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

Announcement of Teaming Partner List
for an upcoming Funding Opportunity Announcement:
SCALABLE MACROALGAE CULTIVATION TECHNOLOGIES FOR FUELS AND CHEMICALS

The Advanced Research Projects Agency – Energy (ARPA–E) intends to issue a new Funding Opportunity Announcement (FOA) in November, 2016, for the development of advanced cultivation technologies that enable profitable and energy efficient production of macroalgal-biomass (seaweeds) in the ocean. These technologies are expected to be deployed and support cultivation of macroalgal-biomass feedstocks at a scale relevant for the production of commodity fuels and chemicals. The primary challenge is to dramatically reduce capital and operating cost of macroalgae cultivation, while significantly increasing the range of deployment by expanding into more exposed, off-shore environments.

Specifically, ARPA-E is interested in new designs and approaches to macroalgae cultivation and production with integrated harvesting solutions. These systems may leverage new material and engineering solutions, autonomous and/or robotic operations, as well as advanced sensing and monitoring capabilities. In addition to "field-type" cultivation, ARPA-E is also interested in unconventional approaches, for example "ranching" where free floating macroalgae are harvested at locations predicted/determined by satellite imaging and current/drift modeling. Given the enormous size and geographic diversity of the U.S. marine Exclusive Economic Zone (EEZ), we expect that there will be different system solutions based on the intended area of deployment, macroalgal species to be cultivated, and downstream processing. To support and accelerate the development of these advanced cultivation systems, ARPA-E is also interested in hydrodynamic and ocean current models that can predict the mechanical stresses on a cultivation system as well as the flow and distribution of nutrients through a macroalgae "field". Furthermore, to validate the performance of macroalgae cultivation systems, appropriate sensors to measure in situ biomass production and composition as well as nutrient concentrations will be required. Finally, to complement the new system design approaches, ARPA-E is also looking for advanced breeding tools that can help in the development of new, highly productive macroalgae cultivars. ARPA-E has determined that, at this time, biomass conversion is not a limiting factor for profitable and wide-spread production of fuels and chemicals from macroalgae, and consequently will not support work in that area at this time. However, an understanding of macroalgae conversion processes are expected to inform and guide the development of cultivation and harvest strategies, or other tools described below.

Overall, this program will address marine system design/engineering and integration with biomass production, hydrodynamic and ocean modeling, marine spatial planning, sensor technology development, macroalgae breeding tools, and field testing of cultivation systems and sensor technologies. The program will also address emerging markets necessary as "stepping stones" to a thriving marine macroalgae-to-fuels and chemicals industry.

ARPA–E held a workshop on this topic in February 2016; information on this workshop and other supporting material including a summary of the workshop output can be found at the webpage (http://arpa-e.energy.gov/?q=workshop/macroalgae-workshop).

ARPA–E anticipates that this program will have four areas of interest.

1. Design and field testing of integrated macroalgae cultivation and harvest systems.
2. Hydrodynamic and nutrient flux models to support the design, testing, and operation of the above cultivation systems and their integration with marine spatial planning tools to identify appropriate deployment opportunities for macroalgal cultivation.
3. Sensors/technologies to monitor macroalgal biomass growth, distribution, and composition, as well as nutrient concentrations in the surrounding waters, either as mobile, field (ocean) deployable systems or via remote sensing/satellite imaging; and, sensors/technologies for biosecurity, including disease detection/prevention and herbivory.
4. Development of advanced breeding tools, by leveraging modern terrestrial breeding methods, such as hybridization and genomic marker identification tools, and adopting them to the unique life cycles of macroalgae.

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

- macroalgae biology and ecology
- macroalgae cultivation
- aquaculture technology and operations
- naval architecture and marine systems engineering
- marine logistics
- robotic/autonomous (aquatic) vehicle or systems engineering
- hydrodynamic modeling
- nutrient flux modeling
- spatial planning tool development
- satellite imaging and remote sensing
- sensor development and deployment in marine environments
- plant breeding
- genomics
- other

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. Multidisciplinary 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, in September 2016. 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 Expertise, and Background. For larger

organizations, multiple entries for subgroups with distinct areas of expertise and capabilities are acceptable. **Under the category, "Background", please list verbatim any and all areas of expertise listed above (if "other," please provide additional detail).**

ARPA-E recognizes the significant international efforts currently underway in macroalgae cultivation. However, there are limitations and stipulations regarding the amount of work that can be performed outside of the United States. Please keep this in mind during this team building period.

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 November 2016, for instructions on submitting an application and for the terms and conditions of funding.