imports by shifting the U.S. transportation energy supply from petroleum to electricity. In 2008, the transportation sector alone represented 70% of all U.S. petroleum consumption, 57% of which came from foreign sources. At the same time, nearly 95% of the nation's transportation energy came from petroleum, with light-duty vehicles accounting for more than 60% of this total.¹⁰

In addition to economic benefits, electric vehicles have the potential to dramatically reduce greenhouse gas emissions. The U.S. transportation sector is the single greatest contributor to the nation's greenhouse gas emissions, accounting for ~ 30% of all U.S. carbon dioxide emissions.¹¹ On a well-to-wheel basis, electric vehicles produce ~ 38% less CO₂ emissions than gasoline-powered vehicles, assuming the national average for electrical energy sources (50%

⁷ Gridscale Rampable Intermittent Dispatchable Storage (GRIDS) program FOA, arpa-e-foa.energy.gov/Default.aspx?Archive=1.

⁸ Pratt, H.D., Alyssa, J.R., Staiger, C.L., Ingersoll, D., Anderson, T.M., 40 DALTON TRANSACTIONS 11396-11401 (2011); Wessels, C.D., Huggins, R.A., Cui, Y. 2 Nature Communications 550 (Nov. 22 2011).

⁹ Kamath, C., Transmission and Distribution Conference and Exposition, 2010 IEEE PES (2011).

¹⁰ U.S. Department of Energy, Energy Information Agency, <http://www.eia.doe.gov>.

¹¹ "Inventory of Greenhouse Gas Emissions and Sinks: 1990-2007", Environmental Protection Agency, Report No: EPA 430-R-09-004 (2009).

coal, 18% gas, and 3% oil).¹² Further reductions in CO₂ emissions are anticipated from electric vehicle adoption as the U.S. electrical grid continues to decarbonize.

In order to realize the economic and environmental benefits of wide-spread electric vehicle adoption, batteries should provide for a driving range of at least 300 miles on a single charge and be competitively priced with conventional gasoline-powered vehicles. Today's commercially available lithium-ion batteries for electric vehicles have an energy density and cost of about 120 Wh/kg and 500 \$/kWh, respectively, at the pack-level, or about 200 Wh/kg and 300 \$/kWh at the cell-level. At these levels, a battery pack that can deliver sufficient energy for a 300 mile range (85 kWh) would cost roughly \$40,000.¹³ Widespread adoption of electric vehicles will require battery cells with more than double current state of the art energy densities (> 400 Wh/kg) at a third the cost (< 100 \$/kWh). Despite recent progress in both cost and performance, chemistry-based energy density limitations may prevent current lithium-ion battery technology from achieving these goals.

In this Small Business Innovation Research (SBIR) Funding Opportunity Announcement (FOA), ARPA-E seeks to fund the development of a new generation of ultra-high energy density, low-cost battery technologies capable of providing sufficient performance and cost to enable the widespread deployment of all-electric, long-range vehicles. The ambitious targets for this FOA are largely based upon the long term electric vehicle (EV) battery goals set by the United States Advanced Battery Consortium (USABC).¹⁴ ARPA-E seeks to fund high risk, high reward research efforts that, if successful, will have a transformational impact on the rate and scale of deployment of all-electric, long-range vehicles.

The specific new opportunities in automotive storage presented in this solicitation are:

- (1) New battery chemistries;
- (2) New battery architectures; and
- (3) Novel electric storage systems.

¹² U.S. Department of Energy, Advanced Fuels & Advanced Vehicles Data Center, "Emissions from Hybrid and Plug-In Electric Vehicles" (2011), http://www.afdc.energy.gov/afdc/vehicles/electric_emissions.php.

¹³ Based on ARPA-E calculations using data from Tesla Motors, <http://www.teslamotors.com/models/options>

¹⁴ United States Council on Automotive Research, United States Advanced Battery Consortium (USABC), "USABC Goals for Advanced Batteries for EVs," <http://www.uscar.org/guest/tlc/3/Energy-Storage-TLC>.

E. PROGRAM OBJECTIVES

1. STATIONARY

This solicitation is focused on two emerging research areas for low-cost stationary energy storage: (1) low-cost, grid-scale storage, particularly for electric distribution systems supporting high local-penetration of electric vehicles with high-rate charging demands and (2) low-cost storage for consumer-side of the meter applications. Cost, round-trip efficiency, scalability, safety, and reliability are key drivers for any energy storage technology used for the electrical power grid. Additional considerations include issues such as power and energy density, depending on the specific intended application. All other technical attributes being equal, the lowest cost solution is obviously preferred for stationary applications, providing optimal consumer value under a given regulatory environment and the shortest investment recovery time. In addition, storage technologies must compete with non-storage solutions with similar electrical resource attributes, such as distributed generation or demand response. Consequently, energy and power costs for a new storage technology must have the potential to be less expensive than non-storage alternatives in order to achieve market adoption. Particularly in a small-business framework, consideration of transformational new storage technologies must present a low-cost pathway in order to ultimately have disruptive impact on the electrical power system.

2. TRANSPORTATION

This opportunity is focused on the development of advanced electrical energy storage systems with the potential to provide electrical energy storage for vehicles with cell-level specific and volumetric energy densities exceeding 400 Wh/kg and 600 Wh/L, respectively, and with an electrode materials cost under \$50/kWh. The ability for proposed battery technologies to achieve target metrics on a number of other key performance parameters (detailed below) is of significance, but of secondary importance.

New battery chemistries with high theoretical energy densities are of particular interest for this funding opportunity. The development of traditional lithium-ion based batteries using carbon-based anodes with lithium metal oxide intercalation cathodes (LiM_xO_y , where $M = \text{V, Ni, Co, Mn, FeP}$) are not of interest because other U.S. battery research and development programs¹⁵ are actively engaged in their development.

F. TECHNICAL CATEGORIES OF INTEREST

This program is focused on supporting the development of breakthrough solutions in electrical energy storage for stationary and transportation applications. Research and development

¹⁵ U.S. Department of Energy, Office of Vehicle Technologies, Energy Storage, Batteries, http://www1.eere.energy.gov/vehiclesandfuels/technologies/energy_storage/batteries.html; see also U.S. Advanced Battery Consortium, <http://www.uscar.org/guest/teams/12/U-S-Advanced-Battery-Consortium>.

projects that address the Primary and Secondary Technical Targets described in Section I.F of the FOA are encouraged. ARPA-E will accept applications that provide a well-justified, realistic potential of meeting or exceeding all of the Primary and Secondary Technical Targets. Favorable consideration will be given to applicants who show they can meet or exceed all Primary Technical Targets within the time frame of the award for the following area of interest categories:

1. CATEGORY 1: RAMPABLE INTERMITTENT DISPATCHABLE STORAGE TECHNOLOGIES

The following topics are of particular interest for this category:

- Investigation of technologies with the potential to achieve extremely low cost and high scalability stationary energy storage for deployment on the electric power grid. Such technologies might include, but are not limited to: batteries, flow-batteries, flywheels, superconductors, supercapacitors and compressed air systems;
- Investigation of new materials or component level approaches to membrane assemblies, long lifetime electrodes, high energy density electrolytes, safe and reliable chemistries and high critical current density superconductors, which if successfully developed would provide breakthrough capabilities in energy storage systems. For such investigation, researchers who might be working on sub-system materials or component level innovations are highly encouraged to partner with energy storage system technologists as a means of evaluating system level functionality resulting from breakthroughs in the proposed effort.
- Electric energy storage technologies based on new chemistries or physical properties not previously supported by ARPA-E or previously developed for commercial application;
- Technologies which have the potential to greatly exceed one or more primary technical targets; and
- Technologies with the potential to provide power ramp support needed as a result of a high local penetration of electric vehicle charging demand (particularly for fast charging stations) on the distribution grid are of particular interest.

The following topics are specifically not of interest for this category under this FOA (see Section I.H of the FOA):

- Technologies that do not store energy in a manner compatible with returning it to the power grid on an efficient energy-in to energy-out (electric) basis.

- Thermal energy storage that does not provide a technical pathway for electrical energy-in to electrical energy-out.
- Electrical battery management systems, unless connected specifically to a proposed energy storage mechanism for control.
- Approaches for the hybridization of two or more energy storage technologies as a system through advanced battery management systems.
- Simulations or computer models of energy storage systems which do not include innovation related to any specific energy storage mechanisms.

2. CATEGORY 2: STORAGE TECHNOLOGIES FOR UBIQUITOUS DEPLOYMENT BY CUSTOMERS

The following topics are of particular interest for this category:

- Investigation of stationary energy storage technologies with the potential for deployment in small, modular, extremely low-cost units on electric customer locations. Such technologies might included, but are not limited to: batteries, flow-batteries, flywheels, superconductors, supercapacitors and compressed air systems;
- Investigation of new materials or component level approaches to membrane assemblies, long lifetime electrodes, high energy density electrolytes, safe and reliable chemistries and high critical current density superconductors, which if successfully developed would provide breakthrough capabilities in energy storage systems. For such investigation, researchers are highly encouraged to partner with potential energy storage system technologists as a means of evaluating system level functionality resulting from component or materials level breakthroughs in the proposed effort.
- Electric energy storage technologies based on new chemistries or physical properties not previously supported by ARPA-E or previously developed for potential commercial application; and
- Technologies capable of providing more than one electrical energy storage attribute, for example renewable energy firming and frequency regulation.

The following topics are specifically not of interest for this category under this FOA (see Section I.H of the FOA):

- Technologies that do not store energy in a manner which has a capacity for returning it to the electric power grid on an efficient power-in to power-out (electric) basis.

- Thermal energy storage which does not provide a technical pathway for electrical power-in to electrical power-out (electric) as a system
- Electrical battery management system, unless connected specifically to a proposed energy storage mechanism being controlled.
- Approaches for the hybridization of two or more energy storage technologies as a system through advanced battery management systems.
- Simulations or computer models of energy storage systems which do not include innovation related to any specific energy storage mechanisms.

3. CATEGORY 3: HIGH ENERGY DENSITY ELECTRICAL ENERGY STORAGE FOR TRANSPORTATION

The following topics are of particular interest for this category:

- Non-lithium based battery chemistries, including Al, Mg, and F-ion approaches with the potential for high energy density, low cost, and long cycle life;
- Metal-air battery approaches that address the low cycle life, power density, and round-trip efficiency of current approaches; especially related to improvements in bifunctional air cathodes;
- Novel battery architectures, including 3D batteries that address cell shorting and scale-up issues of current approaches;
- New electrolytes, such as solid state ion conductors or ionic liquids with enhanced chemical and electrochemical stability and high rate capability;
- Metal-sulfur battery approaches that address the low cycle life and high self-discharge of existing state-of-the-art technology;
- Advanced lithium-ion based battery systems that greatly exceed the energy density of existing traditional lithium-ion based systems, including displacement reaction cathodes and advanced anode chemistries; and
- Other novel electrical energy storage approaches with potential for very high energy density and low cost.

The following topics are specifically not of interest for this category under this FOA (see Section I.H of the FOA):

- Electrical battery management system, unless connected specifically to a proposed energy storage mechanism being controlled.
- Approaches for the hybridization of two or more energy storage technologies as a system through advanced battery management systems.
- Simulations or computer models of energy storage systems which do not include innovation related to any specific energy storage mechanisms.

G. TECHNICAL PERFORMANCE TARGETS

1. CATEGORY 1: RAMPABLE INTERMITTENT DISPATCHABLE STORAGE TECHNOLOGIES

New technologies with the potential to meet, or significantly exceed the primary and secondary technical targets of the GRIDS program are of high interest. Two areas of particular interest are (1) newly developed phenomena or scientific understanding that, if successfully developed, would provide a new technical pathway to meeting the targets, or (2) adjacent or subsequent technical challenges that would move emergent scientific approaches towards disruptive impact opportunities. Such adjacent or subsequent technical challenges might include innovative balance of plant components for the scalable development of technologies showing initial promise, but for which there remains too much technical uncertainty for private sector support.

PRIMARY TECHNICAL TARGETS

ID	Category	Value (Units)
1.1.1	System capital cost, per unit rated energy capacity at rated power	< \$100/kWh
1.1.2	Operating time at rated power (at rated power for charge or discharge)	1 hr, minimum
1.1.3	Response time, to rated power (change from 0% to 100% rated power, charge or discharge)	10 minutes, maximum
1.1.4	Rated power, charge or discharge in systems demonstration prototype	>2 0 kW, (subsequently scalable to > 1MW)
1.1.5	Round trip efficiency	> 80%
1.1.6	Cycle life	> 5000 cycles

SECONDARY TECHNICAL TARGETS

ID	Category	Value (Units)
1.2.1	Scalability	Potential for subsequent scaling to grid-scale deployment (1-10 MW), assessed at

Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A. Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

		the energy/power ratio of the proposed small scale system demonstration prototype.
1.2.2	Calendar life	10 year minimum
1.2.3	Internal losses	<5% loss per 24 hrs from fully charged
1.2.4	Safety	Consistent with transmission and distribution grid deployment at unattended locations.
1.2.5	Dwell time	Maximum 10 minutes for reversal between charge and discharge cycles.
1.2.6	Interoperability	Interface with Smart Grid Interoperability Panel standards for storage assets.

ARPA-E will not select projects for award that do not clearly demonstrate realistic, well justified potential to meet or exceed the Primary Technical Requirements. With regard to Primary Technical Requirement 1.1.1 (system level capital cost), ARPA-E understands that small business applicants may not have access to sophisticated energy storage systems cost modeling. Still, it is expected that applicants will make a strong effort to justify how the technology holds promise to meet the \$100/kWh cost target. The cost target is intended to be a forward looking consideration of energy storage system costs, including power conditioning system and balance of plant, assuming successful technology development as an advanced prototype, and subsequent scaling of manufacturing for grid-scale deployment.

2. CATEGORY 2: STORAGE TECHNOLOGIES FOR UBIQUITOUS DEPLOYMENT BY CUSTOMERS

The vision for ubiquitous energy storage deployment is based on a notional system of 2.5 kW power rating (charge or discharge) with up to 4 hr duration and a footprint equivalent to that of an appliance, such as a refrigerator, to be deployed on the consumer-side of the electricity meter as a distributed energy storage resource.¹⁶ This system will facilitate the ubiquitous adoption of storage with a cost target of \$1000, such that the capital investment would be recovered in 3-5 years through an avoidance of peak demand at a time-of-day pricing differential of \$0.10 per kWh-e.^{17,18} Such a storage technology on the customer-side of the meter would provide additional attributes for balancing and firming distributed renewable generation resources, uninterruptible power supply quality services and local back-up

¹⁶ The term “customer” may refer to deployment by either residential consumers or commercial and industrial customers of the proposed modular, small-scale energy storage technologies.

¹⁷ ARPA-E Calculation: At \$1000 for a 2.5kW / 4 hr (10kWh) storage system, at 80% round trip efficiency and 1250 cycles is \$0.10 / kWh-e at full rated depth of discharge.

¹⁸ While time-of-day pricing is not a wide-spread cost structure at present, particularly for residential electricity consumers, the availability of the proposed technology would enable the deployment of such electric pricing policies for distributed electric assets. Initial markets for the proposed technology, if successfully developed, might be in small commercial and industrial applications where time-of-use pricing or similar peak charging mechanisms currently exist.

emergency power resources. If successfully developed, the proposed customer-side of meter storage would be an alternative or compliment to community energy storage systems.¹⁹ It is assumed that cost-effective infrastructure technologies, such as advanced metering and fault protection, will be available at a cost that enables two-way power flow and distributed electric resource integration. The small-scale (2.5 kW) system could individually support either single residence or small business energy resources. The proposed system with modular unit combined in parallel could support larger scale business, multi-unit residence or industrial applications on a cost-effective basis for energy storage and back-up power requirements.

PRIMARY TECHNICAL TARGETS

ID	Category	Value (Units)
2.1.1	Rated power (charge/discharge)	2.5 kW
2.1.2	Duration at power	4 hour minimum
2.1.3	Target cost: total system, including storage management electronics and balance of plant	\$1000 per unit (ultimate target)
2.1.4	Nominal size	1.2 cubic meters ²⁰
2.1.5	Round trip efficiency	> 80%
2.1.6	Minimum cycle life (at rated depth of discharge)	> 1250 cycles

SECONDARY TECHNICAL TARGETS

ID	Category	Value (Units)
2.2.1	Scalability	Parallel installation functionality
2.2.2	Sustainability (Loss over time)	<2% loss in charge over 24 hrs
2.2.3	Safety	Residential and commercial indoor building code compliance for materials, construction and electrical standards.
2.2.4	Life-Cycle Durability (at rated depth of charge / discharge)	5000 cycles
2.2.5	Functionality	Multi-attribute capability (frequency regulation, bulk storage, UPS, peaking)
2.2.6	Interoperability	Smart Grid Interoperability Panel (SGIP) standards compatible
2.2.7	Installation	110V/30A 60Hz circuit or equivalent, as defined by the proposer

¹⁹ Rastler, D., Kamath, H., EPRI JOURNAL (Summer 2010) 20-23.

²⁰ The notional footprint is 0.8m x 0.8m x 1.9m, with a mass of 150 kg such that it does not exceed typical building codes for floor loading for the complete system

ARPA-E will not consider selecting projects for award that do not clearly demonstrate realistic, well justified potential to meet or exceed the Primary Technical Requirements. With regard to Primary Requirement 2.1.3, ARPA-E understands that small business applicants may not have access to sophisticated energy storage systems cost modeling. It is expected that all applicants will make a strong effort to justify how the proposed technology holds promise to meet this FOA’s \$1000 system cost target at rated power and energy. The cost target is intended to be a forward looking consideration of energy storage system costs, including power conditioning system and balance of plant, assuming successful technology and subsequent scaling of manufacturing for ubiquitous deployment.

