FINANCIAL ASSISTANCE
NOTICE OF FUNDING OPPORTUNITY

ADVANCED RESEARCH PROJECTS AGENCY—ENERGY (ARPA-E)
U.S. DEPARTMENT OF ENERGY

UNLOCKING NEW LEVELS OF OUTPUT AND CAPACITY FOR KEY SUBSURFACE RESOURCES (UNLOCK)

Announcement Type: Initial Announcement
Notice of Funding Opportunity No. DE-FOA-0003630
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NOFOs are posted on DOE eXCHANGE (https://exchange.energy.gov/Default.aspx?Org=ARPA-E), grants.gov (http://www.grants.gov/), and FedConnect (https://www.fedconnect.net/FedConnect/). Any modifications to the NOFO are also posted to these websites. You can receive an email when a modification is posted by registering with FedConnect as an interested party for this NOFO. It is recommended that you register as soon as possible after release of the NOFO to ensure that you receive timely notice of any modifications or other announcements.

Questions about this NOFO? Check the Frequently Asked Questions available at https://arpa-e.energy.gov/faqs. For questions that have not already been answered, email ARPA-E-CO@hq.doe.gov (with NOFO name and number in subject line). Problems with DOE eXCHANGE? Email ExchangeHelp@hq.doe.gov (with NOFO name and number in subject line).

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BASIC INFORMATION

KEY DATES:	
Notice of Funding Opportunity (NOFO) Issue Date:	October 21, 2026
Deadline for Concept Paper Questions to ARPA-E-CO@hq.doe.gov:	5 PM ET, November 10, 2026
Submission Deadline for Concept Papers:	9:30 AM ET, November 20, 2026
Anticipated Date for Encourage/Discourage Notifications:	5 PM ET, January 5, 2027
Deadline for Full Application Questions to ARPA-E-CO@hq.doe.gov:	5 PM ET, TBD
Submission Deadline for Full Applications:	9:30 AM ET, TBD
Expected Reviewer Comment Release Date:	5 PM ET, TBD
Submission Deadline for Replies to Reviewer Comments:	5 PM ET, TBD
Anticipated Timeframe for Selection Notifications:	April 2027
Anticipated Timeframe for Award:	July 2027
Anticipated Period of Performance:	July 2027–July 2030

BASIC INFORMATION:	
Total Amount to Be Awarded	Approximately $45 million, subject to the availability of appropriated funds to be shared between NOFOs DE-FOA-0003630 and DE-FOA-0003631.
Anticipated Number and Value of Awards	ARPA-E anticipates making approximately 9–12 awards between NOFOs DE-FOA-0003630 and DE-FOA-0003631. ARPA-E may issue one, multiple, or no awards under this NOFO. The Federal share of awards under this NOFO may vary between $3 million and $5 million.
Agency Contact Information	• Questions and answers (Q&As) about ARPA-E and this specific NOFO: http://arpa-e.energy.gov/faq. • Send other questions about the NOFO to ARPA-E-CO@hq.doe.gov. • Send questions about use of DOE eXCHANGE to ExchangeHelp@hq.doe.gov. Upon the issuance of a NOFO, only the Grants Officer via ARPA-E-CO@hq.doe.gov may communicate with applicants. This "quiet period" remains in effect until ARPA-E's selection notification letters are distributed. Emails sent to other email addresses will be disregarded.

The Unlocking New Levels of Output and Capacity for Key Subsurface Resources (UNLOCK) program seeks to deliver a step-change improvement in energy and critical resource extraction from the subsurface. This program will address persistent geological and technical obstacles that impede efficient recovery from diverse subsurface resources including oil, natural gas, geothermal, and mineral systems. UNLOCK will target key opportunities including improving extraction efficiency from low permeability formations, maximizing resource recovery, and optimizing water management, while maintaining cost efficiency.

Hydraulic fracturing and horizontal drilling ushered in the shale revolution, transforming once uneconomic subsurface formations into productive reservoirs that now supply the majority of oil and gas production in the United States (U.S.). Despite these advances, recovery

efficiency remains low, often below 20%, leaving most of the hydrocarbons trapped underground.[1,2,3] Current stimulation methods use significant amounts of water, generate large volumes of produced water, and are unable to achieve precise control over fracture network geometry and connectivity. Furthermore, enhanced oil recovery (EOR) methods, effective in conventional reservoirs, have yielded limited success in ultra-low permeability formations due to poor reservoir contact.

Similar problems constrain other subsurface resources, including geothermal energy, in-situ mineral extraction, coalbed methane, and emerging fields such as geologic hydrogen. In these resources, technical hurdles including restricted reservoir contact, complex rock-fluid interactions, and sensing limitations continue to impede sustained recovery. Complex demands for water usage and produced-water management also compound these issues. The shared technical barriers across these sectors present an opportunity for developing cross-cutting technologies to accelerate progress.

The UNLOCK program aims to address these challenges by supporting efforts to develop and field-validate integrated stimulation and enhanced recovery approaches that can deliver transformative (not incremental) performance improvement in subsurface resource recovery. The program's goal is to double the per-well recovery efficiency of energy and critical resources from low-permeability formations, while maintaining or reducing both per-unit cost and wastewater volume relative to state-of-the-art methods. Achieving this goal requires innovative approaches to stimulation and enhanced recovery processes supported by rigorous laboratory experiments, numerical modeling, and downhole monitoring. After successful laboratory proof of concept, technologies will undergo field validation to ensure a practical path to real-world deployment. Success will not only revolutionize subsurface resource recovery but also contribute to ARPA-E's goals of reducing foreign energy imports and enhancing the nation's energy infrastructure resilience.

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[1] U.S. Energy Information Administration, "Technically Recoverable Shale Oil and Shale Gas Resources: Northern South America" (September 2015): https://www.eia.gov/analysis/studies/worldshalegas/pdf/overview.pdf.

[2] M. R. Fassihi and A. R. Kovscek, "Low-Energy Processes for Unconventional Oil Recovery," Society of Petroleum Engineers (2017): https://doi.org/10.2118/9781613994757.

[3] U.S. Department of Energy - National Energy Technology Laboratory, "Unconventional Resources," (2019): https://netl.doe.gov/sites/default/files/2019-04/Program-130.pdf.

I. FUNDING OPPORTUNITY DESCRIPTION

A. AGENCY OVERVIEW

The Advanced Research Projects Agency—Energy (ARPA-E), an organization within the Department of Energy (DOE), is chartered by Congress in the America COMPETES Act of 2007 (P.L. 110-69), as amended by the America COMPETES Reauthorization Act of 2010 (P.L. 111-358), as further amended by the Energy Act of 2020 (P.L. 116-260).

ARPA-E issues this Notice of Funding Opportunity (NOFO) under its authorizing statute codified at 42 U.S.C. § 16538.[4] The NOFO and any cooperative agreements or grants made under this NOFO are subject to 2 C.F.R. Part 200 as supplemented by 2 C.F.R. Part 910.

ARPA-E funds research on, and the development of, transformative science and technology solutions to address the energy and environmental missions of the Department. The agency focuses on technologies that can be meaningfully advanced with a modest investment over a defined period of time in order to catalyze the translation of scientific discovery into early-stage technology. For the latest news and information about ARPA-E, its programs and the research projects currently supported, see: http://arpa-e.energy.gov/.

ARPA-E funds transformational research. Existing energy technologies generally progress on established "learning curves" where refinements to a technology and the economies of scale that accrue as manufacturing and distribution develop drive improvements to the cost/performance metric in a gradual fashion. This continual improvement of a technology is important to its increased commercial deployment and is appropriately the focus of the private sector or the applied technology offices within DOE. In contrast, ARPA-E supports transformative research that has the potential to create fundamentally new learning curves. ARPA-E technology projects typically start with cost/performance estimates well above the level of an incumbent technology. Given the high risk inherent in these projects, many will fail to progress, but some may succeed in generating a new learning curve with a projected cost/performance metric that is significantly better than that of the incumbent technology. ARPA-E will provide support at the highest funding level only for submissions with significant technology risk, aggressive timetables, and careful management of the associated risks.

ARPA-E funds technology with the potential to be disruptive in the marketplace. The mere creation of a new learning curve does not ensure market penetration. Rather, the ultimate value of a technology is determined by the marketplace, and impactful technologies ultimately become disruptive—that is, they are widely adopted and displace existing technologies from the marketplace or create entirely new markets. ARPA-E understands that definitive proof of market disruption takes time, particularly for energy technologies. Therefore, ARPA-E funds the development of technologies that, if technically successful, have clear disruptive potential, e.g., by demonstrating capability for manufacturing at competitive cost and deployment at scale.

[4] ARPA-E, Authorization (2026). https://arpa-e.energy.gov/about/arpa-e-at-a-glance/authorization.

ARPA-E funds applied research and development (R&D). The Office of Management and Budget defines "applied research" as an "original investigation undertaken in order to acquire new knowledge…directed primarily towards a specific practical aim or objective" and defines "experimental development" as "creative and systematic work, drawing on knowledge gained from research and practical experience, which is directed at producing new products or processes or improving existing products or processes."[5] Applicants interested in receiving financial assistance for basic research (defined by the Office of Management and Budget as "experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts")[1] should contact the DOE's Office of Science. Office of Science national scientific user facilities (http://science.energy.gov/user-facilities/) are open to all researchers, including ARPA-E applicants and awardees. These facilities provide advanced tools of modern science including accelerators, colliders, supercomputers, light sources, and neutron sources, as well as facilities for studying the nanoworld, the environment, and the atmosphere. Projects focused on early-stage R&D for the improvement of technology along defined roadmaps may be more appropriate for support through the DOE applied energy offices, including: the Office of Critical Minerals and Energy Innovation (CMEI) , the Hydrocarbon and Geothermal Energy Office, the Office of Nuclear Energy, and the Office of Electricity.

ARPA-E encourages submissions stemming from ideas that still require proof-of-concept R&D efforts as well as those for which some proof-of-concept demonstration already exists. Submissions can propose a project with the end deliverable being an extremely creative, but partial solution.

B. PROGRAM OVERVIEW

1. BACKGROUND AND MOTIVATION

Subsurface resources, including oil, gas, geothermal, and mineral systems, underpin modern energy security, industrial productivity, and economic competitiveness. However, substantial technical hurdles related to the extraction of these resources limit their full potential, especially within geologically complex formations characterized by low matrix permeability and inefficient resource mobility.

Oil and Gas

The combination of horizontal drilling and hydraulic fracturing (Figure 1) has revolutionized U.S. energy supply and made unconventional oil and gas fundamental to U.S. energy security. These methods now account for the production of over 64% of domestic oil and

[5] Office of Management & Budget, OMB Circular A-11 (2025). https://www.whitehouse.gov/wp-content/uploads/2018/06/a11_web_toc.pdf

78% of domestic natural gas from shale and tight formations.[6,7] Despite the substantial production, the recovery efficiency (or recovery factor) remains strikingly low. Although the United States boasts 1,778 trillion cubic feet of recoverable shale and tight gas and 191 billion barrels (bbl) of recoverable unconventional oil,[6] over 80% of the resource remains trapped underground, and well output may decline up to 50% within the first year of operation.[2,8,9,10,11]

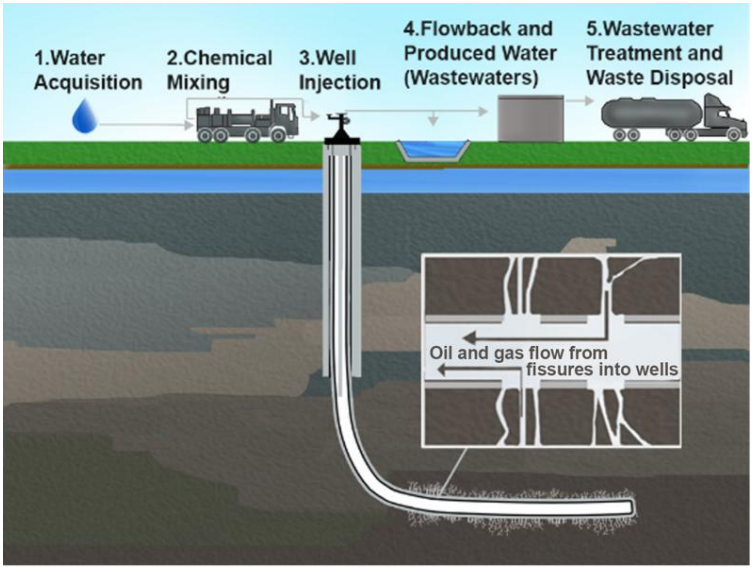

Figure 1. Generalized schematic of hydraulic fracturing for oil and gas development highlighting the water-energy nexus.[12]

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[6] Center for Sustainable Systems, University of Michigan, "Unconventional Fossil Fuels Factsheet," Pub. No. CSS13-19 (2024): https://css.umich.edu/sites/default/files/2024-10/Unconventional%20Fossil%20Fuels_CSS13-19.pdf.

