



**U.S. Department of Energy  
Advanced Research Projects Agency-Energy  
Announcement of Teaming Partner List  
for Upcoming Funding Opportunity Announcement:  
Plant HYperaccumulators TO MIne Nickel-Enriched Soils  
(PHYTOMINES)**

The Advanced Research Projects Agency-Energy (ARPA-E) is considering issuing a Funding Opportunity Announcement (FOA) to support investigating the feasibility of systems that use plants to extract nickel from soils and deliver a nickel-enriched bio-ore for purification. 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 overarching goal of PHYTOMINES would be to develop phytomining as a cost-competitive and low-carbon intensity alternative mining approach by extracting metal resources from soils that are too low in concentration for traditional mining. Additionally, phytomining can provide a clean energy mineral source that is procured and processed domestically. This program supports ARPA-E mission areas impacting energy security through reduction of imports, reduction of emissions involved in the mining of the energy-relevant minerals, and attainment of U.S. leadership in global competitions for locating clean sources of minerals.

ARPA-E has identified two major categories. Technical Category 1 is related to systemic approaches to improve the phytomining of nickel on U.S. marginal lands. Technical Category 2 deals with enhancement of the enabling knowledge base of U.S. phytomining. ARPA-E has identified several modeling, characterization, and risk management approaches that need to be associated with the technology development in Categories 1 & 2.

**Category 1: Systemic approaches to improve the phytomining of nickel on U.S. marginal lands.**

The focus of this category is the development of phytomining technologies that optimize nickel recovery by hyperaccumulator (HA) plants. Technologies could target any or multiple aspects of a phytomining system, for example:

- Soil biota, such as rhizobial, endophyte, or viral communities
- Plant traits to increase plant hyperaccumulation activity
- Technologies at the microbiome, organismal, or metagenomic scale

While research using model organisms/systems could be a complementary work stream, approaches that focus on non-model organisms or have potential to translate to non-model organisms with strong commercialization pathways are encouraged.



## **Category 2: Enhancing the enabling knowledge base of U.S. phytomining.**

A priority outcome from this category is the creation of a unified, publicly available database to identify U.S. phytomining sites for:

- Nickel
- Rare earth elements
- Platinum group metals
- Other critical metals

As nickel is likely to be the near-term target, it will be acceptable to prioritize granularity on soil content of nickel over diversity of data expanding to rare earth/platinum group metals/other critical metals concentrations. The database would, at a minimum, unite currently separated geospatial data and a range of metadata including descriptions of:

- Geologic information
- Environmental information
- Ecological information
- Ownership status of the land

A potential FOA may also seek to support mapping and identifying new HA species of interest for scaling phytomining opportunities as well as facilitate technoeconomic analysis (TEA) and lifecycle analysis (LCA) of phytomining projects.

ARPA-E held a workshop on this topic in June 2023. Information on this workshop can be found at <https://arpa-e.energy.gov/events/phytomining-workshop>.

Expertise in the following non-exhaustive list of technical areas may be useful in responding to the potential FOA:

- Plant biology (physiology, genetics, systems and synthetic biology of hyperaccumulation);
- Microbial biology (expertise in the fungi, bacteria, and other biota that regulate the bioavailability of critical materials to HAs);
- Geology and soil sciences (distribution, mapping, availability and bioavailability of critical materials);
- Data science (acquisition and presentation of geologic, ecological, and economic information necessary for phytomining); and
- TEA/LCA.

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 and will be available on ARPA-E eXCHANGE (<http://arpa-e-foa.energy.gov>), ARPA-E's online application portal. 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, if one is issued, for instructions on submitting an application and for the terms and conditions of funding.