3. CATEGORY 3: HIGH ENERGY DENSITY ELECTRICAL ENERGY STORAGE FOR TRANSPORTATION

The final deliverable for this category is cell performance data that meets all the primary technical targets and as many secondary technical targets as technically feasible, as listed below.

PRIMARY TECHNICAL TARGETS

ID	Category	Value (Units)
3.1.1	Specific energy density	> 400 Wh/kg
3.1.2	Volumetric energy density	> 600 Wh/L
3.1.3	Electrode materials cost	< 50 \$/kWh

METRIC DESCRIPTIONS – PRIMARY TECHNICAL TARGETS

- 3.1.1. The program target specific energy density metric is for a cell discharged at rate of C/3 to 100% depth of discharge and includes the entire mass of the cell (electrodes + electrolyte + current collectors + container). As a justification for how this metric may be achieved for a specific chemistry, applications should include anticipated positive and negative electrode half reactions, total cell reactions, equilibrium cell voltages E_{cell} , and theoretical specific energy densities $U_m = -nFE_{cell} / \sum_i M_i$, where n is the number of electrons, F the Faraday constant (26.8 Ah/mol), and $\sum_i M_i$ the sum of the reactant molecular weights.
- 3.1.2. The program target volumetric energy density metric is for a cell discharged at rate of C/3 to 100% depth of discharge and includes the geometric volume of the entire cell (electrodes + electrolyte + current collectors + container). As a justification for how this metric may be achieved for a specific chemistry, applications should include the theoretical volumetric energy density $U_v = -nFE_{cell} / \sum_i V_i$, where $\sum_i V_i$ the sum of the reactant molar volumes (for metal-air batteries, the product molar volumes should be used).

Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A.
 Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

3.1.3. The program targets a “realized” electrode materials cost $C_{\text{real}} = \sum_i w_i P_i / U_{m,D}$, where w_i and P_i are the mass fraction and market price of electrode component i , and $U_{m,D}$ the measured specific energy at C/3 discharge. As a justification for how this metric may be achieved for a specific chemistry, applications should include an “estimated” minimum electrode materials cost $C_{\text{est}} = \sum_i w_i P_i / U_m$, where U_m is the theoretical specific energy density calculated for 3.1.1.

SECONDARY TECHNICAL TARGETS

ID	Category	Value (Units)
3.2.1	Specific power density	> 800 W/kg
3.2.2	Volumetric power density	> 1200 W/L
3.2.3	Cycle life	> 100 cycles
3.2.4	Energy efficiency	> 80%
3.2.5	Self-discharge	< 15%/mo

METRIC DESCRIPTIONS – SECONDARY TECHNICAL TARGETS

- 3.2.1. The specific power density targeted for the metric is obtained by discharging for duration of 30 s from a state of 80% depth of discharge and includes the entire mass of the cell (electrodes + electrolyte + current collectors + container).
- 3.2.2. The volumetric power density targeted for the metric is obtained by discharging for duration of 30 s from a state of 80% depth of discharge and includes the entire volume of the cell (electrodes + electrolyte + current collectors + container).
- 3.2.3. The cycle life target is defined by the number of charge-discharge cycles at C/3 to 80% depth of discharge until the cell degrades to 80% of its initial energy density.
- 3.2.4. The energy efficiency or round-trip efficiency metric is defined as the discharge energy divided by the charge energy at charge-discharge rate of C/3.
- 3.2.5. The self-discharge target metric is defined as a cell self-discharge rate in terms of percentage loss of initial specific energy density per month.

H. APPLICATIONS SPECIFICALLY NOT OF INTEREST

The following types of applications will be deemed nonresponsive and will not be reviewed or considered (see Section III.F.2 of the FOA):

- Applications submitted by entities or organizations other than Small Business Concerns.

Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A. Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

- For the STTR program, applications submitted without one Research Institution as a member of the project team.
- Applications that fall outside the “Technical Categories of Interest” specified in Section I.F of the FOA, including but not limited to:
 - The projects described as “specifically not of interest” in Section I.F of the FOA.
 - Incremental improvements to lithium-ion batteries.
 - Component innovations that are not validated through demonstration of device and/or system level performance demonstration.
 - Technology areas that have already received significant support from the DOE Office of Vehicles (including its Batteries for Advanced Transportation Technologies (BATT) program) and the United States Automotive Battery Consortium.
 - Technology areas with clear technology show stoppers in any of the Primary Technical Requirements or Secondary Technical Targets that are not addressed clearly by the applicant.
- Similar applications submitted to other pending ARPA-E FOAs. (Applications submitted to this FOA must be scientifically distinct from applications submitted to other pending ARPA-E FOAs.)
- Applications for basic research aimed at discovery and fundamental knowledge generation.
- Pilot-plant demonstrations that do not include a significant degree of technical risk or requirement for scientific research.
- Applications for large-scale demonstration of existing technologies.
- Applications for proposed technologies that represent incremental improvements to, or combinations of, existing products or technologies with no additional advances in understanding or reduction in technical uncertainty, including incremental improvements to technologies previously supported by ARPA-E.
- Applications for proposed technologies that are not based on sound scientific principles (e.g., violates a law of thermodynamics).
- Applications for proposed technologies that are not transformational, as described in Section I.A of the FOA. Transformational, as illustrated in Figure 1 in Section I.A of the FOA, is the promise of high payoff in some sector of the energy economy.

- Applications for proposed technologies that do not have the potential to become disruptive in nature, as described in Section I.A of the FOA. Technologies must be scalable such that they could be disruptive with sufficient technical progress (see Figure 1 in Section I.A of the FOA).

II. AWARD INFORMATION

A. AWARD OVERVIEW

ARPA-E expects to make approximately \$13 million available for new awards under this FOA, subject to the availability of appropriated funds. ARPA-E anticipates making approximately 4-8 awards under this FOA. ARPA-E may issue one, multiple, or no awards.

ARPA-E will accept only new applications under this FOA. Applicants may not seek renewal or supplementation of their existing awards.

Each Full Application must identify the award category under which it is seeking funding (see Section IV.C.1 of the FOA). ARPA-E has established two award categories for this FOA. **A Full Application may not request funding under more than one award category.**

- **Combined Phase I/II Awards** are intended to develop transformational technologies with disruptive commercial potential. Such commercial potential may be evidenced by (1) cost sharing or follow-on funding by private or non-SBIR/STTR sources, or (2) the Small Business Concern's record of successfully commercializing technologies developed under prior SBIR/STTR awards. Combined Phase I/II awards may be funded up to \$1,725,000 and have a period of performance up to 36 months (3 years). ARPA-E anticipates making 1-3 awards in this category.
- **Combined Phase I/II/IIS Awards** are similar to Combined Phase I/II awards, but include a "sequential" (i.e., additional) Phase II award, a.k.a. Phase IIS award, to allow the continued development of promising energy technologies. Combined Phase I/II/IIS awards may be funded up to \$3,225,000 and may have a period of performance up to 48 months (4 years). ARPA-E anticipates making 3-5 awards in this category.

In evaluating applications for Combined Phase I/II and Combined Phase I/II/IIS awards, ARPA-E reserves the right to fund only Phase I or Phase I and Phase II of a proposed project. Applicants may not apply exclusively for a Phase I award. The maximum award amount for a Phase I award is \$225,000.

Although each Full Application must designate a single award category, the Applicant may request both SBIR and STTR funding for that category. A Small Business Concern may request both SBIR and STTR funding under the same award category if:

- The Small Business Concerned is partnered with a Research Institution;
- The Small Business Concern performs at least 66.7% of the work in Phase I and at least 50% of the work in Phase II and/or Phase IIS (as applicable), as measured by the Total Project Cost;
- The partnering Research Institution performs 30-33.3% of the work in Phase I and 30-50% of the work in Phase II and/or Phase IIS (as applicable), as measured by the Total Project Cost; and
- The Principal Investigator (PI) is employed by the Small Business Concern. If the PI is employed by the Research Institution, the application will be considered only under the STTR program.

B. ARPA-E FUNDING AGREEMENTS

1. COOPERATIVE AGREEMENTS

ARPA-E uses cooperative agreements to provide financial and other support to Prime Recipients. Cooperative agreements involve the provision of financial or other support to accomplish a public purpose of support or stimulation authorized by Federal statute. Under cooperative agreements, the Government and Prime Recipients share responsibility for the direction of projects.

Phase I of Combined Phase I/II awards and Combined Phase I/II/IIS awards will be made on a fixed-obligation basis.²¹ Phase II and Phase IIS of Combined Phase I/II awards and Combined Phase I/II/IIS awards will be made through on a reimbursement basis.²²

²¹ Fixed-obligation payments will be made according to the following payment schedule: (1) up to 20% of funding of Phase I funding will be paid to the Prime Recipient based on the submission of a Project Plan and invoice; (2) up to 60% of Phase I funding will be paid to the Prime Recipient based on submission of deliverables; and (3) 20% of Phase I funding will be paid to the Prime Recipient at the end of the Phase I budget period, upon submission of a final report to ARPA-E documenting its achievement of final technical milestones and describing project accomplishments. Upon request, Prime Recipients are required to provide additional information and documentation showing their achievement of the technical milestones. Prime Recipients are required to comply with agency-specific and programmatic requirements.

²² To request reimbursement, Prime Recipients must submit: (1) a Standard Form (SF) 270 (“Request for Advance or Reimbursement”); (2) a “Reimbursement Request Spreadsheet,” which must contain the information shown in Appendix B to Attachment 1 of the “ARPA-E Model Cooperative Agreement for SBIR/STTR Awards” (<http://arpa-e.energy.gov/SBIRSTTR.aspx>); and (3) supporting documentation, which may consist of summary information (e.g.,

ARPA-E encourages Prime Recipients to review the “ARPA-E Model Cooperative Agreement for SBIR/STTR Awards” in advance of award negotiations (<http://arpa-e.energy.gov/SBIRSTTR.aspx>). ARPA-E created this Model Cooperative Agreement to facilitate and expedite award negotiations. **By submitting a Full Application, the Applicant accepts all terms and conditions in the ARPA-E Model Cooperative Agreement for SBIR/STTR Awards.** ARPA-E will consider only changes to the model agreement that are specifically provided and requested in the Business Assurances Form submitted with the Full Application.

2. FUNDING AGREEMENTS WITH FFRDCs, GOGOs, AND FEDERAL INSTRUMENTALITIES²³

Any Federally Funded Research and Development Centers (FFRDCs) involved as a member of a Project Team must complete the “FFRDC Authorization” and “Field Work Proposal” section of the Business Assurances Form, which is submitted with the Applicant’s Full Application.

When a FFRDC or non-DOE/NNSA GOGO is a *member* of a Project Team, ARPA-E executes a funding agreement directly with the FFRDC or non-DOE/NNSA GOGO and a single, separate cooperative agreement with the rest of the Project Team. Notwithstanding the use of multiple agreements, the Prime Recipient under the cooperative agreement is the lead organization for the entire project, including all work performed by the FFRDC or non-DOE/NNSA GOGO and the rest of the Project Team.

Funding agreements with DOE/NNSA FFRDCs take the form of Work Authorizations issued to DOE/NNSA FFRDCs through the DOE/NNSA Field Work Proposal system for work performed under Department of Energy Management & Operation Contracts. Funding agreements with non-DOE/NNSA FFRDCs, GOGOs, and Federal instrumentalities (e.g., Tennessee Valley Authority) generally take the form of Interagency Agreements. Any funding agreement with a FFRDC or non-DOE/NNSA GOGO will have substantially similar terms and conditions as the “ARPA-E Model Cooperative Agreement for SBIR/STTR Awards” (<http://arpa-e.energy.gov/SBIRSTTR.aspx>).

C. STATEMENT OF SUBSTANTIAL INVOLVEMENT

Under cooperative agreements, ARPA-E is substantially involved in the direction of projects from inception to completion. For the purposes of an ARPA-E cooperative agreement, substantial Involvement means:

printouts from internal financial systems) or detailed documentation (e.g., invoices on appropriate letterhead, time cards, travel vouchers). The supporting documentation must show the method by which the Prime Recipient calculated the total Federal share and non-Federal cost share. Upon request, Prime Recipients are required to provide additional information and documentation to support invoices.

²³ DOE/NNSA GOGOs are not eligible to apply for funding, as described in Section III.A of the FOA.

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Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

- ARPA-E does not limit its involvement to the administrative requirements of the ARPA-E funding agreement. Instead, ARPA-E has substantial involvement in the project as a whole.
- ARPA-E may intervene at any time to address the conduct or performance of project activities.
- ARPA-E Program Directors share responsibility with Prime Recipients for the direction of projects. During award negotiations, ARPA-E Program Directors establish an aggressive schedule of quantitative milestones and deliverables that must be met every quarter. Prime Recipients document the achievement of these milestones and deliverables in quarterly progress reports, which are reviewed and evaluated by ARPA-E Program Directors. ARPA-E Program Directors visit each Prime Recipient at least twice per year, and hold periodic meetings, conference calls, and webinars with Project Teams. ARPA-E Program Directors may modify or terminate projects that fail to achieve predetermined technical milestones and deliverables.
- Prime Recipients are required to submit detailed quarterly technical and financial reports on the project, as described in Attachment 4 to the “ARPA-E Model Cooperative Agreement for Phase II and Phase IIS SBIR/STTR Awards” (<http://arpa-e.energy.gov/SBIRSTTR.aspx>).
- ARPA-E reviews reimbursement requests for compliance with applicable Federal cost principles and Prime Recipients’ cost share obligations for Phase II and Phase IIS of Combined Phase I/II awards and Combined Phase I/II/IIS awards. Upon request, Prime Recipients are required to provide additional information and documentation to support claimed expenditures. Prime Recipients are required to comply with agency-specific and programmatic requirements. Please refer to Sections VI.B.4 and VI.B.6 of the FOA for guidance on cost share reporting.
- ARPA-E works closely with Prime Recipients to facilitate and expedite the deployment of ARPA-E-funded technologies to market. ARPA-E works with other Government agencies and nonprofits to provide mentoring and networking opportunities for Prime Recipients. ARPA-E also organizes and sponsors events to educate Prime Recipients about key barriers to the deployment of their ARPA-E-funded technologies. In addition, ARPA-E establishes collaborations with private and public entities to provide continued support for the development and deployment of ARPA-E-funded technologies.

III. ELIGIBILITY INFORMATION

A. ELIGIBLE APPLICANTS

1. *SBIR*

A Small Business Concern²⁴ may apply as a Standalone Applicant²⁵ or as the lead organization for a Project Team.²⁶ If applying as the lead organization, the Small Business Concern must perform at least 66.7% of the work under the award in Phase I and at least 50% of the work under the award in Phase II and Phase IIS (as applicable), as measured by the Total Project Cost.²⁷

2. *STTR*

A Small Business Concern may apply only as the lead organization for a Project Team. The Small Business Concern must perform at least 40% of the work under the award in Phase I, Phase II, and/or Phase IIS (as applicable), as measured by the Total Project Cost. A single Research Institution must perform at least 30% of the work under the award in Phase I, Phase II, and/or Phase IIS (as applicable), as measured by the Total Project Cost. Please refer to Section III.B.1 of the FOA for guidance on Research Institutions' participation in STTR projects.

²⁴ A Small Business Concern is a for-profit entity that: (1) maintains a place of business located in the United States, operates primarily within the United States, or makes a significant contribution to the United States economy through payment of taxes or use of American products, materials or labor; (2) is an individual proprietorship, partnership, corporation, limited liability company, joint venture, association, trust, or cooperative; (3) is at least 51% owned and controlled by one or more individuals who are U.S. citizens or permanent residents; and (4) has, including affiliates, no more than 500 employees. Joint ventures and limited partnerships are eligible only if each entity to the venture or limited partnership is 51% owned and controlled by one or more U.S. citizens or permanent residents.

²⁵ A "Standalone Applicant" is an Applicant that applies for funding on its own, not as part of a Project Team.

²⁶ The term "Project Team" is used to mean any entity with multiple players working collaboratively and could encompass anything from an existing organization to an ad hoc teaming arrangement. A Project Team consists of the Prime Recipient, Subrecipients, and others performing or otherwise supporting work under an ARPA-E funding agreement.

²⁷ The Total Project Cost is the sum of the Prime Recipient share and the Federal Government share of total allowable costs. The Federal Government share generally includes costs incurred by FFRDCs and GOGOs.

B. ELIGIBLE SUBRECIPIENTS

1. RESEARCH INSTITUTIONS

A Research Institution²⁸ may apply only as a member of a Project Team (i.e., as a Subrecipient to a Small Business Concern). In STTR projects, a single Research Institution must perform at least 30%, but no more than 60%, of the work under the award in Phase I, Phase II, and/or Phase IIS (as applicable), as measured by the Total Project Cost.

2. OTHER PROJECT TEAM MEMBERS

The following entities are eligible to apply for SBIR/STTR funding as a member of a Project Team (i.e., as a Subrecipient to a Small Business Concern):

- For-profit entities, including Small Business Concerns;
- Nonprofits other than Research Institutions;²⁹
- Non-DOE/NNSA Government-Owned, Government Operated laboratories (GOGOs);
- State, local, and tribal government entities; and
- Foreign entities.³⁰

In SBIR projects, Project Team members other than the lead organization, including but not limited to Research Institutions, may collectively perform no more than 33.3% of the work under the award in Phase I and no more than 50% of the work under the award in Phase II and/or Phase IIS (as applicable). This includes efforts performed by Research Institutions.