[7] "How much shale gas is produced in the United States?" U.S. Energy Information Administration, Last modified: September 19, 2024, https://www.eia.gov/tools/faqs/faq.php?id=907&t=8.

[8] S. Hendrickson, "Why US Shale Production Declines Are Higher Than You Might Think," *Hart Energy* (June 24, 2020), https://www.hartenergy.com/exclusives/why-us-shale-production-declines-are-higher-you-might-think-188251.

[9] G. Thakur, "Management: Enhanced Recovery Technologies for Unconventional Oil Reservoirs," *Journal of Petroleum Technology* 71, no. 9 (2019): 66–69, https://doi.org/10.2118/0919-0066-JPT.

[10] F. I. Syed, A. K. Dahaghi, T. Muther, "Laboratory to field scale assessment for EOR applicability in tight oil reservoirs," *Petroleum Science* 19, no.5 (2022): 2131–2149, https://doi.org/10.1016/j.petsci.2022.04.014.

[11] U.S. Energy Information Administration, "EIA/ARI World Shale Gas and Shale Oil Resource Assessment—Technically Recoverable Shale Gas and Shale Oil Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States," (June 2013): https://www.eia.gov/analysis/studies/worldshalegas/pdf/overview.pdf.

[12] U.S. Geological Survey, "Water Quality Topics: Hydraulic Fracturing," USGS Office of Water Quality (December 2016): https://water.usgs.gov/owq/topics/hydraulic-fracturing/.

These limitations force continuous drilling of new wells to maintain production volumes, and this strategy is complicated by operational limitations. Infill drilling frequently leads to well interference, diminishing output from both new and existing wells due to overlapping stimulated rock volumes and pressure communication between boreholes.[13] The depletion of prime "Tier 1" drilling locations exacerbates this problem, forcing operators to target lower-quality reservoirs or employ tighter infill spacing. Even though technological advancements such as longer laterals, increased proppant usage, and greater water volumes have been implemented to counteract these challenges, the inherently low permeability of unconventional rock, coupled with limited control over subterranean fracture formation and interaction, means that a substantial portion of the oil and gas remains unrecoverable. Overall, transformative approaches are needed to address low recovery rates, steep production decline, and concerns regarding water sourcing, wastewater management, and related risks.

Other Subsurface Resources

The fundamental challenge of extracting valuable resources from low-permeability, hard-to-access rock formations extends beyond oil and gas. Efficient extraction of other subsurface resources, such as geothermal energy, minerals and metals, and coalbed methane, also depends on creating and maintaining connective, conductive pathways for fluid or heat transport. Addressing these shared challenges presents a significant opportunity for cross-cutting advancements that will enhance recovery efficiency across diverse subsurface systems.

2. TECHNICAL CHALLENGES

Oil and Gas

Low permeability and resource access. Shale and tight formations exhibit extremely low permeabilities, ranging from nanodarcys to microdarcys (approximately 10^{-18} to 10^{-21} m^2), which prevents economic hydrocarbon flow without significant permeability enhancement or stimulation. Hydraulic fracturing remains the dominant method for achieving this enhancement and requires the injection of millions of gallons of water along with millions of pounds of proppants per well to create conductive fractures.[14,15] Its effectiveness is hindered by non-uniform fractures and poor connectivity with natural fractures, reducing effective stimulated reservoir volume, sweep efficiency, and overall recovery.

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[13] T. M. Al-Shami, S. R. Jufar, S. Kumar, H. Abdulelah, M. B. Abdullahi, S. Al-Hajri, and B. M. Negash, "A comprehensive review of interwell interference in shale reservoirs," *Earth-Science Reviews*, 237 (2023): 104327, https://doi.org/10.1016/j.earscirev.2023.104327.

[14] M. U. Shafiq, S. Alajmei, M. S. Aljawad, L. Wang, and A. Bahri, "A Comprehensive Review of Proppant Selection in Unconventional Reservoirs," *ACS Omega*, 10, no. 13 (2025): 13046–13059, https://doi.org/10.1021/acsomega.4c09936.

[15] T. Halsey, G. Agrawal, J. R. Bailey, M. Balhoff, S. Borglum, K. K. Mohanty, and M. T. Traver, "Grand Challenges for the Oil and Gas Industry for the Next Decade and Beyond," *Journal of Petroleum Technology* 75 no. 7 (2023): 52–56, http://dx.doi.org/10.2118/0723-0052-JPT.

Fracture conductivity and propagation. Proppants are crucial for maintaining the conductivity of hydraulically induced fractures, creating pathways for hydrocarbon flow once injection stops. However, traditional proppants (primarily sand) often fail to reach fracture extremities due to factors such as leak-off and settling, causing early closure and diminished flow contribution. Proppant effectiveness is further impaired by crushing, embedding, and chemical and thermal degradation, which diminish fracture conductivity and, consequently, hydrocarbon flow.[144] Although engineered proppants (e.g., resin-coated, ceramic) offer enhanced strength and durability, widespread adoption is limited by their higher cost compared with sand.

In addition, fracture orientation is strongly governed by the in-situ stress field, which is poorly characterized and difficult to control, leading to unpredictable fracture propagation and uneven stimulation. This challenge is further compounded during refracturing operations.

Enhanced recovery. Despite success in conventional fields, enhanced oil recovery (EOR) methods have shown marginal success in unconventional formations due to their ultra-low permeability.[9,10] Injected fluids (e.g., CO_2, surfactants, solvents) are largely confined to the fracture network, with minimal access to the hydrocarbons in the unstimulated matrix. Non-uniform fracture connectivity further causes fluid channeling and inefficient displacement, while complex fluid-rock-hydrocarbon interactions add uncertainties. Together, these hurdles constrain the economic viability of EOR in shale and tight formations.

Refracturing. Refracturing existing wells offers an economic alternative to drilling new wells but faces major challenges. Success depends on accurately characterizing existing fractures and diverting fluids into unstimulated rock, rather than depleted zones, which requires advanced diversion and flow control technologies.

Inter-well interference, common in both refracturing and infill drilling, can reduce neighboring wells' productivity. Without precise candidate selection, accurate reservoir characterization, and improved downhole control, refracturing yields will continue to be economically uncertain.**Error! Bookmark not defined.**[16]

Water management. Each shale and tight well requires 1.5 to 16 million gallons of water for hydraulic fracturing and generates 1–12 bbl of produced water (a combination of formation water and fracturing water) per barrel of oil equivalent (BOE) over its lifecycle.[17,18] Although some of the produced water is reused for fracturing, the majority is still disposed of via injection

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[16] L. Xu, D. Wang, L. Liu, C. Wang, H. Zhu, and X. Tang, "Review of Shale Oil and Gas Refracturing: Techniques and Field Applications," Processes 12, no. 5 (2024): 965, https://doi.org/10.3390/pr12050965.

[17] J. Nicot, R. Darvari, P. Eichhubl, B. R. Scanlon, B. A. Elliott, L. T. Bryndzia, J. F. W. Gale, and A. Fall, "Origin of low salinity, high volume produced waters in the Wolfcamp Shale (Permian), Delaware Basin, USA," Applied Geochemistry 122 (2020): 104771, https://doi.org/10.1016/j.apgeochem.2020.104771.

[18] U.S. Environmental Protection Agency, "Summary of Input on Oil and Gas Extraction Wastewater Management Practices Under the Clean Water Act," EPA-821-S19-001 (May 2020), https://www.epa.gov/sites/default/files/2020-05/documents/oil-gas-final-report-2020.pdf.

wells, posing potential environmental risks. Additionally, the high salinity and complex chemistry of the produced water make surface treatment costly.

Sensing and far-field characterization. Current diagnostic tools such as microseismic and distributed fiber optic sensing offer limited resolution of fracture dimensions, connectivity, and conductivity. This limitation leads to difficulty in mapping fracture networks, characterizing unstimulated zones to estimate undrained volumes, and monitoring fluid migration in the far field. Furthermore, effectively monitoring proppant distribution and assessing fracture conductivity within the stimulated region remains an unsolved challenge. The long-term monitoring capabilities are also constrained by the durability of sensors in harsh downhole environments.

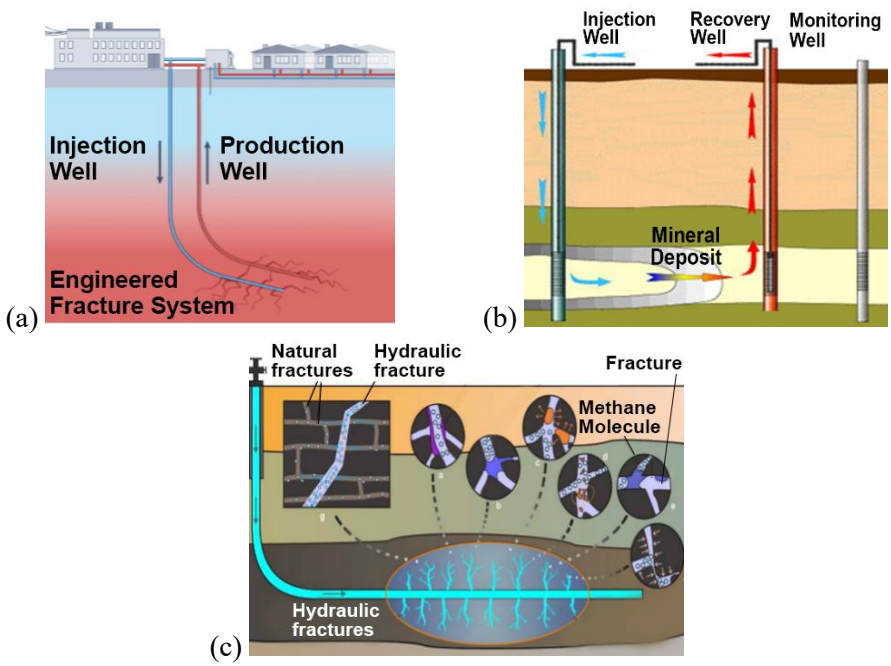

Figure 2. (a) Enhanced geothermal system,[19] (b) in-situ leaching,[20] and (c) coalbed methane reservoir.[21]

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[19] R. Horne, A. Genter, M. McClure, W. Ellsworth, J. Norbeck, and E. Schill, "Enhanced geothermal systems for clean firm energy generation," *Nature Reviews Clean Technology* 1, no. 2 (2025): 148–160, https://doi.org/10.1038/s44359-024-00019-9.

[20] F. L. Pellet, "Rock Mechanics and Environmental Engineering for Energy and Geo-Resources," ISRM European Rock Mechanics Symposium—EUROCK 2018 (May 2018): https://onepetro.org/ISRMEUROCK/proceedings-abstract/EUROCK18/EUROCK18/ISRM-EUROCK-2018-008/446917.

[21] Q. Huang, S. Liu, G. Wang, B. Wu, and Y. Zhang, "Coalbed methane reservoir stimulation using guar-based fracturing fluid: A review," *Journal of Natural Gas Science and Engineering* 66, no. 6 (2019): 107–125, https://doi.org/10.1016/j.jngse.2019.03.027.

Other Subsurface Resources

The challenge of mobilizing and recovering resources from low-permeability, geologically complex formations extends beyond shale and tight oil and gas reservoirs, constraining other subsurface resources, such as those depicted in Figure 2.

