



**U.S. Department of Energy
Advanced Research Projects Agency – Energy
Announcement of Teaming Partner List
for an upcoming Funding Opportunity Announcement:
High efficiency, high power density energy storage and conversion systems**

The Advanced Research Projects Agency – Energy (ARPA–E) intends to issue a new Funding Opportunity Announcement (FOA) in December, 2019 to support the development of novel energy conversion technologies with extremely high power density and conversion efficiency. The envisioned FOA represents part of a wider ARPA-E effort in developing high efficiency and power density systems that could enable electrified, low- or zero-emissions, long-range aviation. There is a separate and complementary announcement targeting high power density, efficient electric motors and power electronics (see link for separate teaming partner list for that program). The overarching goal of the set of proposed programs is to reduce emissions from and increase the efficiency of commercial aviation by developing cost competitive systems for the efficient conversion of the chemical energy of carbon neutral liquid fuels (CNLFs) to delivered electric energy, which is further converted to thrust using power electronics, electric motors and propulsors—the former being the specific focus of this thrust.

Current battery energy storage options for electric aviation technologies are expensive, have low energy density and can only support the power and energy requirements for short range, few passenger aircrafts. The proposed program approach of combining a relatively small high power density energy storage device to provide power for takeoff/climb with a high efficiency CNLFs conversion engine(s) (e.g., different types of fuel cells, advanced combustion engine such as gas turbines, reciprocating internal combustion engines, etc.) to provide cruise power. Charging the battery during the flight at the peak efficiency will further enable long distance all-electric, net zero carbon aviation. To achieve the intended goal, new cost- effective and energy-efficient technologies for conversion of sustainable fuels to electric power must be developed and successfully hybridized with commercial high power energy storage devices while running on a commercially viable, technically feasible CNLF (e.g. bio fuels, ethanol, etc.); this could enable long range zero-carbon aviation for a narrow-body aircraft, such as the Boeing 737 family, at analogous missions, while ensuring commercial viability. This program will likely operate at the intersection of electrochemistry, catalysis, engine development, advanced combustion, materials development, chemical engineering, computational modeling and device integration. ARPA–E held a related workshop on fuel cell and engine hybridization technologies for ground transportation in December 2017; information on this workshop can be found at the webpage: <https://arpa-e.energy.gov/?q=workshop/high-efficiency-hybrid-vehicles>.

Currently, ARPA–E anticipates that this program will have two major focus areas:

1. Hybrid energy storage and conversion system based on fuel cells
2. Hybrid energy storage and conversion system based on advanced combustion engines

In order to realize the goals of this program, expertise in the following areas may be useful:

(i) fuel cells and electrocatalysis, (ii) heterogeneous catalysis, (iii) gas turbine and/or reciprocating internal engine combustion operating with alternative fuels, (iv) chemical engineering with emphasis on catalytic reactor design, (v) electrochemical cell and stack design and manufacturing, (vi) material chemistry including ion-conducting, sealing and multi-functional materials, (vii) process engineering, (viii) batteries



and supercapacitors, (ix) system integration and scale up, etc.

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. 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, October 25, 2019. Once posted, 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 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 to other email addresses or by 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 December 2019, for instructions on submitting an application and for the terms and conditions of funding.