In STTR projects, Project Team members (other than the lead organization and the partnering Research Institution) may collectively perform no more than 30% of work under the award in Phase I, Phase II, and/or Phase IIS (as applicable).

DOE/NNSA GOGOs are not eligible to apply for SBIR or STTR funding.

²⁸ Research Institutions include FFRDCs, nonprofit educational institutions, and other nonprofit research organizations owned and operated exclusively for scientific purposes. Eligible Research Institutions must maintain a place of business in the United States, operate primarily in the United States, or make a significant contribution to the U.S. economy through the payment of taxes or use of American products, materials, or labor.

²⁹ Nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995 are not eligible to apply for funding as a Subrecipient.

³⁰ All work by foreign entities must be performed by subsidiaries or affiliates incorporated in the United States (see Section IV.F.6 of the FOA). However, the Applicant may request a waiver of this requirement in the Business Assurances Form submitted with the Full Application.

C. ELIGIBLE PRINCIPAL INVESTIGATORS

1. SBIR

For the duration of the award, the PI for the proposed project (or, if multiple PIs, at least one PI) must be employed by, and perform at least 50% of his or her work for, the Prime Recipient. The Contracting Officer may waive this requirement or approve the substitution of the PI.

For projects with multiple PIs, at least one PI must meet the primary employment requirement. That PI will serve as the contact PI for the Project Team.

2. STTR

For the duration of the award, the PI for the proposed project (or, if multiple PIs, at least one PI) must be employed by, and perform at least 50% his or her work for, with the Prime Recipient or the partnering Research Institution. The Contracting Officer may waive this requirement or approve the substitution of the PI.

For projects with multiple PIs, at least one PI must meet the primary employment requirement. That PI will serve as the contact PI for the Project Team.

D. COST SHARING OR MATCHING³¹

1. GENERAL COST SHARE REQUIREMENT

Recipients are not required to contribute cost share during Phase I of a SBIR/STTR award. Every Recipient or project team must contribute at least 20% of the Total Project Cost³² as cost share for work performed during Phase II and Phase IIS, as applicable.

2. LEGAL RESPONSIBILITY

Although the cost share requirement applies to the Project Team as a whole, the funding agreement makes the Prime Recipient legally responsible for paying the entire cost share. The Prime Recipient's cost share obligation is expressed in the funding agreement as a static amount in U.S. dollars (cost share amount) and as a percentage of the Total Project Cost (cost share percentage). If the funding agreement is terminated prior to the end of the project

³¹ Please refer to Section VI.B.5-6 of the FOA for guidance on cost share payments and reporting.

³² The Total Project Cost is the sum of the Prime Recipient share and the Federal Government share of total allowable costs. The Federal Government share generally includes costs incurred by FFRDCs and GOGOs.

period, the Prime Recipient is required to contribute at least the cost share percentage of total expenditures incurred through the date of termination.

The Prime Recipient is solely responsible for managing cost share contributions by the Project Team and enforcing cost share obligations assumed by Project Team members in subawards or related agreements.

3. COST SHARE ALLOCATION

Each Prime Recipient is free to determine how much each Project Team member will contribute towards the cost share requirement. The amount contributed by individual Project Team members may vary, so long as the cost share requirement for the project as a whole is met.

4. COST SHARE TYPES AND ALLOWABILITY

Every cost share contribution must be allowable under the applicable Federal cost principles, as described in Section VI.B.4 of the FOA.

Project Teams may provide cost share in the form of cash or in-kind contributions. Cash contributions may be provided by the Prime Recipient or Subrecipients. Allowable in-kind contributions include but are not limited to personnel costs, indirect costs, facilities and administrative costs, rental value of buildings or equipment, and the value of a service, other resource, or third party in-kind contribution. Project Teams may use funding or property received from state or local governments to meet the cost share requirement, so long as the funding or property was not provided to the state or local government by the Federal Government.

The Prime Recipient may not use the following sources to meet its cost share obligations:

- Revenues or royalties from the prospective operation of an activity beyond the project period;
- Proceeds from the prospective sale of an asset of an activity;
- Federal funding or property (e.g., Federal grants, equipment owned by the Federal Government); or
- Expenditures that were reimbursed under a separate Federal program.

In addition, Project Teams may not use independent research and development (IR&D) funds to meet their cost share obligations under cooperative agreements.

Project Teams may not use the same cash or in-kind contributions to meet cost share requirements for more than one project or program.

Cost share contributions must be specified in the project budget, verifiable from the Prime Recipient's records, and necessary and reasonable for proper and efficient accomplishment of the project. Every cost share contribution must be reviewed and approved in advance by the Contracting Officer and incorporated into the project budget before the expenditures are incurred.

Applicants may wish to refer to 10 C.F.R. parts 600 and 603 for additional guidance on cost sharing, specifically 10 C.F.R. §§ 600.30, 600.123, 600.224, 600.313, and 603.525-555.

5. COST SHARE CONTRIBUTIONS BY FFRDCs AND GOGOS

Because FFRDCs and GOGOs are funded by the Federal Government, costs incurred by FFRDCs and GOGOs generally may not be used to meet the cost share requirement. FFRDCs may contribute cost share only if the contributions are paid directly from the contractor's Management Fee or a non-Federal source.

6. COST SHARE VERIFICATION

Applicants are bound by the cost share proposed in their Full Applications. In the Business Assurances Form accompanying the Full Application, Applicants must provide written assurance of their cost share commitments. Please refer to the Business Assurances Form available on ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov/>) for additional guidance.

Upon selection for award negotiations, Applicants are required to provide additional information and documentation regarding their cost share contributions. Please refer to Section VI.B.6 of the FOA for guidance on the requisite cost share information and documentation.

E. OTHER

1. COMPLIANT CRITERIA

Notices of Intent are deemed compliant if:

- The Applicant entered all required information and clicked the "Create Submission" button in ARPA-E eXCHANGE by the deadline stated in the FOA.

ARPA-E will not review or consider noncompliant Notices of Intent, including Notices of Intent submitted through other means, Notices of Intent submitted after the applicable deadline, and incomplete Notices of Intent. A Notice of Intent is incomplete if it does not include required

information, such as the Technical Category (see Section I.E of the FOA). ARPA-E will not extend the submission deadline for Applicants that fail to submit required information due to server/connection congestion.

Full Applications are deemed compliant if:

- The Applicant submitted a compliant and responsive Notice of Intent;
- The Applicant meets the eligibility requirements in Section III.A of the FOA;
- The Full Application complies with the content and form requirements in Section IV.C of the FOA; and
- The Applicant submitted the required information, successfully uploaded all required documents, and clicked the “Submit” button in ARPA-E eXCHANGE by the deadline stated in the FOA.

ARPA-E will not review or consider noncompliant Full Applications, including Full Applications submitted through other means, Full Applications submitted after the applicable deadline, and incomplete Full Applications. A Full Application is incomplete if it does not include required information and documents, such as Forms SF-424 and 424A. ARPA-E will not extend the submission deadline for Applicants that fail to submit required information and documents due to server/connection congestion.

Replies to Reviewer Comments are deemed compliant if:

- The Applicant successfully uploaded all required documents to ARPA-E eXCHANGE by the deadline stated in the FOA.

ARPA-E will not review or consider noncompliant Replies to Reviewer Comments, including Replies submitted through other means and Replies submitted after the applicable deadline. ARPA-E will not extend the submission deadline for Applicants that fail to submit required information due to server/connection congestion. ARPA-E will review and consider each compliant and responsive Full Application, even if no Reply is submitted or the Reply is found to be noncompliant.

2. RESPONSIVENESS CRITERIA

ARPA-E performs a preliminary technical review of Full Applications. Any “Applications Specifically Not of Interest,” as described in Section I.F of the FOA, are deemed nonresponsive and are not reviewed or considered.

3. LIMITATION ON NUMBER OF FULL APPLICATIONS

Each Small Business Concern may submit no more than two (2) applications to this FOA. If a Small Business Concern submits two applications to this FOA, each application must be scientifically distinct.

IV. FULL APPLICATION AND SUBMISSION INFORMATION

A. FULL APPLICATION FORMS

Required forms for Full Applications are available on ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov>), including the SF-424, SF-424A, Business Assurances Form, and Other Sources of Funding Disclosure form. A sample response to the Other Sources of Funding Disclosure form is attached to this FOA as Appendix 2. Applicants must use the templates available on ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov>), including the template for the Technical Volume of the Full Application, the template for the Technical Milestones section of the Technical Volume, the Summary Slide template, and the Reply to Reviewer comments template. A sample Summary Slide is attached to this FOA as Appendix 1.

B. CONTENT OF NOTICE OF INTENT

Each Applicant must enter the following information into ARPA-E eXCHANGE by the deadline stated in the FOA:

- Project Title;
- Lead Organization;
- % of effort contributed by the Lead Organization;
- The Project Team, including:
 - The Principal Investigator for the Prime Recipient;
 - Team Members (i.e., Subrecipients); and
 - Key Participants (i.e., individuals who contribute in a substantive, measurable way to the execution of the proposed project).
- Technical Category (see Section I.E of the FOA); and
- Abstract – The abstract provided should be 200 words in length, and should provide a truncated explanation of the proposed project.

ARPA-E will not review or consider noncompliant Notices of Intent (see Section III.F.1 of the FOA).

ARPA-E eXCHANGE automatically assigns a Control Number upon the submission of a compliant Notice of Intent. Once logged in to ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov/login.aspx>), Applicants may access their submissions by clicking the “My Submissions” link in the navigation on the left side of the page. Every application that the

Applicant has submitted to ARPA-E and the corresponding Control Number is displayed on that page. If the Applicant submits more than one application to a particular FOA, a different Control Number is shown for each application. The Control Number must be included in the header of the Full Application and optional Reply to Reviewer Comments.

C. CONTENT AND FORM OF FULL APPLICATIONS

Full Applications must conform to the following requirements:

- Each document must be submitted in the file format prescribed below.
- All Full Applications must be written in English.
- All pages must be formatted to fit on 8-1/2 by 11 inch paper with margins not less than one inch on every side. Use Times New Roman typeface, a black font color, and a font size of 12 points or larger (except in figures and tables). A Symbol font may be used to insert Greek letters or special characters, but the font size requirement still applies.
- The Control Number must be prominently displayed on the upper right corner of the header of every page. Page numbers must be included in the footer of every page.

ARPA-E will not review or consider noncompliant and/or nonresponsive Full Applications (see Section III.F of the FOA).

Component	Required Format	Description and Information
Technical Volume	PDF	The centerpiece of the Full Application. Provides a detailed description of the proposed R&D project and Project Team. Applicants must use the Technical Volume template available on ARPA-E eXCHANGE (https://arpa-e-foa.energy.gov). In addition, Applicants must use the Technical Milestones template available on ARPA-E eXCHANGE (https://arpa-e-foa.energy.gov) for the Technical milestones section of the Technical Volume.
SF-424	PDF	Application for Federal Assistance (https://arpa-e-foa.energy.gov)
SF-424A	XLS	Budget Information – Non-Construction Programs (https://arpa-e-foa.energy.gov)
Budget Justification Workbook	XLS	Budget Justification Workbook for SF-424A (https://arpa-e-foa.energy.gov)
Summary for Public Release	PDF	Short summary of the proposed R&D project. Intended for public release.
Summary	PPT	A four-panel slide summarizing different aspects of the proposed R&D

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Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

Slide		project. The Applicant must use the fillable Summary Slide template available on ARPA-E eXCHANGE (https://arpa-e-foa.energy.gov).
Business Assurances Form	PDF	Requires the Applicant to disclose potential improprieties, potential conflicts of interest within the Project Team, and written assurance of its cost share commitment. Requires the Applicant to certify its eligibility for participation in ARPA-E's SBIR/STTR program and compliance with program requirements. Requires FFRDCs that are subrecipients to complete a FFRDC Authorization and, if they are a DOE/NNSA FFRDC, provide a Field Work Proposal. Allows the Applicant to request a modification or waiver of the Performance of Work in the United States requirement and/or the U.S. Manufacturing requirement. This form is available on ARPA-E eXCHANGE (https://arpa-e-foa.energy.gov).
Disclosure of Other Sources of Funding	PDF	Requires the PI to describe the additionality and risks associated with the proposed project, disclose the submission of the same or similar applications to Federal and non-Federal entities, disclose financial assistance from Federal entities, disclose funding from non-Federal entities for related work, and provide letters or other communications from private investors explaining why they decided not to fund the proposed R&D project. This form is available on ARPA-E eXCHANGE (https://arpa-e-foa.energy.gov). A sample response to the Other Sources of Funding Disclosure Form is provided as Appendix 2 to this FOA.
Budget Justification Workbook	XLS	The Applicant is required to submit a Budget Justification Workbook to accompany and justify the costs listed in the SF-424A. The Budget Justification Workbook is available on ARPA-E eXCHANGE (https://arpa-e-foa.energy.gov).

ARPA-E provides detailed guidance on the content and form of each component below.

1. FIRST COMPONENT: TECHNICAL VOLUME

The Technical Volume must be submitted in Adobe PDF format. A Technical Volume template is provided as Appendix 4 to the FOA. A fillable version is available on ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov>). The Technical Volume must conform to the following content and form requirements, including maximum page lengths. If Applicants exceed the maximum page lengths indicated below, ARPA-E will review only the authorized number of pages and disregard any additional pages.

Applicants must provide sufficient citations and references to the primary research literature to justify the claims and approaches made in the Technical Volume. ARPA-E and reviewers may review primary research literature in order to evaluate applications. However, ARPA-E and reviewers are under no obligation to review cited sources (e.g., Internet websites).

Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A.
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<u>SECTION</u>	<u>PAGE LIMIT</u>	<u>DESCRIPTION</u>
Award Category	0.5 pages max.	<ul style="list-style-type: none"> Identify the Award Category: Combined Phase I/II or Combined Phase I/II/IIS. See Section II.A of the FOA. State the type of funding being sought: SBIR, STTR, or both SBIR and STTR. See Section II.A of the FOA.
Technical Category	0.5 pages max.	<ul style="list-style-type: none"> Identify the Technical Category: Category 1, 2, or 3. See Section I.F of the FOA.
Technical Approach	1 page max.	<ul style="list-style-type: none"> Provide a concise summary of the proposed R&D project. The summary should be written for a technically literate, but non-specialist, audience.
R&D Tasks	3 pages max.	<ul style="list-style-type: none"> Describe succinctly: <ul style="list-style-type: none"> the purpose of the proposed R&D project in Phase I, Phase II, and Phase IIS (as applicable), the underlying hypothesis(es)/technical concept(s) guiding the approach, and a list of the tasks the research team will undertake and accomplish to achieve this purpose.
R&D Strategy	18 pages max.	<ul style="list-style-type: none"> Applicants are <u>required</u> to address the following factors: <ul style="list-style-type: none"> <u>Innovation</u> – Describe specifically: <ul style="list-style-type: none"> the performance of the current state of the art in the specific technology area of the application, how the work proposed is a departure from currently available technology and/or represents a significant improvement to the performance of the current state of the art, how the proposed approach differs from others under investigation in the field, and how the work, if successful, could leapfrog today’s approaches and significantly impact both technology and business. <u>Preliminary Results</u> – Provide preliminary data and results (if available) that support the feasibility of the application. <u>Significance With Respect to FOA Requirements and Targets</u> – Describe specifically: <ul style="list-style-type: none"> how the proposed effort is responsive to each aspect of the detailed FOA topic description, and the impact that successful completion of the proposed work would have on the FOA target areas. <u>Performance Team</u> – Describe succinctly: <ul style="list-style-type: none"> the members of the proposed research team, and why the proposed team is uniquely qualified to carry out the proposed research. Synopses of past research accomplishments are insufficient to demonstrate that a team is “uniquely qualified.” Applicants are required to identify the unique combination of training and experience that make the proposed team uniquely qualified to successfully execute the proposed project. Preference will

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		be given to multidisciplinary teams where different Project Team members complement each other and have expertise in different aspects of the technology.
Statement of Project Objectives	1 page max.	<ul style="list-style-type: none"> • The Statement of Project Objectives should provide a clear and concise statement of the project goals and expected outcomes. If the Applicant is selected for award negotiations, the ARPA-E funding agreement will incorporate this Statement of Project Objectives and may be released to the public. <ul style="list-style-type: none"> ○ Objectives: Please provide a single paragraph discussing both (1) the overall objective(s) of the work and (2) the objective(s) for each phase of the work described in R&D Tasks above. Please do not include any confidential, proprietary, or privileged information in the Objectives. ○ Scope of Work: Please summarize the effort and approach to achieve the objective(s) of the work for each phase of the work described in R&D Tasks above. The Scope of Work section should not exceed one half-page. Please do not include any confidential, proprietary, or privileged information in the Scope of Work. In addition, please do not include dollar amounts, specific dates, or names of Subrecipients.
Technical Milestones and Deliverables	9 pages max.	<ul style="list-style-type: none"> • Applicants must submit proposed technical milestones and deliverables using the Technical Milestones template available on ARPA-E eXCHANGE (https://arpa-e-foa.energy.gov). • Applicants are required to provide a set of detailed technical milestones and deliverables for Phase I, Phase II, and Phase IIS (as applicable) based on the tasks described in the “R&D Tasks” section above. The milestones and deliverables should provide a clear path to completion of the R&D Tasks, with specific proposed “Go/No-Go” milestones at the end of each year of the proposed project. Milestones should be concrete, objective, and quantitative. • ARPA-E actively negotiates the technical milestones and deliverables of Applicants selected for award. Proposed technical milestones and deliverables submitted as part of the Applicant’s Technical Volume are subject to change. • ARPA-E evaluates the progress of a project by comparing actual progress to predetermined technical milestones and deliverables. Milestones are not aspirational, nor do they describe simple effort (e.g. examine 10 strains; complete report). Milestones describe specific, objective quantitative deliverables due every quarter (e.g. production of xx g/L of fuel; energy density of yyW h kg-1). Aggressive technical milestones and deliverables are required for all projects. Technical milestones and deliverables help focus effort and resources on critical path technology components. Annual/End-of-Project milestones may be subject to independent measurement or verification. ARPA-E Program Directors will require revisions to proposed technical milestones and deliverables during award negotiations. In addition, ARPA-E Program Directors may modify or terminate projects that fail to achieve predetermined technical milestones and deliverables.

