Questions and Answers

Please refer to the General FAQs section of ARPA-E’s website (http://arpa-e.energy.gov/?q=faq/general-questions) for answers to many general questions about ARPA-E and ARPA-E’s funding opportunity announcements. Additional questions specific to this FOA only are included below. Please review all existing general FAQs and FOA-specific questions before submitting new questions to ARPA-E.

I. Concept Paper Phase Questions:

Q1. We plan to propose [a technology to synthesize carbon-neutral liquid fuel]. Would this concept meet the intent of ARPA-E is looking for in the REEACH FOA?

   Answer: Refer to General FAQ 6.19.

   The REEACH program aims to develop and demonstrate a fuel-to-power conversion subsystem that should fit into the ESPG system model proposed by an applicant. Other ESPG components are commercial and not the subject of development.

Q2. Would a fuel-to-power conversion system that is better suited to the sub-MW scale, such as for Urban Air Mobility applications, be suitable to propose to this FOA? Our system will likely not scale well to the MW power levels described in the FOA, which are required for the narrow-body aircraft applications described. In other words, are solutions that are solely applicable to UAM type missions outside of the scope of the REEACH FOA?

   Answer: Refer to General FAQ 6.19.

Q3.1 Are RFI-0000042 (HIGH EFFICIENCY, HIGH POWER DENSITY ENERGY STORAGE AND CONVERSION SYSTEMS) and REEACH PROGRAM [DE-FOA-0002240] devoted to the same idea?

   Answer: RFI-0000042 is the Announcement of Teaming Partner List for DE-FOA-0002240.

Q3.2 The REEACH Program announced the following:

   Fully-electric aviation could potentially eliminate emissions, but thus far the application of electrified propulsion technologies has been restricted to relatively smaller and shorter-range aircraft due to the limited specific energy of current batteries (e.g. 250 Wh/kg) and batteries that are currently under development (e.g. 500 Wh/kg). For comparison, these levels are an order of magnitude lower than that of jet fuel, which has a specific energy of >12,000 Wh/kg. In a recent study, NASA concluded that minimum requirement for full electric regional aircraft energy storage system is 2000 Wh/kg. [refer to Section I.B.2]

The success of this program is contingent upon the development of ultra-high efficiency and specific power (e.g. kW/kg) CNLF-to-electric-power conversion devices,
such as fuel cells and advanced combustion engines. Furthermore, higher specific power energy storage devices (e.g. batteries, supercapacitors, or other such commercially available electric energy storage devices) may be leveraged to further boost their power output for take-off and climb, if necessary.

But, on page 29 [Section III.C.3] it does say:

*Submissions of not interest: Development of novel energy storage devices and/or the use of energy storage devices that are not currently commercially available (i.e. Technology Readiness Level ≥ 7).*

To our understanding there is no currently commercially available, or even developed in the Labs neither ultra-high efficiency and specific power (kW/kg) CNLF-to-electric-power conversion devices, such as fuel cells, nor energy storage system of 2000 Wh/kg. We wonder, if our Team has demonstrated that our concept of [Description of technology], could we apply for funding within the REEACH, or continue working to move the limits of our [Description of technology] and then apply?

**ANSWER:** Refer to General FAQ 6.19.

Q4. I would like to know if ARPA-E is interested in solutions which might only be suitable for the sub-MW scale, such as Urban Air Mobility applications. In other words, would a technology that does not scale well, in terms of specific power, to the narrow-body aircraft power levels discussed in the FOA, be appropriate to propose to the REEACH program? We would propose to thoroughly determine this cross-over point as part of our Phase I efforts.

**ANSWER:** Refer to General FAQ 6.19.

Q5. We are looking to apply for DE-FOA-0002240: RANGE EXTENDERS FOR ELECTRIC AVIATION WITH LOW CARBON AND HIGH EFFICIENCY (REEACH). However, I have some questions around [the] FOA.

Q5.1 Does this FOA also include novel power electronics architecture to combine different energy storage together.

**ANSWER:** While power electronics are a necessary component for the energy storage and power generation sub-system, they are not the focus of development within this FOA. As noted in Section 1.C (“Program objectives”): “The objective of the REEACH program is to develop novel, high specific power, high specific energy, cost-effective technologies for the conversion of chemical energy stored in CNLFs into electric power for use in electrified aircraft powertrains.”
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Q5.2 Is this FOA only limited to fuel cell or can we propose some thing related to turbine + electrical generator along with power electronics for hybrid energy storage.

**ANSWER:** The first paragraph of Section I.D (“Potential Technical Approaches”) notes: “The applicant is allowed to select any CNLF, fuel-to-electric power conversion device(s), and ESPG configuration so long as it conforms to the “fuel in – electric power out” program concept and meets performance and cost targets defined in section 1.E.”

Q5.3 In FOA it was mentioned that this FOA is around borderline of chemical and electrical. [C]an you [clarify] if this FOA have requires an innovation in energy storage like supercapacitor, engines, battery chemistry, etc.

**ANSWER:** Refer to Section III.C.3 of the FOA (“Submissions Specifically Not of Interest”).

Q6. Is a fuel-to-electric system with a power density less than 2.5 kW/kg while still meeting the overall ESPG system power target considered responsive to this FOA?

**ANSWER:** As set forth in FOA Section I.F (p.17):

*The fuel conversion efficiency target depends on selection of CNLF and ESPG system configuration and should be calculated by the applicant to meet the specific energy target. It is highly desirable that specific power of the fuel-to-electric power conversion device developmental prototype be at least 2.5 kW/kg to be able to meet the overall ESPG system specific power target.* (emphasis in the original)