- Enhanced geothermal systems (EGS), particularly in hot dry rock and low-permeability basement formations, face difficulties in sustaining conductive fractures and in maintaining uniform flow across them. This difficulty leads to thermal short circuiting and suboptimal thermal recovery.[22] Sand-based proppants may degrade under high temperatures and stress, causing conductivity loss. High temperatures limit sensor longevity. Monitoring fracture propagation, fluid pathways, and far-field behavior also remains challenging. Circulation losses (~230 to 4,200 gallons per megawatt-hour) raise water demand and seismic risks, while scaling clogs flow paths.[23,24]
- In-situ leaching operations for extracting minerals and metals face challenges in low permeability formations due to poor leaching agent (i.e., lixiviant) to rock contact, resulting in low recovery.[25] Containment of injected fluids during in-situ leaching is critical for groundwater protection, but current wellbore monitoring methods (e.g., logging) are inadequate to track complex subsurface flow, geochemical interactions, and far-field fluid excursions. Further difficulties arise from post-leaching groundwater restoration and wastewater management. For example, uranium recovery can generate 50–250 gallons of wastewater per pound of uranium recovered, underscoring the need for effective water management strategies.[26]
- Coalbed methane production requires extensive dewatering that yields significant wastewater, presenting costly treatment and disposal challenges. The low, anisotropic permeability of coal seams often necessitates stimulation and enhanced recovery to

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[22] M. L. McLean, and D. N. Espinoza, "Thermal destressing: Implications for short-circuiting in enhanced geothermal systems," Renewable Energy 202(2023): 736–755, https://doi.org/10.1016/j.renene.2022.11.102.

[23] C. B. Harto, J. N. Schroeder, R. M. Horner, T. L. Patton, L. A. Durham, D. J. Murphy, and C. E. Clark, "Analysis of the 2024 Circulation Tests at Utah FORGE and the Response of Fiber Optic Sensing Data," Argonne National Lab/EVS-14/14 (October 2014): https://gdr.openei.org/files/464/ANL:EVS-14:14%20(1).pdf.

[24] P. Xing, K. England, J. Moore, and J. McLennan "Analysis of the 2024 Circulation Tests at Utah FORGE and the Response of Fiber Optic Sensing Data," Workshop on Geothermal Reservoir Engineering, Stanford University (2025), https://pangea.stanford.edu/ERE/db/GeoConf/papers/SGW/2025/Xing2.pdf .

[25] L. Sinclair, and J. Thompson, "In situ leaching of copper: Challenges and future prospects," *Hydrometallurgy* 157, no. 10 (2015): 306–324, https://doi.org/10.1016/j.hydromet.2015.08.022.

[26] T. J. Gallegos, A. M. Scott, V. G. Stengel, and A. P. Teeple, "A Methodology to Assess the Historical Environmental Footprint of In-Situ Recovery (ISR) of Uranium: A Demonstration in the Goliad Sand in the Texas Coastal Plain, USA," *Minerals* 12, no. 1 (2022): 369, https://doi.org/10.3390/min12030369.

maintain production. Overcoming hurdles in characterizing permeability, dewatering, and tracking subsurface gas fronts is crucial for optimizing production.

A critical opportunity exists to develop crosscutting, next-generation technologies that enhance stimulation and recovery efficiency, expand flow pathways, and improve water management across diverse subsurface systems.

C. PROGRAM OBJECTIVES

The Unlocking New Levels of Output and Capacity for Key Subsurface Resources (UNLOCK) program seeks fundamentally disruptive technologies to markedly improve resource recovery from low-permeability subsurface environments. The program aims to improve upon state-of-the-art (SoA) methods by:

- Doubling the per-well recovery efficiency of energy and mineral resources from challenging formations
- Maintaining or reducing per-unit costs
- Maintaining or reducing the associated wastewater burden

Achieving this goal requires transformative approaches that integrate innovative stimulation and enhanced recovery processes with advanced sensing and comprehensive numerical and experimental modeling. If successful, this program will transform subsurface resource recovery, directly advancing ARPA-E's statutory goals of reducing foreign energy imports and enhancing energy security and infrastructure resilience.

D. TECHNICAL CATEGORIES OF INTEREST

The UNLOCK program is interested in transformative approaches that combine novel stimulation and enhanced recovery methods, supported by integrated sensing and comprehensive modeling. ARPA-E expects proposed technologies to achieve laboratory and numerical validation against the program objectives in Section I.C., culminating in a field trial that shows sustained recovery, cost-effectiveness, and wastewater metric validation under realistic geological and operational conditions.

The UNLOCK program seeks innovative solutions to the technical barriers described in Section I.B.2. Applicants can choose from one of two categories: Category A (Shale and Tight Oil & Gas) and Category B (Other Low-Permeability Subsurface Resources). ARPA-E anticipates that Category A will comprise the majority of projects selected under this program.

1. TECHNOLOGIES OF INTEREST

For both categories, technologies of interest include, but are not limited to, the following:

- **Waterless or low-water fracturing or stimulation technologies** that could improve resource access by creating more uniform, dense, durable, and controlled fracture networks, such as:

    - Energized gas injection (e.g., supercritical CO_2, nitrogen)
    - Chemical stimulation
    - Electric discharge fracturing
    - Pulsed plasma fracturing
    - High-energy laser-based stimulation
    - Thermal and acoustic stimulations
    - Self-propagating fracture networks
- **Advanced recovery fluids** to improve resource mobility and flow conformance, including biologically derived, nanomaterial-enhanced, adaptive, and catalytic reagents, such as:
    - Supercritical, nanoparticle-enhanced, or microbe-assisted recovery fluids that can enhance permeability, alter interfacial properties, and selectively mobilize trapped resources
    - Adaptive, responsive, or phase-changing fluids, such as temperature or pressure-activated gels
- **Engineered proppants** that can improve fracture conductivity, reservoir connectivity, and production performance, such as:
    - Shape-adaptive (expanding or deformable)
    - Reactive
    - Catalytic
    - In-situ generated
    - Multifunctional (e.g., sensing, scale-inhibiting)
    - High-temperature stable
- **Advanced diagnostics and modeling** for real-time subsurface monitoring, such as:
    - Distributed chemical sensing capable of tracking fluid composition variations
    - Quantum sensors with high sensitivity to reservoir changes
    - Swarm-based sensors that could enable detailed spatial mapping of fracture networks and fluid flow
    - Micro-sensors
    - Quantum computing
    - Super intelligence
    - Integrated experimental validation

2. SUBMISSION AND TEAM LOGISTICS

Both Category A and B submissions must be composed of two phases, each lasting approximately 18 months. Phase 1 (Laboratory Validation) includes controlled laboratory experiments using test-site-specific samples, and Phase 2 (Field Testing) will serve as an opportunity to test the performance of the developed technology at realistic well-scale conditions. The criteria for success under this program are ultimately defined by performance at the field test site. However, laboratory and numerical models must first indicate that the technology's inherent capabilities and predicted behaviors will translate into the successful attainment of the metrics at the field test site. These phases enable the program to focus on field-testing only the technologies that show clear evidence of the ability to meet program targets.

Submissions must propose project plans and budgets for both Phase 1 and Phase 2. Funding for both phases will be obligated at the start of the Period of Performance, but advancement from Phase 1 to Phase 2 is at ARPA-E's sole discretion. This decision will depend on whether a project team's laboratory experiments validate the technology's ability to meet the targets in Sections I.C and I.E and on the quality of deliverables. The transition from Phase 1 to Phase 2 represents a portfolio-wide down-select, so advancement is not guaranteed even if all milestones from Phase 1 are met.

For both categories, submissions must address the following requirements:

- **Integration of Stimulation and Enhanced Recovery:** Combine a stimulation and resource recovery approach, where at least one of these is novel and transformative, not incremental.
- **Integrated Sensing and Modeling**: Incorporate sensing and modeling with stimulation and recovery workflows. Numerical models must be site-calibrated, validated with lab data, and capable of predicting field-scale performance.
- **Laboratory Validation:** Conduct controlled laboratory experiments using test-site-specific core, fluids, and data samples.
- **Field Test Site:** Identify and describe the field test site where the technology will be tested at realistic well-scale conditions, identify current permit status, and provide documentation of site access (e.g., a letter of commitment).
- **Permitting Pathway**: Describe the plan to receive a permit for field testing.
- **Benchmarking Plan:** Provide baseline and test site-specific SoA technical and cost benchmarks (e.g., recovery efficiency, per-unit production cost).
- **Technology Readiness:** Show that the proposed technology is sufficiently mature for a downhole, at-depth field trial during the project's period of performance.
- **Techno-Economic Analysis** (TEA): Quantify economic viability, projected achievement of cost targets, and scale-up potential. Applicants must use the Category-specific template provided in eXCHANGE to complete an initial TEA to be submitted as an element of the Concept Paper and Full Application.

Both Category A and B teams must incorporate the site operator into the performance of the project throughout both Phase 1 and Phase 2 in order to ensure cohesion and reduce delays heading into the field-testing phase.

E. TECHNICAL PERFORMANCE TARGETS

Both Category A and B applicants will need to include their project-specific metrics and targets in the Concept Paper and Full Application, along with lists of all underlying variables used to substantiate those values (see Tables 1 and 2). Applicants must ensure that the data provided is verifiable with clear references, statistically representative of the relevant population or context, and not selectively chosen. ARPA-E reserves the right to request the entirety of the underlying data for verification.

1. CATEGORY A: SHALE AND TIGHT OIL & GAS

Applicants to Category A should meet or exceed the targets summarized in Table 1.

Table 1. List of the technical performance targets for Category A.

ID	Metric	Project Target	Description and Rationale
M1	Recovery Factor	≥ 40% (oil) ≥ 50% (gas)	Recovery factor is the percentage of original hydrocarbon recovered over the project life. Must achieve at least double the recovery of current test site SoA. For shale/tight oil, SoA is considered < 20%, with primary recovery typically in ~5%–10% range and EOR (pilot, lab, and simulation studies) indicating potential for ~15%–20%, while typical gas recovery ranges from ~15%–30% or more, depending on reservoir and operational parameter percentages.[27–30] Applicants must justify any target proposed that is lower than the NOFO's stated target.
M2	Water Disposal	Maintain or lower than test site SoA	Cumulative water disposal volume over the well life. Must maintain or be lower than test site SoA. For oil and gas, SoA is expected to be 1–12 bbl water per BOE.[31–33]
M3	Production Cost	Maintain or lower than test site SoA	Total cost of producing the resource including capital expenditures (CapEx) and operating expenses (OpEx). Must maintain or be lower than SoA for the test site. For oil and gas, SoA is expected to be $30–$50 per BOE.[34,35]

[27] M. R. Fassihi, and A. R. Kovscek, "Shale Oil Recovery," in The Book: Low-Energy Processes for Unconventional Oil Recovery. (Society of Petroleum Engineers, 2017): https://doi.org/10.2118/9781613994757.

[28] G. Dordzie, and M. Balhoff, "A review of chemical methods and testing techniques for enhanced oil recovery in shale reservoirs," Fuel 394 (2025): 135060, https://doi.org/10.1016/j.fuel.2025.135060.

[29] J. J. Sheng, "Technology 101: EOR Methods for Shale and Tight Formations," The Way Ahead, (April 2018): https://jpt.spe.org/twa/technology-101-eor-methods-shale-and-tight-formations.

[30] U.S. Energy Information Administration, "Technically Recoverable Shale Oil and Shale Gas Resources," (September 2015), https://www.eia.gov/analysis/studies/worldshalegas/pdf/overview.pdf.

[31] P. Dwivedi, "Produced water management in the oilfield is back in rage," ADI Analytics, (July 2025): https://adi-analytics.com/2025/07/30/produced-water-management-in-the-oilfield-is-back-in-rage/.

[32] U.S. Environmental Protection Agency, "Summary of Input on Oil and Gas Extraction Wastewater Management Practices Under the Clean Water Act," EPA-821-S19-001 (May 2020), https://www.epa.gov/sites/default/files/2020-05/documents/oil-gas-final-report-2020.pdf.

[33] R. Bruant, "The Growing Pressures of Produced Water Disposal," Journal of Petroleum Technology (November 2023): https://jpt.spe.org/the-growing-pressures-of-produced-water-disposal.

[34] U.S. Energy Information Administration, "Trends in U.S. Oil and Natural Gas Upstream Costs" (March 2016): https://www.eia.gov/analysis/studies/drilling/pdf/upstream.pdf.