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<p>Budget Summary</p>	<p>3 pages max.</p>	<ul style="list-style-type: none"> • Applicants are required to provide a budget summary for each phase of the project, broken down by milestones. The summaries must conform to the following guidelines: <ul style="list-style-type: none"> ○ The budget summaries for each project phase (e.g., Phase I, Phase II, Phase IIS) must be distinct. ○ The budget summary for each project phase should be clearly associated with the milestones outlined as part of the Technical R&D Plan and reflect quarterly progress on the proposed project. ○ All major equipment purchases must be included in the budget summary. For equipment acquired as part of the proposed R&D project, state the proposed disposition of the equipment after the project’s completion. Specifically, state if the useful life of the equipment will correlate with its authorized purpose under the proposed project. ○ If costs are less than would normally be expected due to large amounts of previous R&D work done by one or more members of the research team, please describe and explain accordingly. ○ Applicants are required to estimate the potential materials and manufacturing costs of the proposed technology to justify the technology’s potential to approach, meet, or exceed the cost targets given in each FOA. In making these estimations, Applicants must describe the manufacturing approaches that will most likely scale up the proposed technologies.
<p>Qualifications, Experience, and Capabilities</p>	<p>For each PQS, 3 page max.</p>	<ul style="list-style-type: none"> • Applicants are required to provide a Personal Qualification Summary (PQS) for the PI and a PQS for each Key Participant.³³ Each PQS is limited to <u>3 pages maximum</u>. <u>Curriculum vitae will not be considered</u>. Each PQS must include: <ul style="list-style-type: none"> ○ Education/training, ○ Employment history, ○ Awards and honors, ○ Up to 10 peer-reviewed publications specifically related to the proposed R&D project, ○ Up to 10 other peer-reviewed publications demonstrating capabilities in the broad field, and ○ Up to 10 non-peer reviewed publications and patents demonstrating capabilities in the broad field.
<p>Participating Organizations</p>	<p>1 page max.</p>	<ul style="list-style-type: none"> • Describe succinctly why each proposed organization is qualified to accomplish their portion of the proposed R&D project. Please describe the Project Team’s unique qualifications, expertise, equipment, or facilities that will facilitate the successful completion of the proposed project.

³³ A Key Participant is any individual who would contribute in a substantive, measurable way to the execution of the proposed project.

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Prior Collaboration	1 page max.	<ul style="list-style-type: none"> • Describe succinctly: <ul style="list-style-type: none"> ○ any prior projects, programs, and initiatives on which the Project Team has collaborated; ○ the roles of each Project Team member in the project, program, or initiative; ○ whether the project, program, or initiative was ultimately successful; and ○ any management, intellectual property, or other issues that arose within the Project Team and how they were resolved.
Management Plan	2 pages max.	<ul style="list-style-type: none"> • An effective management plan is essential to ensure continuous effective communication between performance members. Describe succinctly: <ul style="list-style-type: none"> ○ the roles of each Project Team member; ○ any critical handoffs/interdependencies between Project Team members; ○ the technical (i.e., decision-making based on technical understanding of the problem) and management (i.e., monitoring different elements of the project and technology to ensure that it is well-integrated) aspects of the Management Plan and the role of the PI; and ○ manufacturing plans and considerations.
Multi-Investigator Projects	2 pages max.	<ul style="list-style-type: none"> • Roles of Participants: For multi-organizational or multi-investigator projects, describe succinctly: <ul style="list-style-type: none"> ○ the roles and the work to be performed by each PI and Key Participant; ○ business agreements between the Applicant and each PI and Key Participant; and ○ how the various efforts will be integrated and managed. • Multiple PIs: Standalone Applicants and Project Teams are required to disclose if the project will include multiple PIs. If multiple PIs will be designated, identify the Contact PI, and provide a "Coordination and Management Plan" that describes the organization structure of the project as it pertains to the designation of multiple PIs. This plan should include: <ul style="list-style-type: none"> ○ process for making decisions on scientific/technical direction; ○ publication arrangements; ○ intellectual property issues; ○ communication plans; ○ procedures for resolving conflicts; and ○ PIs' roles and administrative, technical, and scientific responsibilities for the project.
Transition/ Commercialization	4 pages max.	<ul style="list-style-type: none"> • ARPA-E supports energy technology R&D projects for a limited period of time at critical high-risk points in the technology development cycle. ARPA-E technologies are not required to achieve commercial deployment by

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Strategy		the end of the project period; however, funded projects must be on a reasonable path toward making substantive impact on ARPA-E’s mission areas through ultimate commercial adoption and wide-scale market deployment. Please describe: <ul style="list-style-type: none">○ high-level milestones for development that follow the end of the proposed project;○ the path by which the proposed technology is expected to transition from its current stage of development and continue through to ultimate commercial deployment;○ specific organizations (partners, customers, etc.) expected to be involved in transition of the technology from research to commercial deployment and their anticipated involvement; and○ resource needs for the next phase of development that follows the end of the ARPA-E project ;○ why the proposed research is not being pursued by industry today; and○ why a successful project outcome will result in a commercially viable outcome.
Intellectual Property Strategy	No page limit	<ul style="list-style-type: none">● Describe specifically:<ul style="list-style-type: none">○ existing intellectual property that will be used to develop the new intellectual property○ new intellectual property and data that will be created as part of this effort;○ how the intellectual property strategy will increase the probability that the proposed transformational technology will reach the market and widely penetrate the installed base; and○ the plan for disposition/ownership of the intellectual property, including intellectual property agreements or memorandums of understanding between Project Team members.

Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A.
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2. SECOND COMPONENT: SF-424

The SF-424 must be submitted in Adobe PDF format. This form is available on ARPA-E eXCHANGE at <https://arpa-e-foa.energy.gov>.

The SF-424 includes instructions for completing the form. Applicants are required to complete all required fields in accordance with the instructions.

Prime Recipients and Subrecipients are required to complete SF-LLL (Disclosure of Lobbying Activities), available at <http://www.whitehouse.gov/sites/default/files/omb/grants/sflllin.pdf>, if any non-Federal funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with your application or funding agreement. The completed SF-LLL must be appended to the SF-424.

ARPA-E provides the following supplemental guidance on completing the SF-424:

- Each Project Team should submit only one SF-424 (i.e., a Subrecipient should not submit a separate SF-424).
- Assume a project start date of October 1, 2012, or as negotiated.
- The list of certifications and assurances in Block 21 can be found at <http://management.energy.gov/documents/CERTSASSUR.doc>.
- The dates and dollar amounts on the SF-424 are for the entire project period (from the project start date to the project end date), not a portion thereof.

3. THIRD COMPONENT: SF-424A

Applicants are required to complete the SF-424A Excel spreadsheet entitled “Budget Information Non-Construction Programs.” The SF-424A must be submitted in Microsoft Excel format. This form is available on ARPA-E eXCHANGE at <https://arpa-e-foa.energy.gov>.

Applicants must create multiple, separate tabs in the SF-424A workbook, as described below.

- For the project as a whole (i.e., all work to be performed by the Project Team under the ARPA-E funding agreement), Applicants must create:

- (1) One tab showing the budget for the entire project period (from the project start date to the project end date) by budget category element for requested Federal funding and by budget category element for non-Federal funding contributed as cost share, and
 - (2) A separate tab showing the budget for each phase of the Project (Phase I, Phase II, and Phase IIS). In addition, a separate tab for each year of each phase. For example: if Phase II is 24 months long, then you would create a tab for Year 1 of Phase II and a separate tab for Year 2 of Phase II. In each tab, you must show the budget category element for requested Federal funding and budget category element for non-Federal funding contributed as cost share.
- For each FFRDC participant, Applicants must create:
 - (1) One tab showing the FFRDC budget for the entire project period (from the project start date to the project end date) by budget category element for requested Federal funding and by budget category element for non-Federal funding contributed as cost share (if applicable), and
 - (2) A separate tab showing the FFRDC's budget for each phase of the Project (Phase I, Phase II, and Phase IIS). In addition, a separate tab for each year of each phase. For example: if Phase II is 24 months long, then you would create a tab for Year 1 of Phase II and a separate tab for Year 2 of Phase II. In each tab, you must show the budget category element for requested Federal funding and budget category element for non-Federal funding contributed as cost share (if applicable).
 - For each entity that is performing at least 20% of the work under the ARPA-E funding agreement (as measured by the Total Project Cost), Applicants must create:
 - (1) One tab showing that entity's budget for the entire project period (from the project start date to the project end date) by budget category element for requested Federal funding and by budget category element for non-Federal funding contributed as cost share (if applicable), and
 - (2) A separate tab showing that entity's budget for each phase of the Project (Phase I, Phase II, and Phase IIS). In addition, a separate tab for each year of each phase. For example: if Phase II is 24 months long, then you would create a tab for Year 1 of Phase II and a separate tab for Year 2 of Phase II. In each tab, you must show the budget category element for requested Federal

funding and budget category element for non-Federal funding contributed as cost share (if applicable).

ARPA-E provides the following supplemental guidance on completing the SF-424A:

- In Section B of the SF-424A, Applicants may request funds under any of the listed object class categories as long as the item and amount requested are necessary to perform the proposed work, meet all the criteria for allowability under the applicable Federal cost principles, and are not prohibited by the funding restrictions described herein.
- If patent costs are requested, they must be included in the Applicant's proposed budget. Please refer to Section IV.F.3 of the FOA for guidance on allowable patent costs.
- For pricing purposes, assume a project start date of October 1, 2012, or as negotiated.

4. FOURTH COMPONENT: BUDGET JUSTIFICATION WORKBOOK

Applicants are required to complete a Budget Justification Workbook to accompany and justify the costs listed in the SF-424A. Please refer to ARPA-E's website (<http://arpa-e.energy.gov/SBIRSTTR.aspx>) for the Budget Justification Workbook template and detailed guidance on completing the Budget Justification Workbook.

The Budget Justification Workbook must be submitted in Microsoft Excel format. Prime Recipients must complete each tab of the Budget Justification Workbook for the project as a whole, including all work to be performed by the Prime Recipient and its Subrecipients and Contractors, and provide all requested documentation (e.g., a Federally-approved forward pricing rate agreement, Defense Contract Audit Agency or Government Audits and Reports, if available).

- Each Subrecipient incurring greater than or equal to 10% of the Total Project Cost must complete a separate Budget Justification workbook to justify its proposed budget. These worksheets must be inserted as additional sheets within in the Prime Recipient's Budget Justification.
- Subrecipients incurring less than 10% of the Total Project Cost are not required to complete a separate Budget Justification workbook. However, such Subrecipients are required to provide supporting documentation to justify their proposed budgets. At a minimum, the supporting documentation must show which Statement of Project

Objective tasks are being performed, the purpose/need for the effort, and a sufficient basis for the estimated costs.

5. FIFTH COMPONENT: SUMMARY FOR PUBLIC RELEASE

Applicants are required to submit a one-page summary of their project. The Summary for Public Release must be submitted in Adobe PDF format. This summary is intended for public release, so it should not include any confidential, proprietary, or privileged information. The summary should be written for a lay audience (e.g., general public, media, Congress) using plain English. Applicants should avoid over-reliance on technical terms that are not familiar or well-understood by the general public.

6. SIXTH COMPONENT: SUMMARY SLIDE

Applicants are required to provide a single PowerPoint slide summarizing the proposed project. The slide must be submitted in Microsoft PowerPoint format. A sample slide is attached as Appendix 1 to this FOA. This slide is used during the evaluation process. The Applicant must use the Summary Slide template available on ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov>).

The slide should be split into four parts as a “quad chart”:

- Non-technical description of the proposed technology;
- Potential impact of the proposed technology relative to the state of the art;
- Project overview consisting of the proposed period of performance, requested ARPA-E funding, proposed cost share, total budget for the entire project period, and a year-by-year breakdown of the project’s key milestones and deliverables; and
- A listing of the PI and Key Participants.

7. SEVENTH COMPONENT: BUSINESS ASSURANCES FORM

Applicants are required to complete a Business Assurances Form. The form must be submitted in Adobe PDF format. This form is available on ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov>).

In the Business Assurances Form, the Applicant is required to:

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- Disclose potential improprieties, such as convictions for fraud and export control violations;
- Disclose potential conflicts of interest within the Project Team;
- Provide written assurance of its cost share commitment; and
- Certify eligibility for participation in ARPA-E's SBIR/STTR program and compliance with program requirements.

In addition, the Applicant may:

- Request authorization to perform some work overseas; and
- Request a modification or waiver of the U.S. Manufacturing requirement.

Any Federally Funded Research and Development Centers (FFRDCs) involved as a member of a Project Team must complete the "FFRDC Authorization" and "Field Work Proposal" section of the Business Assurances Form.

8. EIGHTH COMPONENT: DISCLOSURE OF OTHER SOURCES OF FUNDING FORM

ARPA-E is required by statute to "accelerat[e] transformational technological advances in areas that industry is by itself not likely to undertake because of technical and financial uncertainty."³⁴ In accordance with its statutory mandate, ARPA-E requires the PI to complete the Other Sources of Funding Disclosure Form and submit it with the Full Application. The form must be submitted in Adobe PDF format. The Other Sources of Funding Disclosure Form is available on ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov>).

In the Other Sources of Funding Disclosure Form, the PI is required to:

- Describe the additionality and risks associated with the proposed R&D project;
- Disclose whether the PI or any Co-PI(s) have submitted the same application to any Federal or non-Federal entities;
- Disclose whether the PI or any Co-PI(s) have submitted any applications for related work to any Federal or non-Federal entities within the last 24 months;

³⁴ 21st Century Competitiveness Act, Pub. L. No. 110-69, § 5012, 121 Stat. 572 (2007), as amended (codified at 42 U.S.C. § 16538).

- Disclose all financial assistance from any Federal entity that the PI or any Co-PI(s) is currently receiving or has received within the last 5 years;
- Disclose any funding from non-Federal entities for related work that the PI or any Co-PI(s) is currently receiving or has received within the last 5 years; and
- If available, provide letters or other communications from private investors explaining why they decided not to fund the proposed R&D project or related work.

D. CONTENT AND FORM OF REPLIES TO REVIEWER COMMENTS

Written feedback on Full Applications is made available to Applicants before the submission deadline for Replies to Reviewer Comments. Applicants have a brief opportunity to prepare a short Reply to Reviewer Comments responding to one or more comments or supplementing their Full Application. A Reply to Reviewer Comments template is provided as Appendix 4 to the FOA. A fillable version is available on ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov>).

Replies to Reviewer Comments must conform to the following requirements:

- The Reply to Reviewer Comments must be submitted in Adobe PDF format.
- The Reply to Reviewer Comments must be written in English.
- All pages must be formatted to fit on 8-1/2 by 11 inch paper with margins not less than one inch on every side. Use Times New Roman typeface, a black font color, and a font size of 12 points or larger (except in figures and tables). A Symbol font may be used to insert Greek letters or special characters, but the font size requirement still applies.
- The Control Number must be prominently displayed on the upper right corner of the header of every page. Page numbers must be included in the footer of every page.

ARPA-E will not review or consider noncompliant Replies (see Section III.F.1 of the FOA). ARPA-E will review and consider each compliant and responsive Full Application, even if no Reply is submitted or if the Reply is found to be noncompliant.

Replies to Reviewer Comments must conform to the following content and form requirements, including maximum page lengths, described below. If a Reply to Reviewer Comments is more than six pages in length, ARPA-E will review only the first six pages and disregard any additional pages.

SECTION	PAGE LIMIT	DESCRIPTION
Text	4 pages maximum	<ul style="list-style-type: none">Applicants may respond to one or more reviewer comments or supplement their Full Application.
Images	2 page maximum	<ul style="list-style-type: none">Applicants may provide graphs, charts, or other data to respond to reviewer comments or supplement their Full Application.

E. INTERGOVERNMENTAL REVIEW

This program is not subject to Executive Order 12372 (Intergovernmental Review of Federal Programs).

F. FUNDING RESTRICTIONS

1. ALLOWABLE COSTS

All expenditures must be allowable, allocable, and reasonable in accordance with the applicable Federal cost principles. ARPA-E has listed the Federal cost principles for different categories of Prime Recipients and Subrecipients at <http://arpa-e.energy.gov/SBIRSTTR.aspx>.

2. PRE-AWARD COSTS

ARPA-E will not reimburse any pre-award costs incurred by Applicants before they are selected for award negotiations. Please refer to Section VI.A of the FOA for guidance on award notices.

Upon selection for award negotiations, Applicants may incur pre-award costs at their own risk. ARPA-E generally does not accept budgets as submitted with the Full Application. Budgets are typically reworked during award negotiations. ARPA-E is under no obligation to reimburse pre-award costs if, for any reason, the Applicant does not receive an award or if the award is made for a lesser amount than the Applicant expected.

