



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

**Announcement of Teaming Partner List for an upcoming
Funding Opportunity Announcement:**

**Ultrahigh Temperature Impervious Materials Advancing Turbine
Efficiency (ULTIMATE)**

The Advanced Research Projects Agency – Energy (ARPA-E) intends to issue a new Funding Opportunity Announcement (FOA) in April 2020 to solicit applications for financial assistance to develop and demonstrate ultrahigh temperature materials for gas turbines, targeting power generation and aircraft engine applications.

As described in more detail below, the purpose of this announcement is to facilitate collaborations among performing teams including the testing and resource support teams to respond to the upcoming FOA. The FOA will provide specific Program goals, technical metrics, and selection criteria and the FOA terms. For the purposes of the Teaming Partner List, the following summarizes current planning for the FOA:

Gas turbines are widely used for electric power generation and aircraft propulsion, among other industrial applications. Today, natural gas fueled turbines produce approximately 35% of the total electricity production in US. Air travel is responsible for 2% of carbon emissions and is expected to double in the next two decades globally. Improving the efficiency of gas turbines is thus a very important issue for energy savings, carbon emissions, and the economy of not only those industries, but a broad breath of sectors. Based on thermodynamic principles governing the operation of thermal mechanical systems such as turbines, the efficiency of a gas turbine depends to a large degree on the peak temperature of the working fluid (e.g. air or combustion products). The higher the peak temperature, the higher the efficiency and specific core power. The motivation of this Program is to improve the efficiency of gas turbines by increasing the temperature capability of the materials used in the most demanding environments such as the turbine blade. Currently, turbine blades are made of single crystal nickel-based superalloys with maximum operating temperature capability of 1100 °C. Thus, there is a strong need to discover, develop, and implement novel materials that work at temperatures significantly higher than that of the Ni or Co-based superalloys if further efficiency gains are to be realized.

The ULTIMATE Program seeks to support the development and demonstration of ultrahigh temperature materials that can operate continuously at 1300 °C in a standalone material test environment (or with coatings, enabling gas turbine inlet temperatures of 1800 °C) or higher, targeting gas turbine applications in the power generation and aviation industries. It is expected that the development of novel ultrahigh temperature materials in combination with compatible coatings and manufacturing technologies will enable the efficiency of gas turbines to be improved by up to 7%, which will result in significant reductions in wasted energy and carbon emissions.

To accomplish this goal, ARPA-E is looking for interdisciplinary teams to foster research and development of refractory metal-based alloys, including refractory metal high entropy alloys, as well as necessary coatings, for high temperature turbine blade applications. Another key objective of this Program is that



the materials and manufacturing processes shall be developed concurrently as an integrated package of technology. Currently, ARPA-E anticipates that this Program will have research needs in the following topics: (1) Novel Alloy Development; (2) Coating Development; (3) Manufacturing Process Development; (4) Comprehensive Solutions; and (5) Testing and Resource Support for Topics 1-4 awardees

Presently, ARPA-E anticipates that this Program may have two research award categories:

- a) Projects to conduct research on the topics 1-4 specified immediately above
- b) Testing and resource support for topics 1-4 awardees (Topic 5), to include one or more of the following areas: (i) Testing and evaluation of mechanical properties and environmental damage resistance at ultrahigh temperatures (1300 °C or higher) (ii) Advanced Manufacturing, (iii) Materials Modeling and (iv) Cost Modeling. Individuals participating on a Topic 5 project team will not be permitted to participate on a Topic 1-4 project team.

As a general matter, ARPA-E strongly encourages different organizations with outstanding scientists and engineers, and across different scientific disciplines and technology sectors to participate in this Program. Interdisciplinary and cross-sector collaboration spanning organizational boundaries enables and accelerates the achievement of scientific and technological outcomes that were previously viewed as extremely difficult, if not impossible.

The Teaming Partner List is being compiled to facilitate the formation of new project teams. ARPA-E intends to make the Teaming Partner List available on ARPA-E eXCHANGE (<http://ARPA-E-foa.energy.gov>), ARPA-E's online application portal, starting in April 2020. The Teaming Partner List will be updated periodically, until the close of the Full Application period, to reflect the addition of new Teaming Partners who have provided their information.

Any organization that would like to be included on the Teaming Partner list should complete all required fields in the following link: <https://ARPA-E-foa.energy.gov/Applicantprofile.aspx>. Required information includes: Organization Name; Contact Name; Contact Address; Contact Email; Contact Phone; Organization Type; Area of Technical Expertise; and Brief Description of Capabilities.

By submitting a response to this Notice, you consent to the publication of the above-referenced information. **By facilitating this Teaming Partner List, ARPA-E does not endorse or otherwise evaluate the qualifications of the entities that self-identify themselves for placement on the Teaming Partner List.** ARPA-E will not pay for the provision of any information, nor will it compensate any respondents for the development of such information. Responses submitted via email or other means will not be considered.

This Notice does not constitute a FOA. No FOA exists at this time. Applicants must refer to the final FOA, expected to be issued in April 2020, for instructions on submitting an application and for the terms and conditions of funding.