[35] Federal Reserve Bank of Dallas, "Dallas Fed Energy Survey—Oil and gas expansion stalls amid surging costs and worsening outlooks—Exploration and Production (E&P) Firms,"

To substantiate their ability to achieve the high-level targets of Table 1, applicants must provide a comprehensive list of all underlying variables that contribute to those metrics. Table 2 outlines the minimum required underlying variables for reporting. However, additional site or technology-specific variables deemed relevant to the performance metrics may be appended if necessary for the application.

Table 2. List of underlying variables at the test site for performance metrics assessment (adapt as needed and provide references where possible).

Category	Variables	Units	Test Site Data
Original Geological Characteristics	Play/Formation Target	None	
	Matrix Permeability	Millidarcy (mD)	
	Reservoir Depth	Feet (ft)	
	Net Pay Thickness	ft	
	Porosity (avg.)	%	
	Oil Saturation	%	
	Reservoir Temperature	°F	
	Original Oil and/or Gas in Place	Barrels or ft^3	
	Reservoir Pressure	Psi	
Operational Parameters	Well Lateral Length	ft	
	Fracture Conductivity	mD-ft	
	Fracture Half-Length	Ft	
	Number of Fractures per Cluster	Number	
	Stage Spacing	ft	
Target Performance & Recovery	Peak Oil and/or Gas Production Rate	Barrels or ft^3 per day	
	Avg. Decline Rate (1st and 2nd years)	% decline per year	
	Estimated Ultimate Recovery	Barrels or ft^3, specify well life assumed	
Target Water Usage	Water Use per Well	Barrels, specify well life assumed	
	Water Produced per Well	Barrels, specify well life assumed	
	Water Disposal per Well	Barrels, specify well life assumed	
	+Add other variables as relevant		

Federal Reserve Bank of Dallas (March 2023): https://www.dallasfed.org/research/surveys/des/2023/2301#tab-questions.

2. CATEGORY B: OTHER LOW-PERMEABILITY SUBSURFACE RESOURCES

Specific technical performance target values for Category B metrics will be defined according to the specific resource type. To illustrate the expected level of detail, Table 3a is provided as an example for enhanced geothermal systems and Table 3b for in-situ leaching. Applicants focusing on other low-permeability resources are expected to develop analogous reporting tables adapted to their specific resource. To substantiate the attainment of the proposed metrics (e.g., those in Tables 3a and 3b), Category B applicants must also provide a comprehensive list of all underlying variables that contribute to those metrics. Applicants should refer to the underlying variables table provided for Category A (Table 2) as a foundational example. This table must be adapted by modifying existing variables and adding new ones relevant to the specific resource type.

Example: **Enhanced Geothermal System**

Table 3a. List of the technical performance targets for enhanced geothermal systems under Category B.

ID	Metric	Target	Description and Rationale
M1	Thermal Recovery	≥ 70%	Thermal recovery is the percentage of heat energy in place recovered over the project life. Must achieve at least double the recovery percentage of test site SoA. For enhanced geothermal systems, typical SoA is considered < 35%, although it varies with reservoir and operational parameters.[36–38] Targets proposed that are lower than the stated target must be justified.
M2	Water Leak-Off	< 1%	Water leak-off is the percentage of non-recaptured circulated water during operations. For enhanced

[36] S. Fercho, J. Norbeck, S. Dadi, G. Matson, J. Borell, E. McConville, S. Webb, C. Bowie, and G. Rhodes, "Update on the Geology, Temperature, Fracturing, and Resource Potential at the Cape Geothermal Project Informed by Data Acquired from the Drilling of Additional Horizontal EGS Wells," Workshop on Geothermal Reservoir Engineering, Stanford University (2025), https://pangea.stanford.edu/ERE/db/GeoConf/papers/SGW/2025/Fercho.pdf.

[37] Massachusetts Institute of Technology, *The Future of Geothermal Energy: Impact of Enhanced Geothermal Systems (EGS) on the United States in the 21st Century* (Idaho Falls, ID: Idaho National Laboratory, November 2006), chapter 3: "Recoverable EGS Resource Estimates," https://energy.mit.edu/wp-content/uploads/2006/11/MITEI-The-Future-of-Geothermal-Energy.pdf.

[38] U.S. Geological Survey, "Enhanced Geothermal Systems Electric-Resource Assessment for the Great Basin, Southwestern United States," (May 2025). https://pubs.usgs.gov/fs/2025/3027/fs20253027.pdf.

			geothermal systems, test site SoA water leak-off is expected to be 1%–20%.[39,40]
M3	Cost of Production	Maintain or lower than test site SoA	Must maintain or be lower than SoA for the test site. For enhanced geothermal systems, SoA production cost is expected to be $59–$101/megawatt-hour.[41]

Example: **In-Situ Leaching of Uranium**

Table 3b. List of the technical performance targets for in-situ leaching of uranium under Category B.

ID	Metric	Target	Description and Rationale
M1	Recovery Efficiency	≥ 80%	Recovery efficiency is the percentage of resource in place that is recovered. Must achieve at least double the test site SoA recovery efficiency. For uranium in-situ leaching, the SoA recover rate is considered to be < 40% in low-permeability formations. Targets proposed that are lower than the stated target must be justified.
M2	Wastewater Disposed	Maintain or lower than test site SoA	Must maintain or be lower than the SoA for the test site. For uranium in-situ recovery, the SoA wastewater disposed is expected to be ~50–250 gal/lb U_3O_8.[42]

[39] C. E. Clark, C. B. Harto, J. N. Schroeder, L. E. Martino, and R. M. Horner, "Life Cycle Water Consumption and Water Resource Assessment for Utility-Scale Geothermal Systems: An In-Depth Analysis of Historical and Forthcoming EGS Projects," Environmental Science Division, Argonne National Laboratory, ANL/EVS/R-12/8 (August 2013): https://publications.anl.gov/anlpubs/2013/09/101680.pdf.

[40] "Geothermal Mythbusting: Water Use and Impacts," Fervo Energy, (March 2025): https://fervoenergy.com/geothermal-mythbusting-water-use-and-impacts/.

[41] J. C. Robins, A. Kolker, F. Flores-Espino, W. Pettitt, B. Schmidt, K. Beckers, H. Pauling, and B. Anderson, "2021 U.S. Geothermal Power Production and District Heating Market Report," the National Renewable Energy Laboratory (2021): https://docs.nrel.gov/docs/fy21osti/78291.pdf.

[42] T. J. Gallegos, A. M. Scott, V. G. Stengel, and A. P. Teeple, "A Methodology to Assess the Historical Environmental Footprint of In-Situ Recovery (ISR) of Uranium: A Demonstration in the Goliad Sand in the Texas Coastal Plain, USA," Minerals 12, no. 3 (2022): 369, https://doi.org/10.3390/min12030369.

M3	Cost of Production	Maintain or lower than test site SoA	Must maintain or be lower than SoA for the test site. For uranium in-situ recovery, the SoA production cost is expected to be \$13–\$60/lb U_3O_8.[43,44]

For more guidance on the inclusion of the metrics and underlying variables in the submissions, applicants should closely review Sections III.B and III.C as well as the Concept Paper and Full Application templates available in DOE eXCHANGE.

F. STATEMENT OF SUBSTANTIAL INVOLVEMENT

Congress directed ARPA-E to "establish and monitor project milestones, initiate research projects quickly, and just as quickly terminate or restructure projects if such milestones are not achieved."[45] Accordingly, ARPA-E is substantially involved in the direction of projects from inception to completion.

For the purposes of an ARPA-E project, substantial involvement means:

- Project teams must adhere to ARPA-E's agency-specific and program requirements.
- ARPA-E may intervene at any time in the performance of work under an award.
- ARPA-E does not limit its involvement to the administrative requirements of an award. Instead, ARPA-E has substantial involvement in the direction and redirection of the technical aspects of the project as a whole.
- ARPA-E may, at its sole discretion, modify or terminate projects that fail to achieve predetermined Go/No Go decision points or technical milestones and deliverables.
- During award negotiations, ARPA-E Program Directors and recipients mutually establish an aggressive schedule of quantitative milestones and deliverables that must be met every quarter. In addition, ARPA-E will negotiate and establish "Go/No-Go" milestones for each project. If the recipient fails to achieve any of the "Go/No-Go" milestones or technical milestones and deliverables as determined by the ARPA-E Grants Officer, ARPA-E may, at its discretion, renegotiate the statement of project objectives or schedule of technical milestones and deliverables for the project. In the alternative, ARPA-E may suspend or terminate the award in accordance with 2 C.F.R. §§ 200.339 – 200.343.
- ARPA-E may provide guidance and/or assistance to the recipient to accelerate the commercialization of ARPA-E-funded technologies. Guidance and assistance provided by ARPA-E may include coordination with other Government agencies and nonprofits to provide mentoring and networking opportunities for recipients. ARPA-E may also organize and sponsor events to educate recipients about key barriers to the commercialization of their ARPA-E-funded technologies. In addition, ARPA-E may

[43] M. Seredkin, A. Zabolotsky, and G. Jeffress, "In situ recovery, an alternative to conventional methods of mining: Exploration, resource estimation, environmental issues, project evaluation and economics," Ore Geology Reviews 79, no. 12 (2016): 500–514, https://doi.org/10.1016/j.oregeorev.2016.06.016.

[44] DOE-NE Systems Analysis & Integration Campaign, "Advanced Fuel Cycle Cost Basis Report: Module A1 Uranium Mining and Milling". Idaho Falls: Idaho National Laboratory, (2021): https://sai.inl.gov/content/uploads/29/2024/11/2020_module_a1.pdf.

[45] U.S. Congress, Conference Report to accompany the 21st Century Competitiveness Act of 2007, H. Rpt. 110-289 at 171–172 (Aug. 1, 2007).

establish collaborations with private and public entities to provide continued support for the development and commercialization of ARPA-E-funded technologies.

G. FUNDING RESTRICTIONS

1. ALLOWABLE COSTS

All expenditures must be allowable, allocable, and reasonable in accordance with the applicable Federal cost principles. Under 2 C.F.R. § 910.352, the cost principles in the Federal Acquisition Regulations (48 C.F.R. Part 31 Subpart 31.2) apply to for-profit entities. The cost principles contained in 2 C.F.R. Part 200 Subpart E apply to all other entities.

2. PRE-AWARD COSTS

ARPA-E will not reimburse any pre-award costs incurred by applicants before they are selected for award negotiations. Please refer to Section VI.A for guidance on award notices.

Upon selection for award negotiations, applicants may incur pre-award costs at their own risk, consistent with the requirements in 2 C.F.R. Part 200, as modified by 2 C.F.R. Part 910, and other Federal laws and regulations. All submitted budgets are subject to change and are typically reworked during award negotiations. ARPA-E is under no obligation to reimburse pre-award costs if, for any reason, the applicant does not receive an award or the award is made for a lesser amount than the applicant expected, or if the costs incurred are not considered allowable, allocable, or reasonable.

3. PATENT COSTS

For Subject Inventions disclosed to DOE under an award, ARPA-E will reimburse the recipient—in addition to allowable costs associated with Subject Invention disclosures—up to $30,000 of expenditures for filing and prosecution of U.S. patent applications, including international applications (PCT application) submitted to the U.S. Patent and Trademark Office (USPTO).

The recipient may request a waiver of the $30,000 cap. Note that patent costs are considered to be Technology Transfer & Outreach (TT&O) costs (see Section I.G.8) and should be requested as such.

4. CONSTRUCTION

ARPA-E generally does not fund projects that involve major construction. Recipients are required to obtain written authorization from the Grants Officer before incurring any major construction costs.

5. FOREIGN TRAVEL

ARPA-E generally does not fund projects that involve foreign travel. Recipients are required to obtain written authorization from the ARPA-E Program Director before incurring any foreign travel costs and provide trip reports with their reimbursement requests.

6. PERFORMANCE OF WORK IN THE UNITED STATES

ARPA-E requires all work under ARPA-E funding agreements to be performed in the United States. However, applicants may request a waiver of this requirement where their project would materially benefit from, or otherwise requires, certain work to be performed overseas.

Applicants seeking this waiver must include an explicit request in the Business Assurances & Disclosures Form. Such waivers are granted where ARPA-E determines there is a demonstrated need.