Given the uncertainty of award negotiations, it is strongly recommended that Prime Recipients and Subrecipients consult with the Contracting Officer (ARPA-E-CO@hq.doe.gov) before incurring any pre-award costs. However, Prime Recipients may submit reimbursement requests for insignificant costs (i.e., \$20,000 or less in total aggregate costs) incurred within the 90-day period immediately preceding the effective date of the funding agreement.

Prime Recipients are required to obtain written authorization from the Contracting Officer (ARPA-E-CO@hq.doe.gov) for (i) insignificant costs (i.e., \$20,000 or less in total aggregate costs) incurred outside of the 90-day period immediately preceding the effective date of the funding agreement, and (ii) significant costs (i.e., more than \$20,000 in total aggregate costs). In

reviewing pre-award costs, the Contracting Officer will consider, among other factors, the time between selection and award, the time between receipt of application and award, the value of the pre-award costs to the overall success of the project, the severability of the funded project to the Prime Recipient's overall activities, the effect on the Total Project Cost, and any statutory authorizations and appropriations for the programmatic area.

3. PATENT COSTS

ARPA-E will fully reimburse the following types of patent costs:

- Cost of preparing and submitting invention disclosures to ARPA-E and DOE;
- Cost of searching the art to the extent reasonable and necessary to make invention disclosures to ARPA-E and DOE, as required by Attachment 2 to the funding agreement; and
- Cost of preparing the reports and other documents required by Attachment 2 to the funding agreement.

ARPA-E will reimburse up to \$30,000 in costs and fees incurred in preparing and filing domestic and foreign patents. The Prime Recipient may request a waiver of the \$30,000 cap. The waiver request is subject to review by the ARPA-E Program Director and approval by the Contracting Officer.

4. CONSTRUCTION

ARPA-E generally does not fund projects that involve major construction. Recipients are required to obtain written authorization from the Contracting Officer before incurring any major construction costs. Please note that Davis-Bacon Act requirements do not apply to ARPA-E funding agreements.

5. FOREIGN TRAVEL

ARPA-E generally does not fund projects that involve major foreign travel. Recipients are required to obtain written authorization from the Contracting Officer before incurring any major foreign travel costs (i.e., foreign travel costs in excess of \$10,000 in any twelve-month period) and must provide trip reports with their reimbursement requests.

6. PERFORMANCE OF WORK IN THE UNITED STATES

ARPA-E strongly encourages interdisciplinary and cross-sectoral collaboration spanning organizational and national boundaries. Such collaboration enables the achievement of scientific and technological outcomes that were previously viewed as extremely difficult, if not impossible.

ARPA-E requires all work under ARPA-E funding agreements to be performed in the United States – i.e., Prime Recipients must expend 100% of the Total Project Cost in the United States. However, Applicants may request a waiver of this requirement in the Business Assurances Form, which is submitted with the Full Application. Such waivers are granted where there is a demonstrated need.

7. PURCHASE OF NEW EQUIPMENT

All new equipment purchased under ARPA-E funding agreements must be made or manufactured in the United States, to the maximum extent practicable. This requirement does not apply to used or leased equipment. Project Teams may purchase foreign-made equipment where comparable domestic equipment is not reasonably available.

8. LOBBYING

Prime Recipients and Subrecipients may not use any Federal funds to influence or attempt to influence, directly or indirectly, congressional action on any legislative or appropriation matters.³⁵

Prime Recipients and Subrecipients are required to complete and submit SF-LLL, “Disclosure of Lobbying Activities” (<http://www.whitehouse.gov/sites/default/files/omb/grants/sflllin.pdf>) to the Contracting Officer (ARPA-E-CO@hq.doe.gov) if any non-Federal funds have been paid or will be paid to any person for influencing or attempting to influence any of the following in connection with your application:

- an officer or employee of any Federal agency,
- a Member of Congress,
- an officer or employee of Congress, or
- an employee of a Member of Congress.

³⁵ 18 U.S.C. § 1913.

G. OTHER SUBMISSION REQUIREMENTS

1. USE OF ARPA-E eXCHANGE

To apply to this FOA, Applicants must register with ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov/Registration.aspx>). Notices of Intent, Full Applications, and Replies to Reviewer Comments must be submitted through ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov/login.aspx>). ARPA-E will **not review or consider applications submitted through other means** (e.g., fax, hand delivery, email, postal mail). For detailed guidance on using ARPA-E eXCHANGE, please refer to the “ARPA-E eXCHANGE User Guide” (<https://arpa-e-foa.energy.gov/Manuals.aspx>).

Once logged in to ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov/login.aspx>), Applicants may access their submissions by clicking the “My Submissions” link in the navigation on the left side of the page. Every application that the Applicant has submitted to ARPA-E and the corresponding Control Number is displayed on that page. If the Applicant submits more than one application to a particular FOA, a different Control Number is shown for each application.

V. APPLICATION REVIEW INFORMATION

A. CRITERIA

ARPA-E performs a preliminary review of Notices of Intent and Replies to Reviewer Comments to determine whether they are compliant. ARPA-E also performs a preliminary review of Full Applications to determine whether they are compliant and responsive (see Section III.F of the FOA).

ARPA-E considers a mix of quantitative and qualitative criteria in determining whether to select a Full Application for award negotiations.

1. **CRITERIA FOR FULL APPLICATIONS**

Full Applications are evaluated based on the following criteria:

- (1) *Impact of the Proposed Technology Relative to State of the Art* (30%) - This criterion involves consideration of the following factors:
 - The extent to which the proposed quantitative material and/or technology metrics demonstrate the potential for a transformational and disruptive (not incremental) advancement in one or more energy-related fields;
 - The extent to which the Applicant demonstrates a profound understanding of the current state-of-the-art and presents an innovative technical approach to significantly improve performance over the current state-of-the-art; and
 - The extent to which the Applicant demonstrates awareness of competing commercial and emerging technologies and identifies how its proposed concept/technology provides significant improvement over these other solutions.

- (2) *Overall Scientific and Technical Merit* (30%) - This criterion involves consideration of the following factors:
 - The extent to which the proposed work is unique and innovative;
 - The feasibility of the proposed work;
 - The extent to which the Applicant proposes a sound technical approach to accomplish the proposed R&D objectives;

- The extent to which the Applicant manages risk, by identifying major technical R&D risks and clearly proposes feasible, effective mitigation strategies; and
- The extent to which project outcomes and deliverables are clearly defined; and
- The extent to which the Applicant proposes a strong and convincing technology development strategy, including a feasible pathway to transition the program results to the next logical stage of R&D and/or directly into commercial development and deployment.

(3) *Qualifications, Experience, and Capabilities of the Proposed Project Team* (30%) - This criterion involves consideration of the following factors:

- The extent to which the PI and Project Team have the skill and expertise needed to successfully execute the project plan, evidenced by prior experience that demonstrates an ability to perform R&D of similar risk and complexity; and
- The extent to which the Applicant has access to the equipment and facilities necessary to accomplish the proposed R&D effort and/or a clear plan to obtain access to necessary equipment and facilities.

(4) *Soundness of Management Plan* (10%) - This criterion involves consideration of the following factors:

- The Applicant presents a plausible plan to manage people and resources;
- The Applicant proposes allocation of appropriate levels of effort and resources to proposed tasks; and
- The proposed schedule is reasonable.

Submissions will not be evaluated against each other since they are not submitted in accordance with a common work statement. The above criteria will be weighted as follows:

Impact of the Proposed Technology Relative to State of the Art	30%
Overall Scientific and Technical Merit	30%
Qualifications, Experience, and Capabilities	30%
Sound Management Plan	10%

2. CRITERIA FOR REPLIES TO REVIEWER COMMENTS

ARPA-E has not established separate criteria to evaluate Replies to Reviewer Comments. Instead, Replies to Reviewer Comments are evaluated as an extension of the Full Application.

B. REVIEW AND SELECTION PROCESS

1. PROGRAM POLICY FACTORS

In addition to the above criteria, ARPA-E may consider the following program policy factors in determining which Applicants to select for award negotiations.

- Programmatic balance of risk and technology areas;
- The degree to which the proposed project optimizes use of available ARPA-E funding to achieve programmatic objectives;
- Availability of funding from public and private sources to support the proposed project;
- The budget for the proposed project;
- For projects involving one or more large businesses, the cost share proposed by the large business(es);
- The proposed cost share for the project and whether the proposed cost share is above the minimum established by ARPA-E and appropriate for the maturity of the technology under development;
- The financial and other resources of the Applicant or Project Team;
- For projects involving a Project Team, the quality of the teaming arrangement;
- The extent to which the project includes industry participation;
- Demonstrated potential to meet technical objectives within predetermined budgets;
- Demonstrated potential to commercialize the technology;
- The technical, market, and organizational risks associated with the R&D project;

- If the Applicant is sponsored by private investors, why this R&D project is not being supported by its investors;
- If the Applicant is a startup not sponsored by private investors, why this R&D project has been unable to attract private financing;
- Whether the proposed transition path is likely to lead to increased employment and manufacturing in the United States;
- Soundness of Transition/Commercialization Strategy and the Intellectual Property Strategy in the Technical Volume of the Full Application;
- Degree of participation by economically and socially disadvantaged, women-owned, and HUBZone Small Business Concerns;
- Whether the project will accelerate transformational technological advances in areas that industry or other governmental agencies are by themselves not likely to undertake because of technical and financial uncertainty; and
- The degree to which the proposed project directly addresses ARPA-E's statutory mission to:
 - Enhance the economic and energy security of the United States through the development of energy technologies that result in reductions of imports of energy from foreign sources, reductions of energy-related emissions, and improvements in the energy efficiency of all economic sectors; and
 - Ensure that the United States maintains a technological lead in developing and deploying advanced energy technologies.

2. ARPA-E REVIEWERS

By submitting an application to ARPA-E, Applicants consent to ARPA-E's use of Federal employees, contractors, and experts from educational institutions, nonprofits, industry, and governmental and intergovernmental entities as reviewers. ARPA-E selects reviewers based on their knowledge and understanding of the relevant field and application, their experience and skills, and their ability to provide constructive feedback on applications.

ARPA-E requires all reviewers to complete a Conflict-of-Interest Certification and Nondisclosure Agreement by which they disclose their knowledge of any actual or apparent conflicts and

agree to safeguard confidential information contained in Full Applications and Replies to Reviewer Comments. In addition, ARPA-E trains its reviewers in proper evaluation techniques and procedures.

Applicants are not permitted to nominate reviewers for their applications. Applicants may contact the Contracting Officer by email (ARPA-E-CO@hq.doe.gov) if they have knowledge of a potential conflict of interest or a reasonable belief that a potential conflict exists.

3. ARPA-E SUPPORT CONTRACTOR

ARPA-E utilizes contractors to assist with the evaluation of applications, and project management. To avoid actual and apparent conflicts of interest, ARPA-E prohibits its support contractors from submitting or participating in the preparation of applications to ARPA-E.

By submitting an application to ARPA-E, Applicants represent that they are not performing support contractor services for ARPA-E in any capacity and did not obtain the assistance of ARPA-E's support contractor to prepare the application. ARPA-E will not consider any applications that are submitted by or prepared with the assistance of its support contractors.

C. ANTICIPATED ANNOUNCEMENT AND AWARD DATES

ARPA-E expects to announce selections under this FOA no later than July 2012 and to execute funding agreements no later than September 2012.

Please refer to the "Applicant's Guide to ARPA-E Award Negotiations" (<http://arpa-e.energy.gov/SBIRSTTR.aspx>) for guidance on the award negotiation process.

VI. AWARD ADMINISTRATION INFORMATION

A. AWARD NOTICES

1. REJECTED SUBMISSIONS

Noncompliant and nonresponsive Full Applications are rejected by the Contracting Officer and are not reviewed or considered (see Section III.F of the FOA). The Contracting Officer sends a notification letter by email to the technical and administrative points of contact designated by the Applicant in ARPA-E eXCHANGE. The notification letter states the basis upon which the Full Application was rejected.

2. FULL APPLICATION NOTIFICATIONS

ARPA-E promptly notifies Applicants of its determination. ARPA-E sends a notification letter by email to the technical and administrative points of contact designated by the Applicant in ARPA-E eXCHANGE. The notification letter may inform the Applicant that its Full Application was selected for award negotiations, or not selected. Alternatively, ARPA-E may notify one or more Applicants that a final selection determination on particular Full Applications will be made at a later date, subject to the availability of funds or other factors.

Written feedback on Full Applications is made available to Applicants before the submission deadline for Replies to Reviewer Comments. By providing feedback, ARPA-E intends to guide the further development of the proposed technology and to provide a brief opportunity to respond to reviewer comments.

a. SUCCESSFUL APPLICANTS

A notification letter selecting a Full Application for award negotiations does not authorize the Applicant to commence performance of the project. **ARPA-E selects Full Applications for award negotiations, not for award.** Applicants do not receive an award until award negotiations are complete and the Contracting Officer executes the funding agreement. ARPA-E may terminate award negotiations at any time for any reason.

Please refer to Section IV.F.2 of the FOA for guidance on pre-award costs. Please also refer to the “Applicant’s Guide to ARPA-E Award Negotiations” (<http://arpa-e.energy.gov/SBIRSTTR.aspx>) for guidance on the award negotiation process.

b. POSTPONED SELECTION DETERMINATIONS

A notification letter postponing a final selection determination until a later date does not authorize the Applicant to commence performance of the project. ARPA-E may ultimately determine to select or not select the Full Application for award negotiations.

Please refer to Section IV.F.2 of the FOA for guidance on pre-award costs.

c. UNSUCCESSFUL APPLICANTS

By not selecting a Full Application, ARPA-E intends to convey its lack of programmatic interest in the proposed project. Such assessments do not necessarily reflect judgments on the merits of the proposed project. ARPA-E hopes that unsuccessful Applicants will submit innovative ideas and concepts for future FOAs.

B. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS

The following administrative and national policy requirements apply to Prime Recipients. The Prime Recipient is the responsible authority regarding the settlement and satisfaction of all contractual and administrative issues, including but not limited to disputes and claims arising out of any agreement between the Prime Recipient and a FFRDC. Prime Recipients are required to flow down these requirements to their Subrecipients through subawards or related agreements.

1. DUNS NUMBER AND CCR, FSRS, AND FEDCONNECT REGISTRATIONS

Upon selection for award negotiations, Prime Recipients and Subrecipients are required to obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number at <http://fedgov.dnb.com/webform>. In addition, Prime Recipients and Subrecipients are required to register with the Central Contractor Registry (CCR) at <https://www.bpn.gov/ccr/default.aspx>.

Prime Recipients and Subrecipients should commence this process as soon as possible in order to expedite the execution of a funding agreement. Obtaining a DUNS number and registering with the CCR could take several weeks.

By law, Prime Recipients are also required to register with the Federal Funding Accountability and Transparency Act Subaward Reporting System (FSRS) at <https://www.fsrs.gov/>.³⁶ Prime Recipients are required to report to FSRS the names and total compensation of each of the Prime Recipient's five most highly compensated executives and the names and total

³⁶ The Federal Funding Accountability and Transparency Act, P.L. 109-282, 31 U.S.C. 6101 note.

compensation of each Subrecipient's five most highly compensated executives. Please refer to <https://www.fsr.gov/> for guidance on reporting requirements.

ARPA-E will not execute a funding agreement with the Prime Recipient until it has obtained a DUNS number and completed its CCR and FSRS registrations. In addition, the Prime Recipient may not execute subawards with Subrecipients until they obtain a DUNS number and complete their CCR registration. Prime Recipients and Subrecipients are required to keep their CCR and FSRS data current throughout the duration of the project.

Finally, Prime Recipients are required to register with FedConnect in order to receive notification that their funding agreement has been executed by the Contracting Officer and to obtain a copy of the executed funding agreement. Please refer to <https://www.fedconnect.net/FedConnect/> for registration instructions.

2. NATIONAL POLICY ASSURANCES

Project Teams, including Prime Recipients and Subrecipients, are required to comply with the National Policy Assurances attached to their funding agreement. Please refer to ARPA-E's Model Cooperative Agreement for SBIR/STTR awards (<http://arpa-e.energy.gov/SBIRSTTR.aspx>) for guidance on the National Policy Assurances.

3. PROOF OF COST SHARE COMMITMENT AND ALLOWABILITY

Upon selection for award negotiations, the Prime Recipient must confirm in writing that the proposed cost share is allowable in accordance with applicable Federal cost principles.

The Prime Recipient is also required to provide cost share commitment letters from Subrecipients or third parties that are providing cost share, whether cash or in-kind. Each Subrecipient or third party that is contributing cost share must provide a letter on appropriate letterhead that is signed by an authorized corporate representative. The letter must state, in unconditional and unequivocal terms, its commitment to provide cost share. The letter may not include any conditions for receipt of the cost share contributions. The letter must state the amount and form of cost share, the source and precise nature of the contribution, and the duration and timing of the commitment (e.g., two years beginning in October 1, 2012).

4. COST SHARE PAYMENTS³⁷

All proposed cost share contributions for Phase II and Phase IIS of Combined Phase I/II award and Combined Phase I/II/IIS awards must be reviewed in advance by the Contracting Officer and incorporated into the project budget before the expenditures are incurred.

