

Announcement of Teaming Partner List for Upcoming Notice of Funding Opportunity: Materials Discovery of Powerful Magnets

The Advanced Research Projects Agency – Energy (ARPA-E) is considering issuing a Notice of Funding Opportunity (NOFO) to support the discovery and development of new, powerful magnets to meet the demands of electricity generation and usage while decreasing or diversifying the need for critical minerals. The purpose of this Teaming Partner List announcement is to facilitate the formation of new project teams to respond to the potential NOFO. Any NOFO issued in the future would provide specific program goals, technical metrics, and selection criteria. If there are any inconsistencies between this announcement and the potential NOFO, the NOFO language would be controlling.

Magnetism is one of the most complex yet fundamental forces in nature, and powerful magnets are needed for essential industrial, electronics, energy, and transportation applications. Both hard (permanent) and soft magnets are needed for applications such as high-power density motors for drones, or electrical components for high performance transformers.

Currently, the permanent magnet market is dominated (60%) by magnets based on $\text{Nd}_2\text{Fe}_{14}\text{B}$ (neodymium iron boron) that exhibit the highest energy product, BH_{max} , for any hard magnet, about 400 kilojoules per meter squared (kJ/m^3).¹ The best soft magnets today exhibit a B_{sat} , of about 2 Tesla. Doubling the BH_{max} (to 800 kJ/m^3) or increasing the B_{sat} (above 2.5 Tesla) would enable new ultra-high performance applications and revolutionize U.S. industry. To achieve either of these metrics, a new magnet material must be discovered.

The **Materials Discovery of Powerful Magnets** program would seek to find entirely new physics, chemistries, and structures for ultra-powerful soft and/or hard magnets. New material structures may be discovered at a faster pace through advances in computational physics to calculate B_{sat} , magnetocrystalline anisotropy, and Curie temperature (T_c); and through computational materials discovery using high-throughput techniques, artificial intelligence, and machine learning.

Undiscovered ultra-powerful magnets are, similar to $\text{Nd}_2\text{Fe}_{14}\text{B}$, likely to have complex chemistries (three or more elements) and pronounced anisotropy, requiring expertise in solid state chemistry for synthesis and to guide materials discovery by identifying promising structural motifs. The physics of magnetic exchange interactions necessary for ferromagnetism is complex and may also benefit from high-throughput computational searching for promising structural and chemical motifs. To achieve effective materials discovery, ARPA-E anticipates successful proposers will comprise teams of various experts, including:

- Computational materials discovery, e.g., high-throughput computation, generative AI, thermodynamic stability models;
- Solid state chemistry, e.g., synthesis, characterization of new phases, including specialized interest in subnitrides, high-temperature borides, carbides;
- Magnetism physics for novel strategies and computational methods;
- Magnetic measurement and interpretation of data, including hysteresis curves and T_c estimates above 25°C;

¹ Gutfleisch, Oliver, Matthew A. Willard, Ekkes Bruch, Christina H. Chen, S.G. Sankar, and J. Ping Liu. 2010. "Magnetic Materials and Devices for the 21st Century: Stronger, Lighter, and More Energy Efficient." *Advanced Materials* 23 (7): 821-842. <https://advanced.onlinelibrary.wiley.com/doi/abs/10.1002/adma.201002180>.

- Potential applications of ultra-powerful magnets; and
- Project coordination and program management.

While ARPA-E does not anticipate an active role for application engineering in this potential program's materials discovery projects, all projects must consider manufacturing, cost, and markets during their materials searches. For example, many applications will require a Curie temperature greater than 200°C, and any motor application will require the ability to mass-produce pellets with a volume of approximately 1 cm³. Owing to the wide range of as-yet unexplored potential applications for ultra-strong magnets, we encourage proposers to include both common and specialty elements in their search.

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 scientific and technological outcomes that were previously viewed as extremely difficult, if not impossible, to achieve.

The Teaming Partner List is being compiled to facilitate the formation of new project teams. The Teaming Partner List will be available on ARPA-E eXCHANGE (<http://arpa-e-foa.energy.gov>), ARPA-E's online application portal, starting in July 2025. 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 form: <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 your information to this Teaming Partner List, 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 email addresses or by other means will not be considered. **Participation in and utilization of this list is completely voluntary.** ARPA-E will not identify or facilitate connections through the Teaming Partner List and participation in the list has no bearing whatsoever on the evaluation of applications submitted to the potential funding opportunity.

This list does not constitute a NOFO. A NOFO does not exist at this time. Applicants must refer to the NOFO, expected to be issued by August 2025, for instructions on applying and for details on how projects will be funded.