7. PURCHASE OF NEW EQUIPMENT

All equipment purchased under ARPA-E funding agreements must be made or manufactured in the United States, to the maximum extent practicable. This requirement does not apply to used or leased equipment. The recipients are required to notify the ARPA-E Grants Officer reasonably in advance of purchasing any equipment that is not made or manufactured in the United States with a total acquisition cost of $250,000 or more. Purchases of foreign equipment with a total acquisition cost of $1,000,000 or more require the approval of the Head of Contracting Activity (HCA). The ARPA-E Grants Officer will provide consent to purchase or reject within 30 calendar days of receipt of the recipient's notification.

8. TECHNOLOGY TRANSFER AND OUTREACH

ARPA-E is required to contribute a percentage of appropriated funds to Technology Transfer and Outreach (TT&O) activities. In order to meet this mandate, every project team must spend at least 5% of the Federal funding (i.e., the portion of the award that does not include the recipient's cost share) provided by ARPA-E on TT&O activities to promote and further the development and eventual deployment of ARPA-E-funded technologies. Project teams must seek a waiver from ARPA-E, located in the Business Assurances & Disclosures Form, to spend less than the minimum 5% TT&O expenditure requirement.

All TT&O expenditures are subject to the applicable Federal cost principles (i.e., 2 C.F.R. 200 Subpart E or 48 C.F.R. Part 31). Examples of TT&O expenditures are:

- Documented travel and registration for the ARPA-E Energy Innovation Summit and other energy-related conferences and events
- Documented travel to meet with potential suppliers, partners, or customers
- Documented work by salaried or contract personnel to develop technology-to-market models or plans
- Documented costs of acquiring industry-accepted market research reports

- Approved patent costs

9. LOBBYING

Recipients and subrecipients may not use any Federal funds, directly or indirectly, to influence or attempt to influence, directly or indirectly, congressional action on any legislative or appropriation matters pending before Congress, other than to communicate to members of Congress as described in 18 U.S.C. § 1913. This restriction is in addition to those prescribed elsewhere in statute and regulation.

Recipients and subrecipients are required to complete and submit SF-LLL, "Disclosure of Lobbying Activities" (https://www.gsa.gov/forms-library/disclosure-lobbying-activities) if any non-Federal funds have been paid or will be paid to any person for influencing or attempting to influence any of the following in connection with your application:

- An officer or employee of any Federal agency
- A member of Congress
- An officer or employee of Congress
- An employee of a member of Congress

10. CONFERENCE SPENDING

Recipients and subrecipients may not use any Federal funds to:

- Defray the cost to the U.S. Government of a conference held by any Executive branch department, agency, board, commission, or office that is not directly and programmatically related to the purpose for which their ARPA-E award is made and for which the cost to the U.S. Government is more than $20,000; or
- To circumvent the required notification by the head of any such Executive Branch department, agency, board, commission, or office to the Inspector General (or senior ethics official for any entity without an Inspector General), of the date, location, and number of employees attending such a conference.

11. INDEPENDENT RESEARCH AND DEVELOPMENT COSTS

ARPA-E does not fund Independent Research and Development (IR&D) as part of an indirect cost rate under its grants and cooperative agreements. IR&D, as defined at FAR 31.205-18(a), includes cost of effort that is not sponsored by an assistance agreement or required in performance of a contract, and that consists of projects falling within the four following areas: (i) basic research, (ii) applied research, (iii) development, and (iv) systems and other concept formulation studies.

ARPA-E's goals are to enhance the economic and energy security of the United States through the development of energy technologies and to ensure that the United States maintains a technological lead in developing and deploying advanced energy technologies. ARPA-E accomplishes these goals by providing financial assistance for energy technology projects and has well recognized and established procedures for supporting research through competitive

financial assistance awards based on merit review of proposed projects. Reimbursement for IR&D costs through the indirect cost mechanism could circumvent this competitive process.

To ensure that all projects receive similar and equal consideration, eligible organizations may compete for direct funding of independent research projects they consider worthy of support by submitting applications for those projects to ARPA-E. Because applications for these projects may be submitted for direct funding, costs for IR&D projects are not allowable as indirect costs under ARPA-E awards. IR&D costs, however, would still be included in the direct cost base that is used to calculate the indirect rate so as to ensure an appropriate allocation of indirect costs to the organization's direct cost centers.

12. BUY AMERICA REQUIREMENT FOR PUBLIC INFRASTRUCTURE PROJECTS

Projects funded through this NOFO that are for, or contain, construction, alteration, maintenance, or repair of public infrastructure in the United States undertaken by applicable recipient types, require that:

- All iron, steel, and manufactured products used in the infrastructure project are produced in the United States; and
- All construction materials used in the infrastructure project are manufactured in the United States.

However, ARPA-E does not anticipate soliciting for or selecting projects that propose project tasks that are for, or contain, construction, alteration, maintenance, or repair of public infrastructure. If a project selected for award negotiations includes project tasks that may be subject to the Buy America Requirement, those project tasks will be removed from the project before any award is issued (i.e., no federal funding or recipient cost share will be available for covered project tasks).

This "Buy America" requirement does not apply to an award where the recipient is a for-profit entity.

13. REQUIREMENT FOR FINANCIAL PERSONNEL

ARPA-E requires small business or nonprofit applicants to identify a finance/budget professional (employee or contracted support) with an understanding of Federal contracting and/or financial assistance and cost accounting (including indirect costs, invoicing, and financial management systems) that will support the team in complying with all applicable requirements.

14. PARTICIPANTS, COLLABORATING ORGANIZATIONS, AND CURRENT AND PENDING SUPPORT

If selected for award negotiations the selected applicant must submit, before the award is issued, an updated list of Covered Individuals[46] who are proposed to work on the project, both at

[46] See Section IX, Glossary, for the definition of Covered Individual.

the recipient and subrecipient level, and a list of all participating[47] organizations. Further, the selectee must submit 1) current and pending support disclosures and resumes for any new Covered Individuals, and 2) updated disclosures if the current and pending support submitted with the application has changed.

Throughout the life of the award, recipients have an ongoing responsibility to notify DOE of changes to Covered Individuals, current and pending support, and collaborating organizations, within 30 days of such change, and to submit updated current and pending support disclosure statements and resumes as necessary. Recipients must certify on an annual basis that no such changes have occurred since their most recent certification.

Note that foreign participation is treated separately and requires a Foreign Entity Waiver, per Section II.A.4.

15. PROHIBITION ON THE USE OF FUNDS FOR ACTIVITIES RELATED TO FASC-PROHIBITED UNMANNED AIRCRAFT SYSTEMS

Pursuant to the prohibition in section 1825 of the American Security Drone Act of 2023 (Public Law 118–31), no Federal funds awarded under this program may be used by a recipient or subrecipient (i) to procure a Federal Acquisition Security Council (FASC)-prohibited unmanned aircraft system; or (ii) in connection with the operation of a FASC-prohibited unmanned aircraft system.[48]

[47] "Participation" here and in Section II.A.4 includes any activities performed under an ARPA-E award, including, but not limited to, all work described in the milestone schedule of an award (referred to as "Attachment 3" or the "Statement of Project Objectives" [SOPO]) and any services that include testing, including services performed by contractors. Participation also includes activities that involve the procurement of foreign equipment or supplies.

[48] The terms "FASC-prohibited unmanned aircraft system" and "unmanned aircraft system" have the definitions provided in 48 C.F.R. § 40.201, or successor regulation.

II. ELIGIBILITY INFORMATION

A. ELIGIBLE APPLICANTS

This NOFO is open to U.S. Institutions of Higher Education (IHEs), national laboratories, industry, and individuals.

1. INDIVIDUALS

U.S. citizens or permanent residents may apply for funding in their individual capacity as a standalone applicant, as the lead for a project team, or as a member of a project team. However, ARPA-E will only award funding to an entity formed by the applicant.

2. DOMESTIC ENTITIES

For-profit entities (which includes large businesses and small businesses), IHEs, and nonprofits[49] that (A) are organized, chartered, or incorporated (or otherwise formed) under the laws of a particular state or territory of the United States; (B) have majority domestic ownership and control; and (C) have a physical place of business in the United States, including U.S. territories, are eligible to apply for funding as a standalone applicant, as the lead organization for a project team, or as a member of a project team.

Entities that do not meet the above criteria may still be eligible to apply as a standalone applicant, lead organization or member of a project team, but must either (1) designate in the Full Application a subsidiary or affiliate that meets the above criteria to receive funding (the Full Application must state the nature of the corporate relationship between the foreign entity and domestic subsidiary or affiliate); or (2) request a Foreign Entity Waiver.

- If a Foreign Country of Concern or individual citizen(s) of a Foreign Country of Concern has any ownership interest in any of the entities included in a proposal, then the Full Application must include a Foreign Entity Waiver request for each such entity in order for ARPA-E to consider the participation of such entities.[50]
- All work under the ARPA-E award must be performed in the United States unless a separate Foreign Work Waiver request is granted.[51]

FFRDCs/DOE Labs are eligible to apply for funding as the lead organization for a project team or as a member of a project team that includes IHEs, companies, research foundations, or trade and industry research collaborations, but not as a standalone applicant.

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[49] Nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995, are not eligible to apply for funding as a recipient or subrecipient.

[50] The contents of a Foreign Entity Waiver request can be found in the Business Assurances & Disclosures Form.

[51] The contents of a Foreign Work Waiver can also be found in the Business Assurances & Disclosures Form.

State, local, and tribal government entities are eligible to apply for funding as a member of a project team, but not as a standalone applicant or as the lead organization.

Federal agencies and instrumentalities (other than DOE) are eligible to apply for funding as a member of a project team, but not as a standalone applicant or as the lead organization for a project team.

3. CONSORTIA

Consortia, which may include domestic and foreign entities, must designate one member of the consortium as the consortium representative to the project team. The consortium representative must be incorporated in the United States. The eligibility of the consortium will be determined by reference to the eligibility of the consortium representative under Section II.A. Each consortium must have an internal governance structure and a written set of internal rules. Upon request, the consortium entity must provide a written description of its internal governance structure and its internal rules to the Grants Officer (ARPA-E-CO@hq.doe.gov).

Unincorporated consortia must provide the Grants Officer with a collaboration agreement, commonly referred to as the articles of collaboration, which sets out the rights and responsibilities of each consortium member. This collaboration agreement binds the individual consortium members together and shall include the consortium's:

- Management structure
- Method of making payments to consortium members
- Means of ensuring and overseeing members' efforts on the project
- Provisions for members' cost sharing contributions
- Provisions for ownership and rights in intellectual property developed previously or under the agreement

4. FOREIGN PARTICIPATION CONSIDERATIONS

Foreign participation in a project requires a Foreign Entity Waiver. Awardees have an ongoing obligation to report new foreign participation in a project and may be required to obtain a waiver before new foreign participation can occur. A Foreign Work Waiver may also be required (see Section I.G.6).

5. ENTITY OF CONCERN PROHIBITION

No Entity of Concern may receive any grant, contract, cooperative agreement, or loan of $10 million or more in DOE funds.

In addition, for all awards involving Departmental activities authorized under Public Law 117–167, no Entity of Concern (including an individual that owns or controls, is owned or controlled by, or is under common ownership or control with an Entity of Concern) may receive DOE funds or perform work under any award, subject to certain penalties. See section 10114 of Public Law 117–167 (42 U.S.C. § 18912) and Division D, Title III, section 310

of Division D of the Consolidated Appropriations Act of 2024 (Public Law No. 118–42) for additional information.

6. PROHIBITION RELATED TO MALIGN FOREIGN TALENT RECRUITMENT PROGRAMS

Individuals participating in a Malign Foreign Talent Recruitment Program are prohibited from participating in projects selected for federal funding under this NOFO.

Should an award result from this NOFO, the recipient must exercise ongoing due diligence to reasonably ensure that no such individuals participating on the ARPA-E-funded project are participating in a Malign Foreign Talent Recruitment Program. Consequences for violations of this prohibition will be determined according to applicable law, regulations, and policy.

Further, the recipient must notify ARPA-E within five (5) business days upon learning that an individual on the project team is or is believed to be participating in a Malign Foreign Talent Recruitment Program. ARPA-E may modify and add requirements related to this prohibition to the extent required by law.

