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

Announcement of Teaming Partner List
for Upcoming Funding Opportunity Announcement:
New Program in Fusion First Wall Materials Discovery

The Advanced Research Projects Agency – Energy (ARPA-E) is considering issuing a Funding Opportunity Announcement (FOA) to support the discovery of plasma-facing and structural first wall materials that are suitable for fusion power plants. As described in more detail below, the purpose of this announcement is to facilitate the formation of new project teams to respond to the potential FOA. The FOA will provide specific program goals, technical metrics, and selection criteria. The FOA terms are controlling.

For purposes of this Teaming Partner List, the program's current overarching goal is to discover and test new candidate materials that can withstand high-dose irradiation up to 50 displacements per atom (dpa) while preserving ductility at room temperature. Current state-of-the-art materials such as tungsten and reduced-activation steels suffer from irradiation and helium embrittlement issues that can make fusion power systems prohibitively expensive to qualify and operate. New advancements in machine-learning-assisted material discovery, advanced manufacturing, material damage modeling, and irradiation testing provide the opportunity to discover new materials that can withstand the unique extreme environment required for sustained fusion reactions.

ARPA-E currently expects the FOA to focus on the research of materials with high thermal conductivity, low activation, low tritium retention, and low irradiation-induced swelling that maintain room temperature ductility after significant irradiation damage and helium generation. Two categories of materials will be assessed separately on the following characteristics:

1. Plasma-facing component materials will need to show better performance than tungsten, including plasma erosion performance.
2. Structural materials will need to show better performance than reduced-activation steels, including high temperature strength performance.

The FOA will also seek to establish capability teams to consolidate the materials discovery and performance data generated by the projects. The capability teams will support project performers on digitization, standardization, and storage of materials data as well as create the framework for systems and life-cycle analysis of fusion power system designs with varying materials of construction.

Expertise in the following areas may be useful in responding to the potential FOA:

- Rapid material synthesis and screening
- Material design modeling
- Irradiation damage modeling
- Neutron activation calculations
- Advanced manufacturing

- Ion irradiation and helium implantation
- Materials mechanical testing and analysis
- Plasma erosion testing
- Tritium retention testing
- Artificial intelligence and machine learning (AI/ML)
- Materials database development and maintenance

As a general matter, ARPA-E strongly encourages outstanding scientists and engineers from different organizations, scientific disciplines, and technology sectors to form new project teams. 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. The Teaming Partner List will be available on ARPA-E eXCHANGE (http://arpa-e-foa.energy.gov), ARPA-E's online application portal, starting in October 2023. The Teaming Partner List will be updated periodically until the close of the Full Application period to reflect new Teaming Partners who have provided their information.

Any organization that would like to be included on this list should complete all required fields in the following link: https://arpa-e-foa.energy.gov/Applicantprofile.aspx. Required information includes the following: 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 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 to other email addresses or by other means will not be considered. **This list is completely voluntarily to participate in and utilize.** ARPA-E will not identify or facilitate connections through the teaming list and participation in the list has no bearing whatsoever on the evaluation of applications submitted to the potential FOA.

This Notice does not constitute a FOA. No FOA exists at this time. Applicants must refer to the FOA, expected to be issued by November 2023, for instructions on submitting an application and for the terms and conditions of funding.