ARPA-E requires Prime Recipients to contribute the cost share amount incrementally during the performance of work in Phase II and/or Phase IIS (as applicable).³⁸ Specifically, every Prime Recipient is required to contribute, at a minimum, the cost share percentage of total expenditures incurred during every billing period in Phase II and/or Phase IIS (as applicable). For example, a Prime Recipient is required to contribute at least 22% of the total expenditures incurred during every billing period in Phase II if the funding agreement states that the cost share percentage is 22%. In the alternative, a Prime Recipient may front-load its cost share contributions, so the entire cost share amount is contributed upfront (e.g., in Phase I or the first year of performance).

If Prime Recipients anticipate difficulty providing the requisite cost share every billing period, they may request authorization from ARPA-E upon selection for award negotiations to (1) contribute the cost share percentage of total expenditures incurred every quarter (i.e., every three months), or (2) contribute the cost share percentage of total expenditures incurred every half-year (i.e., every six months). Such requests must be sent by email to the ARPA-E Budget Director during award negotiations and include the following information: (1) a detailed justification for the request; (2) a proposed schedule of payments, including amounts and dates; (3) a written commitment to meet that schedule; and (4) such evidence as necessary to demonstrate that the Prime Recipient has complied with its cost share obligations to date. ARPA-E may revoke its authorization at any time for any reason.

ARPA-E may deny reimbursement requests, in whole or in part, or modify or terminate funding agreements where Prime Recipients (or Project Teams) fail to comply with ARPA-E's cost share payment requirements.

5. COST SHARE REPORTING³⁹

Written documentation showing that the Prime Recipient (or Project Team, as appropriate) paid at least the cost share percentage of total expenditures incurred during the relevant billing period in Phase II or Phase IIS must accompany all reimbursement requests.

³⁷ Please refer to Section III.E of the FOA for guidance on cost share requirements.

³⁸ Prime Recipients may elect to pay the entire cost share amount at the start of the project.

³⁹ Please refer to Section III.E of the FOA for guidance on cost share requirements.

If authorized by ARPA-E to provide the requisite cost share for Phase II and Phase IIS of a Combined Phase I/II award or a Combined Phase I/II/IIS award on a quarterly or biannual basis, the Prime Recipient is required to submit the cost share report for the relevant quarter or half-year with the reimbursement request for that period. Written documentation showing that the Prime Recipient (or Project Team, as appropriate) paid at least the cost share percentage of total expenditures incurred during the relevant quarter or half-year must accompany these reports.

In terms of written documentation, Prime Recipients may provide ARPA-E with (1) summary documentation that presents an overview of expenditures incurred during the relevant billing period in Phase II or Phase IIS (e.g., printouts from internal financial software) or (2) detailed documentation of expenditures incurred during the relevant billing period, including but not limited to invoices on appropriate letterhead, equipment purchase requisitions, and travel vouchers.

ARPA-E may deny reimbursement requests, in whole or in part, or modify or terminate funding agreements where Prime Recipients (or Project Teams) fails to comply with ARPA-E's cost share reporting requirements.

6. ENVIRONMENTAL IMPACT QUESTIONNAIRE

By law, ARPA-E is required to evaluate the potential environmental impact of projects that it is considering for funding.⁴⁰ In particular, ARPA-E must determine before funding a project whether the project qualifies for a categorical exclusion under 10 C.F.R. § 1021.410 or whether it requires further environmental review (i.e., an environmental assessment or an environmental impact statement).

To facilitate and expedite ARPA-E's environmental review, Prime Recipients are required to complete an Environmental Impact Questionnaire during award negotiations. The Environmental Impact Questionnaire must be submitted in Adobe PDF format. This form is available on ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov>).

Prime Recipients are required to complete the Environmental Impact Questionnaire for the project as a whole, including all work to be performed by the Prime Recipient and its Subrecipients and Contractors. Prime Recipients may not limit their responses to work performed by the Prime Recipient.

In completing the Environmental Impact Questionnaire, Prime Recipients must provide specific information regarding the nature of the Project Team's proposed action, including information on their size, operations, and the types and quantities of air emissions, wastewater discharges, solid wastes, land disturbances, etc. Prime Recipients should identify the location(s) of the proposed action and specifically describe the activities that would occur at each location.

Upon request, the Prime Recipient or Subrecipients are required to provide additional information to the ARPA-E NEPA Compliance Officer.

7. TECHNOLOGY-TO-MARKET PLAN

During award negotiations, Prime Recipients are required to negotiate and complete a Technology-to-Market Plan for Phase II and Phase IIS with the designated ARPA-E Program Director. Prime Recipients must show how budgeted costs relate to furthering elements of the Technology-to-Market Plan. Prime Recipients are required to submit updated versions of the plan every six months through the end of the project period. Prime Recipients may be required to perform other actions to further the commercialization of their respective technologies. (Prime Recipients are not required to negotiate a Technology-to-Market Plan for Phase I only awards.)

ARPA-E Program Directors may waive or modify this requirement, as appropriate.

8. INTELLECTUAL PROPERTY AND COMMERCIALIZATION RIGHTS AGREEMENT

ARPA-E requires every multi-member Project Team to negotiate and execute an Intellectual Property and Commercialization Rights Agreement that governs management and disposition of intellectual property arising from the project, and allocates rights to carry out any follow-on research, development, or commercialization activities. The Prime Recipient must submit a completed and signed Intellectual Property and Commercialization Rights Agreement to ARPA-E within six weeks of the effective date of the ARPA-E funding agreement. All Intellectual Property and Commercialization Rights Agreements are subject to the terms and conditions of the ARPA-E funding agreement and applicable Federal laws, regulations, and policies, all of which take precedence over the terms of Intellectual Property and Commercialization Rights Agreements.

ARPA-E has developed a template for Intellectual Property and Commercialization Rights Agreements (<http://arpa-e.energy.gov/SBIRSTTR.aspx>) so as to facilitate and expedite negotiations between Project Team members. ARPA-E does not mandate the use of the templates. ARPA-E and DOE do not make any warranty (express or implied) or assume any liability or responsibility for the accuracy, completeness, or usefulness of the templates. ARPA-

E and DOE strongly encourage Project Teams to consult independent legal counsel before using the templates.

9. U.S. MANUFACTURING REQUIREMENT

ARPA-E requires subject inventions (i.e., inventions conceived or first actually reduced to practice under ARPA-E funding agreements) to be substantially manufactured in the United States by Project Teams and their licensees, as described below. The Applicant may request a modification or waiver of the U.S. Manufacturing Requirement through the Business Assurances Form submitted with the Full Application.

a. SMALL BUSINESSES

Small businesses (including Small Business Concerns) that are Prime Recipients or Subrecipients under ARPA-E funding agreements are required to substantially manufacture the following products in the United States for any use or sale in the United States: (1) products embodying subject inventions, and (2) products produced through the use of subject invention(s).⁴¹ This requirement does not apply to products that are manufactured for use or sale overseas.

Small businesses must apply the same U.S. Manufacturing requirements to their assignees, licensees, and entities acquiring a controlling interest in the small business. Small businesses must require their assignees and entities acquiring a controlling interest in the small business to apply the same U.S. Manufacturing requirements to their licensees.

b. LARGE BUSINESSES AND FOREIGN ENTITIES

Large businesses and foreign entities that are Subrecipients under ARPA-E funding agreements are required to substantially manufacture the following products in the United States: (1) products embodying subject inventions, and (2) products produced through the use of subject invention(s).⁴² This requirement applies to products that are manufactured for use or sale in the United States and overseas.

⁴¹ Small businesses are generally defined as domestically incorporated entities that meet the criteria established by the U.S. Small Business Administration's "Table of Small Business Size Standards Matched to North American Industry Classification System Codes" (http://www.sba.gov/idc/groups/public/documents/sba_homepage/serv_sstd_tablepdf.pdf). Small businesses include Small Business Concerns, as defined in Note 2.

⁴² Large businesses are generally defined as domestically incorporated entities that do not meet the criteria established by the U.S. Small Business Administration's "Table of Small Business Size Standards Matched to North American Industry Classification System Codes" (http://www.sba.gov/idc/groups/public/documents/sba_homepage/serv_sstd_tablepdf.pdf).

Large businesses and foreign entities must apply the same U.S. Manufacturing requirements to their assignees, licensees, and entities acquiring a controlling interest in the large business or foreign entity. Large businesses and foreign entities must require their assignees and entities acquiring a controlling interest in the large business or foreign entity to apply the same U.S. Manufacturing requirements to their licensees.

c. EDUCATIONAL INSTITUTIONS AND NONPROFITS

Domestic educational institutions and nonprofits that are Subrecipients under ARPA-E funding agreements must require their exclusive licensees to substantially manufacture the following products in the United States for any use or sale in the United States: (1) articles embodying subject inventions, and (2) articles produced through the use of subject invention(s). This requirement does not apply to articles that are manufactured for use or sale overseas.

Educational institutions and nonprofits must require their assignees to apply the same U.S. Manufacturing requirements to their exclusive licensees.

These U.S. Manufacturing requirements do not apply to nonexclusive licensees.

d. FFRDCs and State and Local Government Entities

FFRDCs and state and local government entities are subject to the same U.S. Manufacturing requirements as domestic educational institutions and nonprofits.

10. SUBJECT INVENTION UTILIZATION REPORTING

To ensure that Prime Recipients and Subrecipients holding title to subject inventions are taking the appropriate steps to commercialize subject inventions, ARPA-E requires Recipients to submit annual reports (throughout the project period and for the duration of U.S. patents resulting from the ARPA-E project) on the utilization of subject inventions and efforts made by Recipients or their licensees or assignees to stimulate such utilization. The reports must information regarding the status of development, date of first commercial sale or use, gross royalties received by the Recipient, and such other data and information as ARPA-E may specify.

11. MANDATORY LIGHTING UPGRADES

The Prime Recipient of any ARPA-E award in excess of \$1 million will be required to certify that it will, by the end of the fiscal year, upgrade the efficiency of its facilities by replacing any lighting that does not meet or exceed the energy efficiency standard for incandescent light

bulbs set forth in Section 325 of the Energy Policy and Conservation Act (42 U.S.C. § 6295). This requirement is derived from the Consolidated Appropriations Act of 2012, available at <http://www.gpo.gov/fdsys/pkg/BILLS-112hr2055enr/pdf/BILLS-112hr2055enr.pdf>.

C. REPORTING

Recipients are required to submit periodic, detailed reports on technical, financial, and other aspects of the project, as described in Attachment 4 to ARPA-E's Model Cooperative Agreement for SBIR/STTR awards (<http://arpa-e.energy.gov/SBIRSTTR.aspx>).

VII. AGENCY CONTACTS

A. COMMUNICATIONS WITH ARPA-E

Upon the issuance of a FOA, ARPA-E personnel are prohibited from communicating (in writing or otherwise) with Applicants regarding the FOA. This “quiet period” remains in effect until ARPA-E’s public announcement of its project selections.

During the “quiet period,” Applicants are required to submit all questions regarding this FOA to ARPA-E-CO@hq.doe.gov.

- Every Friday, ARPA-E will post responses to any questions that were received by Wednesday at 12 PM Eastern Time. (Questions received after Wednesday at 12 PM Eastern Time will be answered the following week.) ARPA-E may re-phrase questions or consolidate similar questions for administrative purposes.
- ARPA-E will cease to accept questions approximately 3 business days in advance of each submission deadline. Responses to questions received before the cutoff will be posted approximately one business day in advance of the submission deadline. ARPA-E may re-phrase questions or consolidate similar questions for administrative purposes.
- Responses are posted to “Frequently Asked Questions” on ARPA-E’s website (<http://arpa-e.energy.gov/About/FAQs.aspx>)

Applicants may submit questions regarding ARPA-E eXCHANGE, ARPA-E’s online application portal, to ExchangeHelp@hq.doe.gov. ARPA-E will promptly respond to emails that raise legitimate, technical issues with ARPA-E eXCHANGE. ARPA-E will refer any questions regarding the FOA to ARPA-E-CO@hq.doe.gov.

ARPA-E will not accept or respond to communications received by other means (e.g., fax, telephone, mail, hand delivery). Emails sent to other email addresses will be disregarded.

During the “quiet period,” only the Contracting Officer may authorize communications between ARPA-E personnel and Applicants. The Contracting Officer may communicate with Applicants as necessary and appropriate. As described in Section I.B.4 of the FOA, the Contracting Officer may arrange pre-selection meetings and/or site visits during the “quiet period.”

B. DEBRIEFINGS

*Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A.
Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).*

ARPA-E does not offer or provide debriefings to unsuccessful Applicants. However, ARPA-E provides Applicants with feedback on compliant and responsive Full Applications. Reviewer comments on Full Applications are made available before the submission deadline for Replies to Reviewer Comments.

VIII. OTHER INFORMATION

A. FOAs AND FOA MODIFICATIONS

FOAs are posted on ARPA-E eXCHANGE (<https://arpa-e-foa.energy.gov/>), Grants.gov (<http://www.grants.gov/>), FedConnect (<https://www.fedconnect.net/FedConnect/>), and the Government-wide SBIR/STTR website (<http://www.sbir.gov/solicitations>). Any modifications to the FOA are also posted to these websites. You can receive an e-mail when a modification is posted by registering with FedConnect as an interested party for this FOA. It is recommended that you register as soon as possible after release of the FOA to ensure that you receive timely notice of any modifications or other announcements. More information is available at <https://www.fedconnect.net>.

B. OBLIGATION OF PUBLIC FUNDS

The Contracting Officer is the only individual who can make awards on behalf of ARPA-E or obligate ARPA-E to the expenditure of public funds. A commitment or obligation by any individual other than the Contracting Officer, either explicit or implied, is invalid.

C. REQUIREMENT FOR FULL AND COMPLETE DISCLOSURE

Applicants are required to make a full and complete disclosure of the information required in the Business Assurances Form and the Other Sources of Funding Disclosure Form. Disclosure of the requested information is mandatory. Any failure to make a full and complete disclosure of the requested information may result in:

- The rejection of a Full Application and/or Reply to Reviewer Comments;
- The termination of award negotiations;
- The modification, suspension, and/or termination of a funding agreement;
- The initiation of debarment proceedings, debarment, and/or a declaration of ineligibility for receipt of Federal contracts, subcontracts, and financial assistance and benefits; and
- Civil and/or criminal penalties.

D. RETENTION OF SUBMISSIONS

ARPA-E expects to retain copies of all Notices of Intent, Full Applications, Replies to Reviewer Comments, and other submissions. No submissions will be returned. By applying to ARPA-E for funding, Applicants consent to ARPA-E's retention of their submissions.

E. MARKING OF CONFIDENTIAL INFORMATION

ARPA-E will use data and other information contained in Notices of Intent, Full Applications, and Replies to Reviewer Comments strictly for evaluation purposes. Applicants should not include confidential, proprietary, or privileged information in their Notices of Intent, Full Applications, or Replies to Reviewer Comments unless such information is necessary to convey an understanding of the proposed project.

Notices of Intent, Full Applications, Replies to Reviewer Comments, and other submissions containing confidential, proprietary, or privileged information must be marked as described below. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under the Freedom of Information Act or otherwise. The U.S. Government is not liable for the disclosure or use of unmarked information, and may use or disclose such information for any purpose.

The cover sheet of the Full Application, Reply to Reviewer Comments, or other submission must be marked as follows and identify the specific pages containing confidential, proprietary, or privileged information:

Notice of Restriction on Disclosure and Use of Data:

Pages [] of this document may contain confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for evaluation purposes or in accordance with a financial assistance or loan agreement between the submitter and the Government. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source.

The header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: "Contains Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure." In addition, every line and paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets or highlighting.

F. TITLE TO SUBJECT INVENTIONS

Ownership of subject inventions is governed pursuant to the authorities listed below. Typically, either by operation of law or under the authority of a patent waiver, Prime Recipients and Subrecipients may elect to retain title to their subject inventions under ARPA-E funding agreements.

- Domestic Small Businesses (including Small Business Concerns), Educational Institutions, and Nonprofits: Under the Bayh-Dole Act (35 U.S.C. § 200 et seq.), domestic small businesses, educational institutions, and nonprofits may elect to retain title to their subject inventions.
- All other parties: The Federal Non Nuclear Energy Act of 1974, 42. U.S.C. § 5908, provides that the Government obtains title to new inventions unless a waiver is granted (*see below*).
- Class Waiver: Under 42 U.S.C. § 5908, title to subject inventions vests in the U.S. Government and large businesses and foreign entities do not have the automatic right to elect to retain title to subject inventions. However, ARPA-E typically issues “class patent waivers” under which large businesses and foreign entities that meet certain stated requirements may elect to retain title to their subject inventions. If a large business or foreign entity elects to retain title to its subject invention, it must file a patent application.

G. GOVERNMENT RIGHTS IN SUBJECT INVENTIONS

Where Prime Recipients and Subrecipients retain title to subject inventions, the U.S. Government retains certain rights.

1. GOVERNMENT USE LICENSE

The U.S. Government retains a nonexclusive, nontransferrable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States any subject invention throughout the world. This license extends to contractors doing work on behalf of the Government.

2. MARCH-IN RIGHTS

The U.S. Government retains march-in rights with respect to all subject inventions. Through “march-in rights,” the Government may require a Prime Recipient or Subrecipient who has elected to retain title to a subject invention (or their assignees or exclusive licensees), to grant a

license for use of the invention. In addition, the Government may grant licenses for use of the subject invention when Prime Recipients, Subrecipients, or their assignees and exclusive licensees refuse to do so.