Required Certifications:

a. Each Covered Individual must certify as a part of the Biosketch that they are not party to a Malign Foreign Talent Recruitment Program.
b. The applicant and the subrecipients must certify that the covered individuals in their respective employment have been made aware of the Malign Foreign Talent Recruitment Program prohibition and have complied with their certification responsibilities stated above.

Non-Discrimination:

ARPA-E will ensure the Malign Foreign Talent Recruitment Program Prohibition is carried out in a manner that does not target, stigmatize, or discriminate against individuals on the basis of race, ethnicity, or national origin, consistent with title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d et seq.).

B. COMPLIANCE AND RESPONSIVENESS

Submissions that are noncompliant or nonresponsive to the NOFO as described in Sections IV.D and V.A are not eligible.

C. LIMITATION ON NUMBER OF SUBMISSIONS

ARPA-E is not limiting the number of submissions from applicants. Applicants may submit more than one application to this NOFO, if each application is scientifically distinct.

Small business applicants that qualify as a "small business concern" may apply to only one of the two ARPA-E UNLOCK NOFOs as a project team lead: DE-FOA-0003631

(UNLOCK SBIR/STTR), or DE-FOA-0003630 (UNLOCK). Small businesses that qualify as "small business concerns" are strongly encouraged to apply under the former (SBIR/STTR NOFO). To determine eligibility as a "small business concern" under DE-FOA-0003631 (SBIR/STTR), please review the eligibility requirements in Sections II.A - II.C of that NOFO.

ARPA-E will accept only new submissions under this NOFO. Applicants may not seek renewal or supplementation of their existing awards through this NOFO.

D. COST SHARING

1. BASE COST SHARE REQUIREMENT

ARPA-E generally uses cooperative agreements to provide financial and other support to recipients (Section VI.D.1). Under a cooperative agreement or grant, the recipient must provide at least 20% of the Total Project Cost as cost share, except as provided in Sections II.D.2 or II.D.3.[52]

2. INCREASED COST SHARE REQUIREMENT

Large businesses are strongly encouraged to provide more than 20% of the Total Project Cost as cost share.

Under an "other transaction" agreement, the recipient is normally expected to provide at least 50% of the Total Project Cost as cost share. ARPA-E may reduce this cost share requirement, as appropriate.

3. REDUCED COST SHARE REQUIREMENT

ARPA-E has reduced the base cost share requirement for the following types of projects:

- A domestic IHE or domestic nonprofit applying as a standalone applicant is required to provide at least 5% of the Total Project Cost as cost share.
- Project teams composed exclusively of domestic IHEs, domestic nonprofits, and/or FFRDCs/DOE Labs/Federal agencies and instrumentalities (other than DOE) are required to provide at least 5% of the Total Project Cost as cost share. Small businesses – or consortia of small businesses – may provide 0% cost share from the outset of the project through the first 12 months of the project (hereinafter the "Cost Share Grace Period"). If the project is continued beyond the Cost Share Grace Period, then at least 10% of the Total Project Cost (including the costs incurred during the Cost Share Grace Period) will be required as cost share over the remaining period of performance.
- Project teams where a small business is the lead organization and small businesses perform greater than or equal to 80% of the total work under the funding agreement (as measured by the Total Project Cost) are entitled to the same cost share reduction and Cost Share Grace Period as provided above to standalone small businesses or consortia of small businesses.

[52] Energy Policy Act of 2005, Pub.L. 109-58, sec. 988(c)

- Project teams where domestic IHEs, domestic nonprofits, small businesses, and/or FFRDCs perform greater than or equal to 80% of the total work under the funding agreement (as measured by the Total Project Cost) are required to provide at least 10% of the Total Project Cost as cost share. However, any entity (such as a large business) receiving patent rights under a class waiver, or other patent waiver, that is part of a project team receiving this reduction must continue to meet the statutory minimum cost share requirement (20%) for its portion of the Total Project Cost.
- Projects that do not meet any of the above criteria are subject to the base cost share requirements described in Sections II.D.1 and II.D.2.

4. LEGAL RESPONSIBILITY

Although the cost share requirement applies to the project team as a whole, the funding agreement makes the recipient legally responsible for paying or ensuring payment of the entire cost share. The recipient's cost share obligation is expressed in the funding agreement as a static amount in U.S. dollars (cost share amount) and as a percentage of the Total Project Cost (cost share percentage). If the funding agreement is terminated prior to the end of the period of performance, the recipient is required to contribute at least the cost share percentage of total expenditures incurred through the date of termination.

The recipient is solely responsible for managing cost share contributions by the project team and enforcing cost share obligations assumed by project team members in subawards or related agreements.

5. COST SHARE ALLOCATION

Each project team is free to determine how much each project team member will contribute towards the cost share requirement. The amount contributed by individual project team members may vary, as long as the cost share requirement for the project as a whole is met.

6. COST SHARE TYPES AND ALLOWABILITY

Every cost share contribution must be allowable under the applicable Federal cost principles, as described in Section I.G. Upon selection for award negotiations, the recipient must confirm in writing that the proposed cost share contribution is allowable in accordance with applicable Federal cost principles.

Project teams may provide cost share in the form of cash or in-kind contributions. Cash contributions may be provided by the recipient or subrecipients. Allowable in-kind contributions include but are not limited to personnel costs, indirect costs, facilities and administrative costs, rental value of buildings or equipment, and the value of a service, other resource, or third-party in-kind contribution. project teams may use funding or property received from state or local governments to meet the cost share requirement, so long as the funding or property was not provided to the state or local government by the U.S. Government.

The recipient may not use the following sources to meet its cost share obligations:

- Revenues or royalties from the prospective operation of an activity beyond the period of performance
- Proceeds from the prospective sale of an asset of an activity
- Appropriated Federal funding or property (e.g., Federal grants, equipment owned by the Federal Government)
- Expenditures that were reimbursed under a separate Federal program

In addition, project teams may not use IR&D funds[53] to meet their cost share obligations under cooperative agreements. However, project teams may use IR&D funds to meet their cost share obligations under "other transaction" agreements.

Project teams may not use the same cash or in-kind contributions to meet cost share requirements for more than one project or program.

Cost share contributions must be specified in the project budget, verifiable from the recipient's records, and necessary and reasonable for proper and efficient accomplishment of the project. Every cost share contribution must be reviewed and approved in advance by the Grants Officer and incorporated into the project budget before the expenditures are incurred.

Applicants may wish to refer to 2 C.F.R. Parts 200 and 910, and 10 C.F.R Part 603[54] for additional guidance on cost sharing, specifically 2 C.F.R. §§ 200.306 and 910.130, and 10 C.F.R. §§ 603.525-555.

7. COST SHARE CONTRIBUTIONS BY FFRDCS AND GOGOS

Because FFRDCs are funded by the Federal Government, costs incurred by FFRDCs generally may not be used to meet the cost share requirement. FFRDCs may contribute cost share only if the contributions are paid directly from the contractor's Management Fee or a non-Federal source.

Because GOGOs/Federal Agencies are funded by the Federal Government, GOGOs/Federal Agencies may not provide cost share for the proposed project. However, the GOGO/Agency costs would be included in Total Project Costs for purposes of calculating the cost-sharing requirements of the applicant.

8. COST SHARE VERIFICATION

The recipient is required to provide cost share commitment letters from subrecipients or third parties that are providing cost share, whether cash or in-kind, in their Full Application. Each subrecipient or third party that is contributing cost share must provide a letter on appropriate letterhead that is signed by an authorized corporate representative.

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[53] As defined in Federal Acquisition Regulation Subsection 31.205-18.

[54] In the case of Technology Investment Agreements under 42 U.S.C. § 7256(g).

Upon selection for award negotiations, applicants are required to provide information and documentation regarding their cost share contributions. Please refer to Section II.D for guidance on the requisite cost share information and documentation.

III. APPLICATION CONTENTS AND FORMAT

A. GENERAL APPLICATION CONTENT REQUIREMENTS

1. MARKING OF CONFIDENTIAL INFORMATION

Except as described in Section VIII.E below, ARPA-E will use data and other information contained in Concept Papers, Full Applications, and Replies to Reviewer Comments strictly for evaluation purposes.

Concept Papers, Full Applications, Replies to Reviewer Comments, and other submissions containing confidential, proprietary, or privileged information should be marked as described below. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under the Freedom of Information Act or otherwise. The U.S. Government is not liable for the disclosure or use of unmarked information and may use or disclose such information for any purpose.

The cover sheet of the Concept Paper, Full Application, Reply to Reviewer Comments, or other submission must be marked as follows and identify the specific pages containing confidential, proprietary, or privileged information:

Notice of Restriction on Disclosure and Use of Data:

> Pages [___] of this document may contain confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for evaluation purposes or in accordance with a financial assistance or loan agreement between the submitter and the Government. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source.

The header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: "Contains Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure." In addition, every line and paragraph containing confidential, proprietary, or privileged information must be clearly marked with double brackets or highlighting.

2. EXPORT CONTROL INFORMATION

Do not include information subject to export controls in any submissions, including Concept Papers, Full Applications, and Replies to Reviewer Comments, whether marked as subject to U.S. export control laws/regulations or otherwise. Such information may not be accepted by ARPA-E and may result in a determination that the application is non-compliant, and therefore not eligible for selection. This prohibition includes any submission containing a general, non-determinative statement such as "The information on this page [or pages _ to__] may be subject to U.S. export control laws/regulations", or similar. Under the terms of their award, awardees shall be responsible for compliance with all export control laws/regulations.

3. IMPACTED INDIAN TRIBES DOCUMENTATION

This section requires applicants to ascertain potential impacts to Indian Tribes[55], including Alaska Native village or regional or village corporations, other than the applicant. For any application that potentially impacts Indian Tribes, including when the potentially impacted Indian Tribe is the applicant, this section specifies the documentation required to be submitted.

For any project that potentially impacts Indian Tribes, applicants are required to submit documentation demonstrating that an authorized representative[56] of each potentially impacted Indian Tribe is, at a minimum, aware of the nature of the application and its potential impacts to the relevant Indian Tribes. Documentation must demonstrate affirmative awareness of the application (e.g., a delivery record from certified mail, a reply by the authorized representative).

For any project intended to be sited on Tribal land(s)[57] [or intersecting with Tribal subsurface rights], applicants are required to submit documentation demonstrating support from the relevant Indian Tribes at the time of application (this will be considered to also demonstrate awareness of an Indian Tribe, specified above). Documentation may include either:

- A letter of support from Tribal leadership, signed by an authorized representative of the Indian Tribe; or
- A Tribal Council Resolution, Board resolution (including the Board of Directors of an Alaska Native Corporation (ANC)), or similar act passed by the legislative body of the Tribal government or Board of Directors of an ANC, expressing support for the project.

For projects not intended to be sited on Tribal land(s) [or intersecting with Tribal subsurface rights], but that may have other potential impacts on Tribal resources or reserved rights, letters of support or resolutions of support are strongly encouraged and, depending on the nature of the impact, may be required if selected for negotiation of an agreement. Applicants are encouraged to reach out to Indian Tribes as early as possible in the application process to give Indian Tribes ample time to evaluate and respond. The following resources may be useful to help determine if a project may impact an Indian Tribe(s) resources or reserved rights and the appropriate contacts. These resources are not exhaustive, and many Indian Tribes have resources or reserved rights which extend beyond their Tribal reservation or land, or are covered within treaties, statutes, or case-law. Applicants are encouraged to do additional research:

- Map of Indian Lands: https://bia-geospatial-internal.geoplatform.gov/indianlands
- Tribal Treaties Database: https://treaties.okstate.edu/

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[55] Indian Tribe is as defined in 25 U.S.C. § 5304 (e).

[56] An authorized representative must be an elected official or designated leader according to the traditions, constitution, or charter of the Indian Tribe, or someone with relevant delegated authority within the Tribal government. Examples include: Chief, Chairman, Chairwoman, Governor, Nation Representative, President, Chief Executive Officer, Chief Financial Officer, Speaker of the Council, Speaker of the Congress, Tribal administrator. The authorized representative must be holding their position while the award is open for applications or negotiations.

[57] Tribal lands is as defined in 25 U.S.C. §§ 3501(2), (3), (4)(A) and (13).

