



**U.S. Department of Energy
Advanced Research Projects Agency – Energy
Announcement of Teaming Partner List
for Upcoming Funding Opportunity Announcement:
Enhanced Mineral Recovery**

The Advanced Research Projects Agency-Energy (ARPA-E) is considering issuing a new Funding Opportunity Announcement (FOA) to develop net-zero mineral beneficiation technologies that decrease comminution energy and increase yield of energy-relevant metals from CO₂-reactive ore. The objectives of this program are: (1) transform the CO₂-reactive gangue minerals into softer and insoluble carbonate to decrease comminution energy; (2) increase yield of metals, such as nickel, cobalt, chromium, lithium, copper, and rare earth elements from conventional critical minerals and surrounding CO₂-reactive gangue minerals; (3) eliminate possible negative impact on metal yield from conventional critical minerals during the development of new mineral beneficiation technologies to carbonate gangue mineralogy ; and (4) maintain the stable carbonate from cradle-to-grave. The timing of this program coincides with the need for market-ready breakthrough negative emission technologies that can exploit unconventional energy-relevant minerals to secure domestic supply and decrease comminution energy.

As described in more detail below, the purpose of this announcement is to facilitate collaborations among performing teams. ARPA-E is open to team(s) interested in both subsurface in-situ and ex-situ carbonation and energy-relevant metal recovery approaches.

Five focus areas have been identified as necessary to achieve the program objectives:

- (1) **Mineral Comminution and Yield:** A category focused on developing breakthrough technologies to decrease comminution energy and energy-relevant metal yields lost during mineral beneficiation of CO₂-reactive ore. The technology must accomplish this objective by changing the mineral properties of the CO₂-reactive ore to utilize preexisting mineral beneficiation processes. Preferably, the team should have expertise in current mineral beneficiation processes, carbonate chemistry, and carbonate mineralogy.
- (2) **Gangue Mineral Yield:** A category focused on fundamental research into developing breakthrough technologies to exploit energy-relevant metals from CO₂-reactive gangue minerals. The technology must accomplish this by not impacting conventional critical mineral yield or decarbonating the ore. Preferably, the team should have expertise in metallurgy, mafic-ultramafic petrology, carbonate chemistry, carbonate mineralogy, and catalysis.
- (3) **Carbon Negative Reactions:** A category focused on fundamental research into carbon-negative reactions. The team's expertise should include laboratory experiments, numerical modeling, and



characterization of physico-chemical changes during rock carbonation. Preferably, the team should have expertise in CO₂ sequestration, mafic-ultramafic petrology, carbonate chemistry, and catalysis.

(4) Sensing and Analyzing Carbonation Potential and Mineralization: The research category focuses on developing breakthrough technology to conduct geophysical and (or) geochemical surveys to produce models that develop exploratory vectors of CO₂-reactive rock formations, quantify rock carbonation, and quantify energy-relevant metals leached and remineralized during carbonation of the CO₂-reactive gangue minerals. Preferably, the team should have experience in geophysical, geochemical, and geostatistical modeling of ore bodies.

(5) Applied Research: A category focused on the proper scale-up of this technology from bench-scale demonstrations. The team should have expertise in field characterization and planning (e.g., geophysics, geology, mining engineering, drilling). The team should understand geochemical, mineralogical, structural, and petrological heterogeneity within CO₂-reactive ore bodies. An understanding of the changes in petrophysical properties and alteration mineralogy during rock carbonation. The ability to provide proper reservoir characterization to optimize rock carbonation and metal capture from gangue minerals. Understanding reservoir fluid dynamics to mitigate injection fluid loss and maximize recovery of possible production fluids. Adequate experience operating and maintaining a drilling and injection site to perform successful rock carbonation and recovery of carbonated samples.

ARPA-E held a workshop on these topics on July 13 and 15, 2021. Information from this workshop can be found at the event webpage (<https://arpa-e.energy.gov/events/sequestering-carbon-hybrid-employment-mineral-assets-workshop>).

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. Furthermore, ARPA-E strongly encourages involving industry partners to advise and collaborate with these project teams, with the goal of achieving successful industry adoption and integration of the innovative technologies these project teams develop.

A 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 (<https://ARPA-E-foa.energy.gov>), ARPA-E's online application portal, in December 2021. 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 Announcement, respondents 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 via email or by other means will not be considered.

This Announcement does not constitute a Funding Opportunity Announcement (FOA). No FOA exists at this time. Applicants must refer to the final FOA, expected to be issued January 2022, for instructions on submitting an application, the desired technical metrics, and the terms and conditions of funding.