The U.S. Government may exercise its march-in rights if it determines that such action is necessary under any of the four following conditions:

- The owner or licensee has not taken or is not expected to take effective steps to achieve practical application of the invention within a reasonable time;
- The owner or licensee has not taken action to alleviate health or safety needs in a reasonably satisfied manner;
- The owner has not met public use requirements specified by Federal statutes in a reasonably satisfied manner; or
- The U.S. Manufacturing requirement has not been met.

H. RIGHTS IN TECHNICAL DATA

Data rights differ based on whether data is first produced under an award or instead was developed at private expense outside the award.

- **Background or “Limited Rights Data”:** The U.S. Government will not normally require delivery of technical data developed solely at private expense prior to issuance of an award, except as necessary to monitor technical progress and evaluate the potential of proposed technologies to reach specific technical and cost metrics.
- **Generated Data:** The U.S. Government normally retains very broad rights in technical data produced under Government financial assistance awards, including the right to distribute to the public. However, pursuant to special statutory authority, certain categories of data generated under ARPA-E awards may be protected from public disclosure for up to four years from delivery of the last deliverable under the agreement. Such data should be clearly marked as described in Section VIII.E of the FOA. In addition, invention disclosures may be protected from public disclosure for a reasonable time in order to allow for filing a patent application.

I. PROTECTED PERSONALLY IDENTIFIABLE INFORMATION

Applicants may not include any Protected Personally Identifiable Information (Protected PII) in their submissions to ARPA-E. Protected PII is defined as data that, if compromised, could cause harm to an individual such as identity theft. Listed below are examples of Protected PII that Applicants must not include in their submissions.

- Social Security Numbers in any form;
- Place of Birth associated with an individual;
- Date of Birth associated with an individual;
- Mother’s maiden name associated with an individual;
- Biometric record associated with an individual;
- Fingerprint;
- Iris scan;
- DNA;
- Medical history information associated with an individual;
- Medical conditions, including history of disease;
- Metric information, e.g. weight, height, blood pressure;
- Criminal history associated with an individual;
- Ratings;
- Disciplinary actions;
- Performance elements and standards (or work expectations) are PII when they are so intertwined with performance appraisals that their disclosure would reveal an individual’s performance appraisal;
- Financial information associated with an individual;
- Credit card numbers;
- Bank account numbers; and
- Security clearance history or related information (not including actual clearances held).

J. ANNUAL COMPLIANCE AUDITS FOR FOR-PROFIT ENTITIES

For-profit entities (including Small Business Concerns) that are Prime Recipients and, if applicable, Subrecipients may be required to have an annual compliance audit performed by an independent auditor. For additional information, please refer to 10 C.F.R. § 600.316 and for-profit audit guidance documents posted under the “Coverage of Independent Audits” heading at http://management.energy.gov/business_doe/business_forms.htm.

IX. GLOSSARY

Applicant: The Small Business Concern that submits the application to ARPA-E. In the case of a Project Team, the Applicant is the lead organization listed on the application.

Application: The submission received by ARPA-E, including the Notice of Intent, Full Application, and Reply to Reviewer Comments.

ARPA-E: Advanced Research Projects Agency-Energy.

Cost Share: The Prime Recipient share of the Total Project Cost.

DOE: U.S. Department of Energy.

DOE/NNSA: U.S. Department of Energy/National Nuclear Security Administration

FFRDCs: Federally Funded Research and Development Centers.

FOA: Funding Opportunity Announcement.

GOGOs: U.S. Government-Owned Government-Operated laboratories.

Key Participant: Any individual who would contribute in a substantive, measurable way to the execution of the proposed project.

Prime Recipient: The signatory to the funding agreement with ARPA-E.

Project Team: The term “Project Team” is used to mean any entity with multiple players working collaboratively and could encompass anything from an existing organization to an ad hoc teaming arrangement. A Project Team consists of the Prime Recipient, Subrecipients, and others performing or otherwise supporting work under an ARPA-E funding agreement.

R&D: Research and Demonstration.

Research Institution: A FFRDC, nonprofit educational institution, or other nonprofit research organization owned and operated exclusively for scientific purposes. Eligible Research Institutions must maintain a place of business in the United States, operate primarily in the United States, or make a significant contribution to the U.S. economy through the payment of taxes or use of American products, materials, or labor.

SBA: U.S. Small Business Administration

SBIR: Small Business Innovation Research Program

Small Business Concern: A for-profit entity that: (1) maintains a place of business located in the United States, operates primarily within the United States, or makes a significant contribution to the United States economy through payment of taxes or use of American products, materials or labor; (2) is an individual proprietorship, partnership, corporation, limited liability company, joint venture, association, trust, or cooperative; (3) is at least 51% owned and controlled by one or more individuals who are U.S. citizens or permanent residents; and (4) has, including affiliates, no more than 500 employees. Joint ventures and limited partnerships are eligible only if each entity to the venture or limited partnership is 51% owned and controlled by one or more U.S. citizens or permanent residents.

Standalone Applicant: An Applicant that applies for funding on its own, not as part of a Project Team.

STTR: Small Business Technology Transfer Program.

Subject Invention: Any invention conceived or first actually reduced to practice under an ARPA-E funding agreement.

Total Project Cost: The sum of the Prime Recipient share and the Federal Government share of total allowable costs. The Federal Government share generally includes costs incurred by FFRDCs and GOGOs.

APPENDIX 1: SAMPLE SUMMARY SLIDE

3D XYZ-based Battery - The Most Epic Battery Material Ever *John Smith, ABC University*

0000-1234

ARPA-E funds: \$5.55M

Cost share: 25%

Technology Summary

- Develop novel material XYZ, which, because of its structure, inherently has the most active sites of all battery materials.
- Demonstrate roll to roll printing of mechanically stable material XYZ
- Integration of XYZ into novel 3D battery architecture (shown in picture)

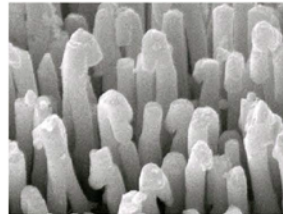
Technology Impact

- Reduces cost of batteries by 4X, enables higher penetration of EVs
- Maintain US leadership in \$100B market

Proposed Targets

Metric	State of the Art	Proposed
Active sites	25/cm ²	100/cm ²
Stability	2 defects/cm ²	1 defect/cm ²
Energy Density	33 J/kg	100J/kg
Recharge time	60 min	15 min
Manufacturing cost	\$1,000	\$250

Supporting Figures, Tables, & Illustrations



Material XYZ, with many active sites



Proposed 3D battery architecture

Transportation scale batteries with 3X energy density at ¼ cost



Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A.
Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

APPENDIX 2: SAMPLE RESPONSE TO “OTHER SOURCES OF FUNDING DISCLOSURE FORM”

Applicant: ThermoCapture LLC
Application Control Number: 0123-4567

***INSTRUCTIONS:** The Principal Investigator (PI) is required to complete and submit this form with the Full Application. Additional instructions are provided below. A sample response to this form is attached to the Funding Opportunity Announcement.*

Certification: I certify that the information contained in this disclosure form is accurate and complete. I understand that false statements or misrepresentations may result in civil and/or criminal penalties under 18 U.S.C. § 1001.

PI Name: Jane Doe, Ph.D.

Date: 02-13-12

PI Signature: [Insert below. Electronic signatures are acceptable.]

X

Principal Investigator

(1) ADDITIONALITY AND RISK: Mandatory. 4 pages maximum. The PI must provide a narrative response to each question below. If the question is not applicable, please insert “N/A” in the space provided.

- a. Describe the technical, market, and organizational risks associated with the proposed R&D project.**

ThermoCapture’s proposed technology will use supercritical fluids in a thermal energy storage device that can be integrated with utility-scale solar thermal and geothermal generating sources. A thermal energy storage of the proposed scale has never been developed by researchers in the field, making ThermoCapture’s proposed device advanced relative to the existing state of the art.

To date, ThermoCapture’s research has focused on identification and optimization of appropriate supercritical fluids that demonstrate ideal P-V-T characteristics for thermal energy storage. However, supercritical fluids have not been integrated into a scaled proof-of-concept system sufficient to demonstrate the full potential of supercritical thermal storage capacity for large-scale power systems. As a result private investors have deemed ThermoCapture’s technology premature for commercialization and risky from an investment standpoint (see Item (e) below). Intensive RD&D is required to overcome this perceived market barrier and

Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A.
Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

situate the proposed technology for scaled manufacturing, market penetration, and commercial deployment. Securing public funding to support the proposed RD&D is critical to meeting these objectives.

b. Describe why the proposed Prime Recipient or Project Team needs ARPA-E funding for the proposed R&D project, relative to other funding sources.

The proposed RD&D project seeks to prove the technical and commercial feasibility of using supercritical fluid in a proposed thermal energy storage system through proof-of-concept prototype testing. This work will lay the foundation for eventual commercial-scale demonstration activities. These are critical steps towards scale up, market penetration, and commercial deployment.

Given the technical risk of RD&D that remains for ThermoCapture's proposed technology, at a proof-of-concept scale private investors are hesitating to provide further backing towards ThermoCapture. In particular, the risks associated with developing a compression technology matching the P-V-T characteristics identified in basic research of the supercritical fluid are high. In addition, as the P-V-T characteristics of the supercritical fluid have been investigated on a basic science basis, the proposed technology has advanced to a level of development beyond basic science (TRL 2), making funding from public sources such as the National Science Foundation inappropriate. Finally, due to the intensive involvement of the National Renewable Energy Laboratory (NREL) in the proposed project, funding under public programs such as the Small Business Innovation Research program is inappropriate.

Within the Department of Energy, ARPA-E is particularly well situated to fund a project of this nature. The project presents significant technical risk and demonstrates immense innovation potential, while other sources of funding are unavailable.

c. Describe how, if the successful, the proposed R&D project may lead to increased employment and manufacturing in the United States.

In its 3 years of operation, ThermoCapture has generated 21 high technology and 3 administrative jobs. Based on existing growth trajectory, ThermoCapture plans to develop new manufacturing facilities that will expand the company's size to 110 personnel within 2-3 years. If successful in this project, ThermoCapture may accelerate this growth.

d. If the proposed Prime Recipient is sponsored by private investors, identify the types of private investors that have supported your business and explain why this R&D project is not being supported by the private investors. In addition, describe technical outcomes of the proposed R&D project that could lead to additional private investment following a successful ARPA-E project.

In April 2010, ThermoCapture raised \$1,500,000 in Series A capital based on support from EnergyFund LLC, a venture capital fund. This funding was used to recruit a strong research team and support preliminary RD&D through computational modeling, and laboratory and bench-scale research. Since May 2011, ThermoCapture has sought Series B funding, but has not succeeded in securing additional venture backing.

An appraisal of ThermoCapture's intellectual property portfolio has characterized ThermoCapture's technologies as "systematically unique" and "innovative." However, the company has failed to secure next-round financing due to investor concern that its core thermal energy storage system is too premature for commercialization and would require a proof-of-concept scale demonstration.

A successful ARPA-E project could prove the technical and financial feasibility of utilizing supercritical fluids for thermal energy storage at the commercial scale and demonstrate the proposed technology's flexible use with a variety of renewable energy applications. Funding from ARPA-E will thus assist ThermoCapture in bringing the proposed technology to a point of development at which investor confidence will increase.

- e. **If the proposed Prime Recipient is not sponsored by private investors, describe why this R&D project has been unable to attract private financing. In addition, describe technical outcomes of the proposed R&D project that could lead to private investment following a successful ARPA-E project.**

N/A

Sample

Applicant: ThermoCapture LLC
Application Control Number: 0123-4567

(2) POTENTIAL OVERLAP WITH OTHER APPLICATIONS: Mandatory. No page limit. The PI must answer "Yes" or "No" to each question below. If the answer to either question is "Yes," the PI must provide the requested information.

a. Has the PI or any Co-PIs submitted this application to any Federal or non-Federal entity (including but not limited to industry, private investors, and foreign, state, or local governments)?

YES NO

If "Yes," complete a separate table for each Federal and non-Federal entity. If additional tables are required, include the tables in an addendum to this form.

Source of Funding #1:
Date of Submission:
Title of Submission:
Application Status:

Source of Funding #2:
Date of Submission:
Title of Submission:
Application Status:

b. Has the PI or any Co-PI(s) submitted any application(s) for related work (i.e., work that relates directly or indirectly to the proposed R&D project) to any Federal or non-Federal entity (including but not limited to industry, private investors, and foreign, state, or local governments) within the last 24 months?

YES NO

If "Yes," complete a separate table for each Federal and non-Federal entity. If additional tables are required, include the tables in an addendum to this form.

Source of Funding #1: U.S. Department of Energy - Small Business Innovation Research Program
Date of Submission: 09/15/2009
Title of Submission: Development of Supercritical Fluids for Thermal Energy Storage Devices
Application Status: Funded - Project Completed (see Section 3 below)

Source of Funding #2:

Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A.
Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

Date of Submission:
Title of Submission:
Application Status:

Sample

Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A.
Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

Applicant: ThermoCapture LLC
Application Control Number: 0123-4567

(3) OTHER SOURCES OF FUNDING: Mandatory. No page limit. The PI is required to disclose all Federal financial assistance received by the PI and Co-PIs. In addition, the PI is required to disclose any funding from non-Federal entities for related work (i.e., work relating directly or indirectly to the proposed R&D project).

- a. The PI is required to disclose **all financial assistance from any Federal entity** that the **PI or any Co-PI(s)** is **currently receiving or has received within the last 5 years**. Complete a separate table for each Federal entity. If additional tables are required, include the tables in an addendum to this form. If the PI and any Co-PI(s) have not received any such financial assistance, check the box marked "None" below.

If NONE, check here <input type="checkbox"/>

Federal Entity #1: U.S. Department of Energy
Federal Program Manager Name and Title: Tommy Johnson
Federal Program Manager Telephone: (202) 555-5555
Federal Program Manager Email Address: Tommy.Johnson@hq.doe.gov
Federal Program Manager Postal Address: U.S. Department of Energy 1000 Independence Ave., SW Washington, DC 20585
Title of Project: Development of Supercritical Fluids for Thermal Energy Storage Devices
Federal Funding: \$150,000 (Phase I SBIR)
Non-Federal Funding: \$0
Start and End Dates: 10/15/2009 – 04/15/2010
Abstract for Project This project focused on the development of a supercritical fluid to accommodate heat-based, grid-scale energy storage. Various supercritical fluid mediums were examined in order to determine which allowed for the highest capacity of energy storage within traditional metrics.

Federal Entity #2:
Federal Program Manager Name and Title:
Federal Program Manager Telephone:
Federal Program Manager Email Address:
Federal Program Manager Postal Address:
Title of Project:
Federal Funding:
Non-Federal Funding:
Start and End Dates:

Questions about this FOIA? Email ARPA-E-CO@hq.doe.gov (with FOIA name and number in subject line); see FOIA Sec. VII.A.
Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOIA name and number in subject line).

Abstract for Project:

- b. The PI is required to disclose any funding from any non-Federal entity for related work (i.e., work that is related directly or indirectly to the proposed R&D project) that the PI or any Co-PI(s) is currently receiving or has received within the last 5 years. Please complete a separate table below for each source of funding. If additional tables are required, include the tables in an addendum to this form. If the PI and Co-PI(s) have not received any such funding, check the box marked "None" below.

If NONE, check here

Non-Federal Entity #1: EnergyFund LLC
Point of Contact Name and Title: John Smith, President and CEO
Point of Contact Telephone: 650-555-5555
Point of Contact Email Address: JSmith@genericemailaddress.com
Point of Contact Postal Address: EnergyFund LLC 123 Venture Way Suite 430 Palo Alto, CA 94301
Title of Project: Optimization of Supercritical Fluids for Thermal Energy Storage Devices
Funding Amount: \$1,500,000
Start and End Dates: 04/2010 - ongoing
Abstract for Project: ThermoCapture raised \$1,500,000 in internal Series A capital. The uses of funds were explicitly defined in the investment agreement as "general working capital" under the direction and approval of EnergyFund's Board of Directors. This funding was used to recruit a strong research team and support preliminary applied RD&D through computational modeling, and laboratory and bench-scale research, to optimize supercritical fluids for use in an integrated proof-of-concept-scale thermal storage system.

Non-Federal Entity #2:
Point of Contact Name and Title:
Point of Contact Telephone:
Point of Contact Email Address:
Point of Contact Postal Address:
Title of Project:
Funding Amount:
Start and End Dates:
Abstract for Project:

Questions about this FOIA? Email ARPA-E-CO@hq.doe.gov (with FOIA name and number in subject line); see FOIA Sec. VII.A.
Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOIA name and number in subject line).