- Directory of federally recognized Tribes and Tribal leaders: https://www.bia.gov/service/tribal-leaders-directory
- Best Practices for Identifying and Protecting Tribal Treaty Rights, Reserved Rights, and other similar rights in federal regulatory actions: https://www.bia.gov/sites/default/files/dup/inline-%09files/best_practices_guide.pdf

To help determine if an Indian Tribe's resources or reserved rights may be impacted by the project, applicants must address the following elements. If the applicant is an Indian Tribe, these elements should be addressed to ascertain impacts to Indian Tribes other than the applicant. Applicants do not need to reveal specific details about sacred sites such as specific location or specific ceremonies.

- Identify any shale or tight oil and gas or other subsurface resources that will be utilized on or near Tribal land, traditional homelands, Tribal historic sites, sacred sites, or in areas where an Indian Tribe maintains rights to specific subsurface resources targeted in this application. Identify which Indian Tribe(s) may be impacted. Explain any instances of uncertainty or confidentiality.
- Identify any elements of the project that will occur on or near Indian land, Tribal historic sites, or sacred sites and describe its potential impacts to Indian Tribes. Identify the potentially impacted Indian Tribe(s).
- Identify any Tribal mineral rights, subsurface, or water rights at or near the proposed project location. Explain any relevant studies already performed, such as groundwater studies. Identify which Indian Tribe(s) might be impacted. Explain any instances of uncertainty and any potential for subsurface resource migration.
- Identify any other proposed actions that may impact an Indian Tribe(s) resources or reserved rights. Tribal resources and reserved rights include, and are not limited to, an Indian Reservation or Land (as defined in 25 U.S.C. § 3501) or intersecting Tribal sub-surface rights, historic homelands from which they were removed, cultural sites, sacred sites, water rights, mineral and other subsurface rights, fishing rights, and hunting rights. Identify the Tribe(s) potentially impacted and sources of uncertainty or confidentiality.
- Explain any actions taken by the applicant to mitigate or address any potential impacts identified above, including engaging with the potentially impacted Indian Tribe(s).

Applicants are required to document any efforts taken to identify any potential impacts to Indian Tribes, Indian lands, Alaska Native regional and village land, traditional homelands, Tribal rights, or Tribal historic sites, or sacred sites. This includes any correspondence with Indian Tribes. These documents should be available on request to DOE.

An applicant's failure to submit documentation of an Indian Tribe's awareness, or a letter of support, when required as described above, may constitute grounds for determining an application ineligible, non-responsive to the NOFO, not subject to further review and/or not otherwise subject to selection or award.

Any data from an application that may potentially impact Indian Tribe(s) may be shared with the potentially impacted Indian Tribe(s). Applicants should include a Notice of Restriction on Disclosure and Use of Data identifying any business sensitive, trade secrets, proprietary, or

otherwise confidential information. Such information shall be used or disclosed only for evaluation purposes, where such evaluation includes a determination of whether the proposed project affects an Indian Tribe(s).

Data delivered under award that may potentially impact Indian Tribe(s) may also be shared with the potentially impacted Indian Tribe(s), subject to any restrictions included on properly marked data per the award terms.

If an applicant determines an Indian Tribe(s) will be impacted, the applicant must provide information on the project location, potential impacts and how the applicant will engage with Indian Tribe(s), during the period of performance of the agreement, and, if necessary, after the end of the agreement. Approval by DOE must be obtained before any activities take place that could impact Tribal resources or reserved rights, including but not limited to lands, cultural sites, sacred sites, water rights, mineral rights, fishing rights, and hunting rights. DOE will determine if formal government-to-government consultation is needed, and DOE will conduct that consultation accordingly, in addition to any engagement by applicant.

B. CONCEPT PAPERS

1. FIRST COMPONENT: CONCEPT PAPER

The Concept Paper is mandatory (i.e., in order to submit a Full Application, a compliant and responsive Concept Paper must have been submitted) and must conform to the following formatting requirements:

- Sections 1–4 of the Concept Paper must not exceed 4 pages in length including graphics, figures, and/or tables.
- Section 6 of the Concept Paper (Variables Underlying Metrics & Targets) must not exceed 1 page in length.
- The Concept Paper must be submitted in Adobe PDF format.
- The Concept Paper must be written in English.
- All pages must be formatted to fit on 8-1/2 by 11-inch paper with margins not less than one inch on every side. Single space all text and use Times New Roman typeface, a black font color, and a font size of 12 point or larger (except in figures and tables).
- The ARPA-E assigned Control Number, the Lead Organization Name, and the Principal Investigator's Last Name must be prominently displayed on the upper right corner of the header of every page. Page numbers must be included in the footer of every page.
- The first paragraph must include the Lead Organization's Name and Location, Principal Investigator's Name, Technical Category, Proposed Funding Requested (Federal and Cost Share), and Project Duration.

A fillable Concept Paper template is available on DOE eXCHANGE at https://exchange.energy.gov/Default.aspx?Org=ARPA-E. Concept Papers must conform to the content requirements described in the template associated with this NOFO. If applicants exceed the maximum page lengths specified for each section, or add any additional sections not requested, ARPA-E may review only the authorized number of pages and disregard any additional pages or sections.

Each Concept Paper must be limited to a single concept or technology. Unrelated concepts and technologies must not be consolidated into a single Concept Paper.

Concept Papers found to be noncompliant or nonresponsive may not be merit reviewed or considered for award (see Section II.B).

2. SECOND COMPONENT: SUMMARY SLIDE

Applicants are required to provide a single PowerPoint slide summarizing the proposed project. The slide must be submitted in Microsoft PowerPoint format and must follow the provided summary slide template associated with this NOFO available on DOE eXCHANGE. This slide will be used during ARPA-E's evaluation of Concept Papers. Summary Slides must conform to the content and format requirements described in the template.

3. THIRD COMPONENT: TECHNO-ECONOMIC ANALYSIS

Applicants are required to complete a TEA as a part of the application to quantify economic viability, project achievement of cost targets, and determine scale-up potential. The file must be submitted in Microsoft Excel format and must follow the TEA template available on DOE eXCHANGE.

4. FOURTH COMPONENT: LETTER OF COMMITMENT

Applicants are required to provide documentation of site access for the site where the proposed technology will be tested in Phase 2. This documentation should be in the form of a letter of commitment from the site operator and must be signed and on the appropriate entity's letterhead. The letter of commitment must be submitted in Adobe PDF format.

C. FULL APPLICATIONS

Full Applications must conform to the following formatting requirements:

- Each document must be submitted in the file format prescribed below and/or written in the document template at https://exchange.energy.gov/Default.aspx?Org=ARPA-E.
- The Full Application must be written in English.
- All pages must be formatted to fit on 8-1/2 by 11-inch paper with margins not less than one inch on every side. Single space all text and use Times New Roman typeface, a black font color, and a font size of 12 point or larger (except in figures and tables).
- The ARPA-E assigned Control Number, the Lead Organization Name, and the Principal Investigator's Last Name must be prominently displayed on the upper right corner of the header of every page. Page numbers must be included in the footer of every page.

Fillable Full Application template documents associated with this NOFO are available on DOE eXCHANGE at https://exchange.energy.gov/Default.aspx?Org=ARPA-E. **Applicants must refer to these template application documents and not templates associated with earlier NOFOs, which may cause the application to be deemed noncompliant.**

Applicants should name all Covered Individuals in the eXCHANGE interface when prompted and ensure consistency between eXCHANGE, the Technical Volume (III.C.1), the Business Assurances and Disclosures Form(s) (III.C.6), the Biosketches (III.C.7), and the CPS Common Forms (III.C.8).

Full Applications found in any component to be noncompliant or nonresponsive may not be merit reviewed or considered for award (see Section II.B).

ARPA-E provides detailed guidance on the content and form of each component below.

1. FIRST COMPONENT: TECHNICAL VOLUME

The Technical Volume is the centerpiece of the Full Application. The Technical Volume must be submitted in Adobe PDF format. The Technical Volume must conform to the content and form requirements included within the template, including maximum page lengths. If applicants exceed the maximum page lengths specified for each section, or add any additional sections not requested, ARPA-E may review only the authorized number of pages and disregard any additional pages or sections.

Applicants must provide sufficient citations and references to the primary research literature to justify the claims and approaches made in the Technical Volume. ARPA-E and reviewers may review primary research literature to evaluate applications. <u>However, all relevant technical information should be included in the body of the Technical Volume.</u>

2. SECOND COMPONENT: SF-424

The SF-424 must be submitted in Adobe PDF format using the available template. An instructional document is also available on DOE eXCHANGE. Applicants must complete all required fields per the instructions. Applicants may identify and include in Block 14 the entities, their addresses, and corresponding census tract numbers for any project activities that will occur within any designated Qualified Opportunity Zone (QOZ). To locate QOZs, go to: https://www.cdfifund.gov/opportunity-zones.

Recipients and subrecipients are required to complete SF-LLL (Disclosure of Lobbying Activities), also available on DOE eXCHANGE, if any non-Federal funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with your application or funding agreement. The completed SF-LLL must be appended to the SF-424.

ARPA-E provides the following supplemental guidance on completing the SF-424:

- Each project team should submit only one SF-424 (i.e., a subrecipient should not submit a separate SF-424).
- The list of certifications and assurances in Block 21 can be found at https://www.energy.gov/management/articles/certifications-and-assurances-use-sf-424.

- The dates and dollar amounts on the SF-424 are for the entire period of performance, not a portion.
- Applicants are responsible for ensuring that the proposed costs listed in eXCHANGE match those listed on forms SF-424 and the Budget Justification Workbook/SF-424A. Inconsistent submissions may affect ARPA-E's final award determination.

3. THIRD COMPONENT: BUDGET JUSTIFICATION WORKBOOK/SF-424A

Applicants are required to complete the Budget Justification Workbook/SF-424A Excel spreadsheet using the available template. Recipients must complete each tab of the Budget Justification Workbook for the project as a whole, including all work to be performed by the recipient and its subrecipients and Contractors. The SF-424A form included with the Budget Justification Workbook will "auto-populate" as the applicant enters information into the Workbook. Applicants should carefully read the "Instructions and Summary" tab provided within the Budget Justification Workbook, and all instructions at the top of each category tab.

In accordance with 2 C.F.R. § 200.332, Requirements for pass-through entities, the recipient must ensure the subrecipients' proposed costs are allowable, allocable, and reasonable.

4. FOURTH COMPONENT: SUMMARY FOR PUBLIC RELEASE

Applicants are required to provide a 250-word maximum Summary for Public Release following the instructions in the available template. The Summary for Public Release must be submitted in Adobe PDF format. For applications selected for award negotiations, the Summary may be used as the basis for a public announcement by ARPA-E; therefore, this summary should not include any confidential, proprietary, or privileged information. This summary may not include any graphics, figures, or tables. The summary should be written for a lay audience (e.g., general public, media, Congress) using plain English.

5. FIFTH COMPONENT: SUMMARY SLIDE

Applicants are required to provide a single PowerPoint slide summarizing the proposed project. The slide must be submitted in Microsoft PowerPoint format and must follow the provided summary slide template available on DOE eXCHANGE. This slide will be used during ARPA-E's evaluation of Full Applications. Summary Slides must conform to the content and format requirements described in the template.

6. SIXTH COMPONENT: BUSINESS ASSURANCES & DISCLOSURES FORM

Applicants are required to provide the information requested in the Business Assurances & Disclosures Form. The information must be submitted in Adobe PDF format and digitally signed by all required parties. The fillable Business Assurances & Disclosures Form template on

DOE eXCHANGE includes instructions for items the applicant is required to disclose, describe, or request a waiver for.

Applicants should submit separate Business Assurances & Disclosures Forms for each member of the project team. DOE eXCHANGE will allow multiple PDF documents to be submitted under the Business Assurances & Disclosures Forms file name. Any additional documents submitted under this file name will be disregarded.

7. SEVENTH COMPONENT: BIOGRAPHICAL SKETCHES (BIOSKETCH)

As part of the application, each Covered Individual at the applicant and subrecipient level must submit a biographical sketch (Biosketch). Use SciENcv (Science Experts Network Curriculum Vitae - https://www.ncbi.nlm.nih.gov/sciencv/) to produce a DOE/NNSA compliant PDF version of the Biosketch. Note that there is no page limitation for the Biosketch, though some fields in SciENcv have character limitations for consistency.

