

## OPEN 2009 Program Overview

### B. ADVANCED RESEARCH PROJECTS AGENCY – ENERGY

The Advanced Research Projects Agency – Energy (ARPA-E) is an organization within the Department of Energy, chartered by Congress in the America COMPETES Act (P. L. 110-69) to create transformational new energy technologies and systems through funding and managing research and development (R&D) efforts. The mission of ARPA-E is to overcome the long-term and high risk technological barriers in the development of energy technologies that can achieve the following, with no direct detriment to any of ARPA-E's 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.

Under this announcement, ARPA-E will achieve these goals by funding energy technology projects that (1) translate scientific discoveries and cutting-edge inventions into technological innovations and (2) accelerate transformational technological advances in areas that industry by itself is not likely to undertake because of high technical or financial risk.

ARPA-E is not intended to be a substitute for existing R&D organizations within the Department of Energy. ARPA-E complements the existing organizations by adding an organization focused on R&D that is both transformational and translational. ARPA-E's purpose is not to support basic research aimed at discovery and knowledge generation for its own sake, nor will it undertake large-scale demonstration projects. Applicants interested in receiving basic research financial assistance should continue to work with the Department of Energy's Office of Science. Similarly, projects focused on incremental improvement in existing technology platforms that fall under the applied programs, e.g., the Office of Energy Efficiency and Renewable Energy, Office of Fossil Energy and the Office of Nuclear Energy, should continue to be directed to those offices.

ARPA-E does not own or manage any laboratories. ARPA-E will accomplish its mission by funding scientists and technologists outside ARPA-E to perform high-risk, high-payoff R&D efforts with the purpose of enabling major technological advances to overcome the problems of energy security and climate change.

ARPA-E's strategy is to define key challenges, develop solution concepts, support R&D projects that are transformational in nature, and bring those concepts to fruition. Transformational R&D is not about incremental improvements of the state of the art. It is about enabling major leaps forward in the technology base, technology components, and/or integrated systems. Transformational R&D emphasizes high-risk concepts with potentially high-payoff.

Transformational energy technologies are those that have the potential to create new paradigms in how energy is produced, transmitted, used, and/or stored. Such advances are characterized by a clear view of a desired outcome, an understanding of the barriers that intervene, and innovative pathways toward a new frontier. They have the potential to radically change understanding of important energy-related concepts or to lead to the creation of new energy-related fields. As breakthroughs, they often depend on technical approaches that are novel, emergent, integrative, or enabling, and fall outside the established constructs of existing mission-directed or discipline-oriented R&D programs.

The kinds of R&D activities supported by ARPA-E are not restricted. They may include targeted acceleration of novel, early-stage energy research with possible technology applications; development of techniques, processes, and technologies, and related testing and evaluation; research and development of manufacturing processes for novel energy technologies; and coordination with nongovernmental entities for demonstration of technologies and research applications to facilitate technology transfer. However, this announcement is focused on accelerated development of technologies.

Within the spectrum of technology research activities, from basic research to full system validation, as defined within a framework of nine (9) "technology readiness levels" (TRL) in FOA. (See Appendix 4 – Technology Readiness Levels (TRL)) ARPA-E is expected to operate mainly within the range of TRL-2 through TRL-7. There is a strong expectation that ARPA-E funded R&D, if successful, will advance technology readiness from lower to higher levels over the course of a project.

The test for how far to take technology maturation depends on: (1- early stage) whether the transformational objective is to open up a new field of technology through applied research; or (2 - late stage) whether the objective is to reduce the technology risk low enough for industry to invest in further development and deployment. Under this announcement, R&D projects should carry the technology development to one of these two decision points. For the later stage targeted development work, the R&D plan must overcome all key technical barriers currently preventing industrial absorption of the transformational technology, but should not carry the tax-payer investment beyond the point where industry should be able to shoulder the remaining technical and market risks. Depending on the specific technology and its industry, the industry absorption point may vary in TRL level.

R&D performers funded by ARPA-E may include the full range of R&D entities. ARPA-E encourages the appropriate skills mix to perform the proposed R&D. This may be a single performer or team, may be one or more institutions, and may include operational experts along with the research team.

The result of a later stage successful ARPA-E project will be such that the transformational technology originally conceived at the beginning of the R&D project will at the end of the project be sufficiently advanced and well defined in terms of performance and risk that industry can incorporate the new technology into product development. Projects under this FOA must be aimed at *more than progress toward* identified project goals; the project must be aimed at *delivering* on these project goals. The R&D effort on later stage technology development projects must carry the risk reduction process for the technology to the point entrepreneurial decisions can be made with confidence.

ARPA-E is part of a broader national energy strategy. The elements of the Administration's Energy and Environment Agenda ([www.whitehouse.gov/agenda/energy\\_and\\_environment](http://www.whitehouse.gov/agenda/energy_and_environment)) relevant to this FOA include:

- **Reduce GHG emissions:** Drive emissions to 80% below 1990 levels by 2050, and ensure 25 percent of our electricity comes from renewable sources by 2025.
- **Enhance Energy Security:** Save more oil than the U.S. currently imports from the Middle East and Venezuela combined (more than 3.5 million barrels per day) within 10 years.

- **Restore Science Leadership:** Strengthen America's role as the world leader in science and technology.
- **Quickly Implement the Economic Recovery Package:** Create millions of new green jobs and lay the foundation for the future.

Under this FOA, ARPA-E is seeking R&D applications for technologies that, when in wide-spread use, will make substantial, significant, quantitative contributions to these national goals and ARPA-E Mission Areas. In addition, the proposed technology when in use may not have a negative impact on any of the ARPA-E Mission Areas.

### C. ESTIMATED FUNDING /NUMBER OF AWARDS

ARPA-E anticipates that most awards will be for total project costs in the range of \$2 million to \$5 million. Some may be as low as \$500,000 or as high as \$10 million. In extremely exceptional cases, ARPA-E may choose to accept efforts up to \$20 million. The applicant should propose a funding level that is appropriate to the work, not introducing additional risk by underfunding nor adding extraneous tasks or large management reserves that will drive up the R&D cost.

Multiple awards are anticipated. ARPA-E anticipates awarding agreements totaling up to \$150 million. However, the amount of resources made available under this announcement will depend on the quality of the proposed R&D projects and other programmatic considerations.

### D. PERIOD OF PERFORMANCE

The period of performance for efforts selected under this announcement is limited to no more than 36 months performance; however, ARPA-E has a strong preference for a period of performance of no more than 24 months.