Applicant: ThermoCapture LLC
Application Control Number: 0123-4567

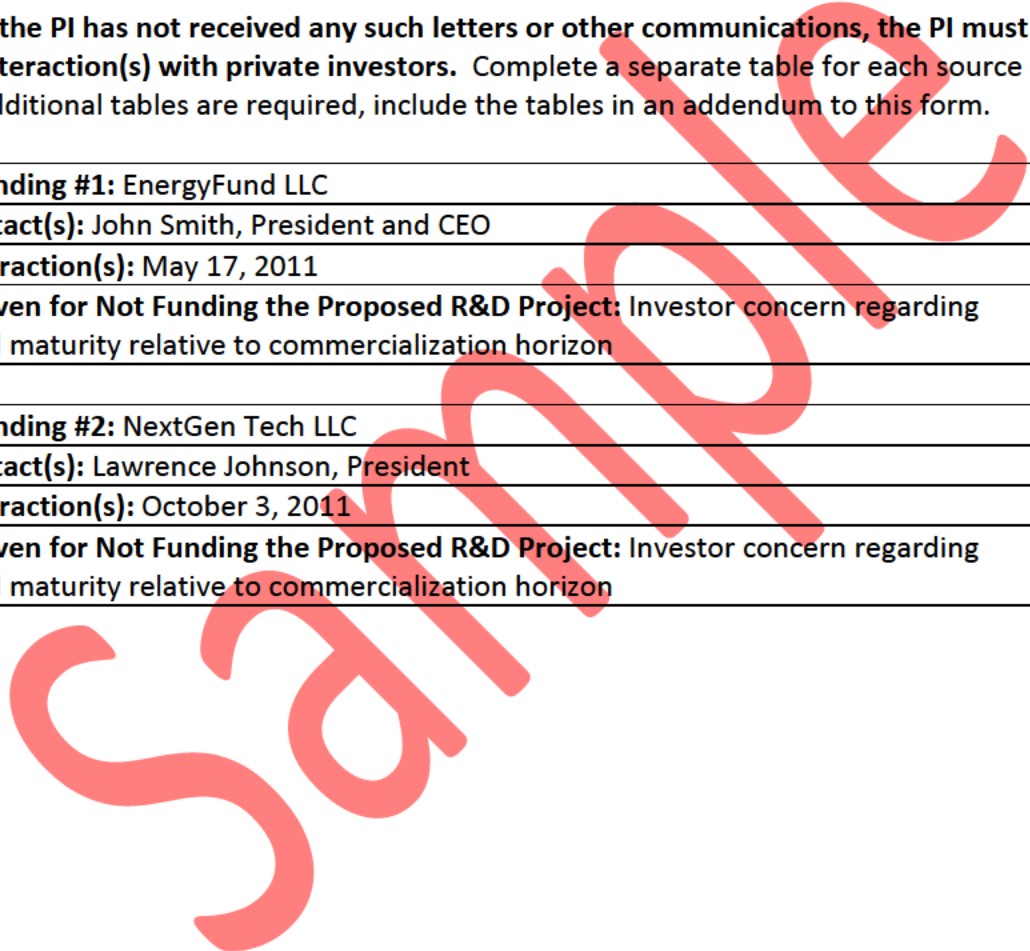
(4) LETTERS OF CORROBORATION: Mandatory. No page limit.

- a. The PI is required to provide any letter(s) or other communications (e.g., emails) from private investors explaining why they decided not to fund the proposed R&D project or related work (i.e., work that is related directly or indirectly to the proposed R&D project). Append copies of the letters or other communications to this form.

- b. If the PI has not received any such letters or other communications, the PI must document any interaction(s) with private investors. Complete a separate table for each source of funding. If additional tables are required, include the tables in an addendum to this form.

Source of Funding #1: EnergyFund LLC
Point of Contact(s): John Smith, President and CEO
Dates of Interaction(s): May 17, 2011
Reason(s) Given for Not Funding the Proposed R&D Project: Investor concern regarding technological maturity relative to commercialization horizon

Source of Funding #2: NextGen Tech LLC
Point of Contact(s): Lawrence Johnson, President
Dates of Interaction(s): October 3, 2011
Reason(s) Given for Not Funding the Proposed R&D Project: Investor concern regarding technological maturity relative to commercialization horizon



~~The Principal Investigator is required to complete and submit this form with the Full Application.~~

~~I certify that the information contained in this disclosure is accurate and complete. I understand that false statements or misrepresentations may result in civil and/or criminal penalties under 18 U.S.C. § 1001.~~

~~Principal Investigator Name: Jane Doe~~

~~Principal Investigator Signature:~~

~~Date: January 11, 2012~~

~~1. **ADDITIONALITY AND RISK:** Mandatory. 4 pages maximum. ARPA-E funds high risk, high-reward projects that have significant market impact potential if the technology development plan is successful.~~

~~(a) Describe the technical, market, and organizational risks associated with the proposed R&D project.~~

~~ThermoCapture's proposed technology will use supercritical fluids in a thermal energy storage device that can be integrated with utility scale solar thermal and geothermal generating sources. A thermal energy storage of the proposed scale has never been developed by researchers in the field, making ThermoCapture's proposed device advanced relative to the existing state of the art.~~

~~To date, ThermoCapture's research has focused on identification and optimization of appropriate supercritical fluids that demonstrate ideal P-V-T characteristics for thermal energy storage. However, supercritical fluids have not been integrated into a scaled proof-of-concept system sufficient to demonstrate the full potential of supercritical thermal storage capacity for large scale power systems. As a result, private investors have deemed ThermoCapture's technology premature for commercialization and risky from an investment standpoint (see Item (e) below). Intensive R&D efforts are required to overcome this perceived market barrier and situate the proposed technology for scaled manufacturing, market penetration, and commercial deployment. Securing public funding to support the proposed R&D efforts is critical to meeting these objectives.~~

~~(b) Describe why the lead organization or project team uniquely needs ARPA-E funding for the proposed R&D project, relative to other funding sources.~~

~~The proposed R&D project seeks to prove the technical and commercial feasibility of using supercritical fluid in a proposed thermal energy storage system through proof-of-concept~~

~~prototype testing. This work will lay the foundation for eventual commercial scale demonstration activities. These are critical steps towards scale up, market penetration, and commercial deployment.~~

~~Given the technical risk of R&D that remains for ThermoCapture's proposed technology, at a proof of concept scale private investors are hesitating to provide further backing towards ThermoCapture. In particular, the risks associated with developing a compression technology matching the P-V-T characteristics identified in basic research of the supercritical fluid are high. In addition, as the P-V-T characteristics of the supercritical fluid have been investigated on a basic science basis, the proposed technology has advanced to a level of development beyond basic science (TRL-2), making funding from public sources such as the National Science Foundation inappropriate. Finally, due to the intensive involvement of the National Renewable Energy Laboratory (NREL) in the proposed project, funding under public programs such as the Small Business Innovation Research program is inappropriate.~~

~~Within the Department of Energy, ARPA-E is particularly well situated to fund a project of this nature. The project presents significant technical risk and demonstrates immense innovation potential, while other sources of funding are unavailable.~~

~~(c) Describe how, if the successful, the proposed R&D project may lead to increased employment and manufacturing in the United States.~~

~~In its 3 years of operation, ThermoCapture has generated 21 high technology and 3 administrative jobs. Based on existing growth trajectory, ThermoCapture plans to develop new manufacturing facilities that will expand the company's size to 110 personnel within 2-3 years. If successful in this project, ThermoCapture may accelerate this growth.~~

~~(d) If the lead organization is a large business, describe why this R&D project is not being sponsored internally.~~

~~N/A~~

~~(e) If the lead organization is a small business sponsored by private investors, identify the types of private investors that have supported your business, and describe why this R&D project is not being supported by these investors. Please also describe technical outcomes of the proposed R&D project that could lead to additional private investment following a successful ARPA-E project.~~

~~In April 2010, ThermoCapture raised \$1,500,000 in Series A capital based on support from EnergyFund LLC, a venture capital fund. This funding was used to recruit a strong research team and support preliminary R&D through computational modeling, and laboratory and bench-scale research. Since May 2011, ThermoCapture has sought Series B funding, but has not succeeded in securing additional venture backing.~~

~~An appraisal of ThermoCapture's intellectual property portfolio has characterized ThermoCapture's technologies as "systematically unique" and "innovative." However, the company has failed to secure next round financing due to investor concern that its core thermal energy storage system is too premature for commercialization and would require a proof-of-concept scale demonstration.~~

~~A successful ARPA-E project could prove the technical and financial feasibility of utilizing supercritical fluids for thermal energy storage at the commercial scale and demonstrate the proposed technology's flexible use with a variety of renewable energy applications. Funding from ARPA-E will thus assist ThermoCapture in bringing the proposed technology to a point of development at which investor confidence will increase.~~

~~(f) If the lead organization is a startup not sponsored by private investors, describe why this R&D project has been unable to attract private financing. Please describe technical outcomes of the proposed R&D project that could lead to private investment following a successful ARPA-E project.~~

~~_____ N/A~~

~~(g) If the proposing organization is a university, nonprofit, or FFRDC, describe the sort of institutional or foundation resources that may be leveraged, and why this leverage has not been available to date.~~

~~_____ N/A~~

~~2. LETTERS OF CORROBORATION: Mandatory. No page limit.~~

~~(a) Principal Investigators are required to provide letters of corroboration documenting their efforts to secure funding from other sources prior to seeking funding from ARPA-E for the proposed project. Specifically, Principal Investigators must include letters from potential funding sources indicating why they chose not to fund the project or a very similar research effort. All letters must be appended to this form.~~

~~(b) If such letters are not available, the Principal Investigator must document its interaction with funding sources by providing the information in the table below. A separate table should be completed for each funding source that was approached and declined to fund the project.~~

Source of Funding #1	EnergyFund LLC
Name and Title of Person who Decided Not to Fund The Proposed ARPA-E Project	John Smith, President and CEO
Date that Decision Was Conveyed to Applicant	May 17, 2011

Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A.
Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

Person to whom the Decision Was Conveyed	Jane Doe, President and CTO, ThermoCapture
Reason Given for Decision	Investor concern regarding technological maturity relative to commercialization horizon

Source of Funding #1	NextGenTech LLC
Name and Title of Person who Decided Not to Fund The Proposed ARPA-E Project	Lawrence Johnson, President
Date that Decision Was Conveyed to Applicant	October 3, 2011
Person to whom the Decision Was Conveyed	Jane Doe, President and CTO, ThermoCapture
Reason Given for Decision	Investor concern regarding technological maturity relative to commercialization horizon.

~~3. OTHER SOURCES OF FUNDING: Mandatory. No page limit. Principal Investigators are required to describe in detail all financial assistance received by the Principal Investigator(s) and Key Participants.~~

~~(1) Financial assistance from any Federal Government agency or instrumentality. Identify all current financial assistance awards, prior financial assistance awards received in the last 5 years, and pending applications for financial assistance submitted within the last 24 months. For each award or application, please provide the information in the table below. A separate table should be completed for each award or application. If no such funding, check the box marked "None" below.~~

~~IF NONE, check here _____~~

Source of Funding #1	U.S. Department of Energy
Title of Project	Development of Supercritical Fluids for Thermal Energy Storage Devices
Funding Amount	\$150,000 (Phase I SBIR)
Start and End Dates	10/15/2009 – 04/15/2010
Abstract for Project	Quo eu ludus facilisi similique. Modo debitis assentior ad pri, usu et tale latine. Duis dolorem et sed, an tota falli mel. Nec te fastidii oporteat, ut vim idque viris. Nisi oratio voluptatum pri eu, euismod menandri deserunt pri at. Te eam dicat vidisse concludaturque. Oporteat deterruisset eum ei, vim te ponderum sententiae. Pri id etiam timeam forensibus, feugiat prodesset duo id. Ad illum augue simul mel, ridens delicata pro ea, probo consetetur at sea.
Specific Aims of Project	To develop, test, and fabricate supercritical fluids with a range of P-T-X characteristics sufficient for in use thermal energy storage applications.
Federal Program Manager Name	Tommy Johnson
Federal Program Manager Email Address	Tommy.Johnson@hq.doe.gov
Federal Program Manager	(202) 555-5555

Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A. Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

Telephone	
Federal Program Manager Postal Address	U.S. Department of Energy 1000 Independence Ave., SW Washington, DC 20585

Source of Funding #2	
Title of Project	
Funding Amount	
Start and End Dates	
Abstract for Project	
Specific Aims of Project	
Federal Program Manager Name	
Federal Program Manager Email Address	
Federal Program Manager Telephone	
Federal Program Manager Postal Address	

~~(2) Financial assistance from non Federal entities, including but not limited to industry, private investors, and foreign, state, and local governments: Identify all current funding agreements, prior funding agreements received in the last 5 years, and pending applications for funding submitted within the last 24 months for the proposed project or work that relates directly or indirectly to the proposed project. For each funding agreement or application, please provide the information in the table below. A separate table should be completed for each funding agreement or application. If no such funding, check the box marked "None" below.~~

~~If NONE, check here _____~~

Source of Funding #1	EnergyFund LLC
Source Point of Contact Name	John Smith, President and CEO
Source Point of Contact Email Address	JSmith@generic.com
Source Point of Contact Telephone	650 555 5555
Source Point of Contact Postal Address	EnergyFund LLC 123 Venture Way Suite 430 Palo Alto, CA 94301
Detailed Description of Differences between Existing	In April 2010, ThermoCapture raised \$1,500,000 in internal Series A capital. The uses of funds were explicitly defined in the investment

Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A.
Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

<p>Projects Funded by Source and Proposed ARPA-E Project, Including the Uses of Funds</p>	<p>agreement as “general working capital” under the direction and approval of EnergyFund’s Board of Directors. This funding was used to recruit a strong research team and support preliminary applied R&D tasks through computational modeling, and laboratory and bench scale research. Specific R&D tasks included:</p> <ul style="list-style-type: none"> ● Nihil adversarium cum no, solet menandri id eam. Id pro erat civibus. Case mollis officiiis cum ex, vero definiebas quo an. Ut prima graecis concludaturque pri, eos agam fabulas dolorem ea. ● Consulatu referrentur ne ius, verear mentitum repudiare cu has. Nostro maiorum invenire ne mel. ● Quot elit laboramus vel ut. Usu corpora senserit ne, pro id altera dictas. Sumo nonumes an vim. Ne duo habeo tempor, est at minim mollis. ● Eu vix saepe exerci, id eam alia propriae placerat, cum cu iriure oblique evertitur. ● Praesent partiendo no duo, cum ut dicunt tritani, vim no legere albucius. His maiorum elaboraret te, est te dicta option partiendo, ad usu fuisset fastidii aliquando. ● Ullum abhorreant cum no. Cu dicta nostro inermis nec. <p>To date, no venture funding has been used for proof of concept scale R&D objectives.</p> <p>ARPA-E funding would build on the work that has already been performed by shifting focus from optimization of supercritical fluids towards use of fluids in an integrated proof of concept scale thermal storage system, coupled with various renewable energy generating applications. Proposed work will focus on applied system development, testing, and optimization, rather than thermochemical research. For detailed information on the proposed R&D strategy, please see pages 10-25 of ThermoCapture’s Technical Volume.</p>
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<p>Source of Funding #2</p>	
<p>Source—Point of Contact Name</p>	
<p>Source—Point of Contact Email Address</p>	
<p>Source—Point of Contact Telephone</p>	
<p>Source—Point of Contact Postal Address</p>	
<p>Detailed Description of Differences between Existing Projects Funded by Source and</p>	

Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A. Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

Proposed ARPA-E Project	
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Sample

Questions about this FOA? Email ARPA-E-CO@hq.doe.gov (with FOA name and number in subject line); see FOA Sec. VII.A.
Problems with ARPA-E eXCHANGE? Email ExchangeHelp@hq.doe.gov (with FOA name and number in subject line).

APPENDIX 3: TECHNICAL VOLUME FOR THE FULL APPLICATION TEMPLATE

I. **AWARD CATEGORY:** Mandatory. 0.5 pages maximum. See Section IV.C.1 of the FOA for content requirements.

- **Award Category:** _____

Choose one of the following:

- Combined Phase I/II
- Combined Phase I/II/IIS

- **Funding Sought:** _____

Choose one of the following:

- SBIR
- STTR
- SBIR and STTR

II. **TECHNICAL CATEGORY:** Mandatory. 0.5 pages maximum. See Section IV.C.1 of the FOA for content requirements.

III. **TECHNICAL APPROACH:** Mandatory. 1 page maximum. See Section IV.C.1 of the FOA for content requirements.

IV. **R&D TASKS:** Mandatory. 3 pages maximum. See Section IV.C.1 of the FOA for content requirements.

V. **R&D STRATEGY:** Mandatory. 18 pages maximum. See Section IV.C.1 of the FOA for content requirements.

- VI. STATEMENT OF PROJECT OBJECTIVES:** Mandatory. 1 page maximum. See Section IV.C.1 of the FOA for content requirements.

- VII. TECHNICAL MILESTONES AND DELIVERABLES:** Mandatory. 9 pages maximum. See Section IV.C.1 of the FOA for content requirements.

- VIII. BUDGET SUMMARY:** Mandatory. 3 pages maximum. See Section IV.C.1 of the FOA for content requirements.

- IX. QUALIFICATIONS, EXPERIENCE, AND CAPABILITIES:** Mandatory. 3 pages maximum for each Personal Qualification Summary. See Section IV.C.1 of the FOA for content requirements.

- X. PARTICIPATING ORGANIZATIONS:** Mandatory. 1 page maximum. See Section IV.C.1 of the FOA for content requirements.

- XI. PRIOR COLLABORATION:** Mandatory. 1 page maximum. See Section IV.C.1 of the FOA for content requirements.

- XII. MANAGEMENT PLAN:** Mandatory. 1 page maximum. See Section IV.C.1 of the FOA for content requirements.

- XIII. MULTI-INVESTIGATOR PROJECTS:** Mandatory. 2 pages maximum. See Section IV.C.1 of the FOA for content requirements.

- XIV. TRANSITION/COMMERCIALIZATION STRATEGY:** Mandatory. 4 pages maximum. See Section IV.C.1 of the FOA for content requirements.
- XV. INTELLECTUAL PROPERTY STRATEGY:** Mandatory. No page limit. See Section IV.C.1 of the FOA for content requirements.

APPENDIX 4: REPLIES TO REVIEWER COMMENTS TEMPLATE

I. **TEXT REPLY:** Optional. 4 pages maximum. See Section IV.D of the FOA for content requirements.

II. **IMAGES:** Optional. 2 page maximum. See Section IV.D of the FOA for content requirements.