Consistent with the instructions in NSPM-33 Implementation Guidance Pre- and Post-Award Disclosures Relating to the Biographical Sketch and Current and Pending (Other) Support and the ARPA-E NOFO-Specific Biosketch Instructions below, the Biosketch and CPS Common Forms (Section III.C.8, below) must together include a list of all sponsored activities, awards, and appointments, whether

- Paid or unpaid
- Provided as a gift with terms or conditions or provided as a gift without terms or conditions
- Full-time, part-time, or voluntary
- Faculty, visiting, adjunct, or honorary
- Cash or in-kind
- Foreign or domestic
- Governmental or private-sector
- Directly supporting the individual's research or indirectly supporting the individual by supporting students, research staff, space, equipment, or other research expenses

All connections with malign foreign talent recruitment programs must be identified.

Please note the following:

- With the exception of Covered Individual, which is defined in the Glossary (Section IX), all other definitions of terms used in the Biosketch are available at: Definitions - Policies | NSF - U.S. National Science Foundation.
- If there is any conflict between the NSPM-33 Implementation Guidance and the ARPA-E NOFO-Specific Biosketch Instructions below, follow the instructions in this NOFO.

ARPA-E NOFO-SPECIFIC BIOSKETCH INSTRUCTIONS	
Persistent Identifier (PID) of the Covered Individual	The PID field is required for all ARPA-E NOFOs.
Appointments and Positions Reporting Timeframe	Identify all domestic and foreign professional appointments and positions, both inside and outside the primary organization. There should be no lapses in time over the past 10 years or since age 18, whichever period is shorter.
Products: Limitation on Number Provided	List up to 10 products most closely related to the proposed project.

8. EIGHTH COMPONENT: CURRENT, PENDING, AND PAST SUPPORT

Current and pending (other) support ("CPS Common Form") is used to identify potential duplication, overcommitment, potential conflicts of interest or commitment, and all other sources of support. As part of the application, each Covered Individual at the applicant and subrecipient levels must submit a CPS Common Form. Use SciENcv (https://www.ncbi.nlm.nih.gov/sciencv/) to produce a DOE/NNSA compliant PDF version of the CPS Common Form. Note that there is no page limitation for the CPS Common Form, though some fields in SciENcv have character limitations for consistency.

The CPS Common Form and the Biosketch must together include a list of all sponsored activities, awards, and appointments as described in Section III.C.7, above.

Please note the following:

- With the exception of Covered Individual, which is defined in the Glossary (Section IX), all other definitions of terms used in the CPS Common Form are available at: Definitions - Policies | NSF - U.S. National Science Foundation.
- If there is any conflict between the NSPM-33 Implementation Guidance and the ARPA-E NOFO-Specific CPS Instructions below, follow the instructions in this NOFO.

ARPA-E NOFO-SPECIFIC CPS INSTRUCTIONS	
Persistent Identifier (PID) of the Covered Individual	The PID field is required for all ARPA-E NOFOs.
Reporting Timeframe for Proposals, Projects, and In-Kind Contributions	In addition to **current** and **pending** support, disclosure of the **past** five years of support is required. See the "Status of Support" field of the SciENcv CPS Common Form for definitions of current, pending, and past.
Types of Proposals and Active Projects to Disclose	In addition to the guidance listed above, consulting activities must be disclosed under the proposals and active projects section of the form when any of the following scenarios apply: • The consulting activity will require the Covered Individual to perform research as part of the consulting activity

	• The consulting activity does not involve performing research, but is related to the Covered Individual's research portfolio and may have the ability to impact funding, alter time or effort commitments, or otherwise impact scientific integrity • The consulting entity has provided a contract that requires the Covered Individual to conceal or withhold confidential financial or other ties between the Covered Individual and the entity, irrespective of the duration of the engagement
Disclosure Instructions for In-Kind Travel	DOE/NNSA's in-kind disclosure requirements for the "Travel supported/paid by an external entity to attend a conference or workshop" line of the table entitled, NSPM-33 Implementation Guidance Pre- and Post-award Disclosures Relating to the Biographical Sketch and Current and Pending (Other) Support differs from NSPM-33 as follows: Disclosure is required for: • "Travel supported/paid by an external entity to attend a conference or workshop" located in a foreign country of concern (FCOC) • "Travel supported/paid by an external entity to attend a conference or workshop" when the supporting/paying external entity is located in an FCOC Disclosure is not required for: • "Travel supported/paid by an external entity to attend a conference or workshop" that is not located in an FCOC • "Travel supported/paid by an external entity to attend a conference or workshop" when the supporting/paying external entity is not located in an FCOC
Current and Pending (Other) Support Addendum	All Covered Individuals who submit a Current and Pending (Other) Support disclosure must also submit the Current and Pending (Other) Support Addendum. The Addendum is available on SciENcv at the bottom of the SciENcv Current and Pending Other Support form.

9. NINTH COMPONENT: TRANSPARENCY OF FOREIGN CONNECTIONS

Applicants must provide a Transparency of Foreign Connections disclosure and certification as it relates to the proposed project team lead and subrecipients. Applicants should submit separate Transparency of Foreign Connections disclosures for each member of the project team. The information must be submitted in Adobe PDF format and digitally signed by all

required parties. The fillable Transparency of Foreign Connections template on DOE eXCHANGE includes all required disclosures.

Disclosure exceptions by entity type:

- U.S. National Laboratories and domestic government entities are not required to respond to the Transparency of Foreign Connections disclosure.
- Institutions of higher education are only required to respond to items with an asterisk symbol (*).
- Whether disclosure requirements apply is determined by the entity type. Regardless of whether the project team lead is exempt, the subrecipients must provide these disclosures unless the subrecipient is also exempt.

DOE reserves the right to request additional or clarifying information based on the information submitted. Questions can be directed to rtesinfo@hq.doe.gov.

10. TENTH COMPONENT: IMPACTED INDIAN TRIBES DOCUMENTATION

Applicants whose projects may potentially impacts Indian Tribes must submit the documentation described in Section III.A.3 (e.g., letter of support, Tribal resolution) as a component of their Full Application. The document(s) must be submitted in Adobe PDF format.

11. ELEVENTH COMPONENT: TECHNO-ECONOMIC ANALYSIS

Applicants are required to complete a TEA as a part of the application to quantify economic viability, project achievement of cost targets, and determine scale-up potential. The file must be submitted in Microsoft Excel format and must follow the TEA template available on DOE eXCHANGE.

D. REPLIES TO REVIEWER COMMENTS

Written feedback on Full Applications is made available to applicants before the submission deadline for Replies to Reviewer Comments. Applicants have a brief opportunity to prepare a short Reply to Reviewer Comments responding to one or more comments or supplementing their Full Application. A fillable Reply to Reviewer Comments template is available on DOE eXCHANGE (https://exchange.energy.gov/Default.aspx?Org=ARPA-E).

Replies to Reviewer Comments must conform to the following requirements:

- The Reply to Reviewer Comments must be submitted in Adobe PDF format.
- The Reply to Reviewer Comments must be written in English.
- All pages must be formatted to fit on 8-1/2 by 11-inch paper with margins not less than one inch on every side. Use Times New Roman typeface, a black font color, and a font size of 12 points or larger (except in figures and tables).
- The Reply to Reviewer Comments must be a maximum of 3 pages—2 pages maximum for text, and 1 page maximum for images (e.g., graphics, charts, or other data).

- The Control Number must be prominently displayed on the upper right corner of the header of every page. Page numbers must be included in the footer of every page.

IV. SUBMISSION REQUIREMENTS AND DEADLINES

All documents, templates, and instructions required to apply to this NOFO are either linked in this document or available on DOE eXCHANGE at https://exchange.energy.gov/Default.aspx?Org=ARPA-E.

Concept Papers, Full Applications, and Replies to Reviewer Comments must be submitted through DOE eXCHANGE. ARPA-E will not review or consider applications submitted through other means (e.g., fax, hand delivery, email, postal mail).

ARPA-E expects to retain copies of all Concept Papers, Full Applications, Replies to Reviewer Comments, and other submissions. No submissions will be returned. By applying to ARPA-E for funding, applicants consent to ARPA-E's retention of their submissions.

A. UNIQUE ENTITY IDENTIFIER AND SAM REGISTRATION

Applicants must register with the System for Award Management (SAM) at www.sam.gov/SAM prior to submitting an application, at which time the system will assign (if newly registered) a Unique Entity Identifier (UEI). Applicants should commence this process as soon as possible. Registering with SAM and obtaining the UEI could take several weeks.

Recipients must:

- Maintain a current and active registration in SAM.gov at all times during which it has an active Federal award or an application or plan under consideration by a Federal awarding agency, including (if applicable) information on its immediate and highest-level owner and subsidiaries and on all predecessors that have been awarded a Federal contract or financial assistance award within the last three years
- Remain registered in SAM.gov after the initial registration
- Update their information in SAM.gov as soon as it changes
- Review their information in SAM.gov annually from the date of initial registration or subsequent updates to ensure it is current, accurate and complete
- Include their UEI in each application it submits
- Not make a subaward to any entity unless the entity has provided its UEI

Subrecipients are not required to complete a full registration in SAM.gov but must obtain a UEI.

ARPA-E may not execute a funding agreement with the recipient until it has obtained a UEI and completed SAM registration.

B. USE OF DOE EXCHANGE

To apply to this NOFO, applicants must register with DOE eXCHANGE (https://exchange.energy.gov/Registration.aspx). For detailed guidance on using DOE eXCHANGE, please refer to the "DOE eXCHANGE applicant Guide" (https://exchange.energy.gov/Manuals.aspx).

Applicants are encouraged to log in to eXCHANGE using Enhanced Identity Proofing. DOE eXCHANGE offers both Login.gov and ID.me as methods to authenticate identities. Applicants can still use the legacy Login.gov option. Please note that Login.gov and ID.me may require some users to go through a validation process that can take up to 10 days.

Upon creating an application submission in DOE eXCHANGE, applicants will be assigned a Control Number. If the applicant creates more than one application submission, a different Control Number will be assigned for each application.

Once logged in to DOE eXCHANGE (https://exchange.energy.gov/Login.aspx), applicants may access their submissions by clicking the "Submissions" and then "My Submissions" links in the navigation on the left side of the page. Every application that the applicant has submitted to ARPA-E and the corresponding Control Number is displayed on that page. If the applicant submits more than one application to a particular NOFO, a different Control Number is shown for each application.

Applicants are responsible for meeting each submission deadline in DOE eXCHANGE. **Applicants are strongly encouraged to submit their applications at least 48 hours in advance of the submission deadline.** Under normal conditions (i.e., at least 48 hours in advance of the submission deadline), applicants should allow at least 1 hour to submit a Concept Paper or Full Application. In addition, applicants should allow at least 15 minutes to submit a Reply to Reviewer Comments. Once the application is submitted in DOE eXCHANGE, applicants may revise or update their application until the expiration of the applicable deadline.

Applicants should not wait until the last minute to begin the submission process. During the final hours before the submission deadline, applicants may experience server/connection congestion that prevents them from completing the necessary steps in DOE eXCHANGE to submit their applications. **ARPA-E will not extend the submission deadline for applicants that fail to submit required information and documents due to server/connection congestion.**

C. REQUIRED DOCUMENTS CHECKLIST AND DEADLINES

The following table outlines the required documents and their submission deadlines.

SUBMISSION	COMPONENTS	OPTIONAL/ MANDATORY	NOFO SECTION	DEADLINES
Concept Paper	• Concept Paper (Adobe PDF format) o Sections 1–4 (4 pages max.) o Bibliographic References (no page limit)	Mandatory	III.B	9:30 AM ET, November 20, 2026

	○ Variables Underlying Metrics & Targets (1 page max.) • Summary Slide (1 page limit, Microsoft PowerPoint format) • Techno-Economic Analysis (Microsoft Excel format) • Letter of Commitment (Adobe PDF format)			
Full Application	• Technical Volume (Adobe PDF format): ○ Cover Page (1 page max.) ○ Executive Summary (1 page max.) ○ Sections 1–5 (20 pages max.) ○ Bibliographic References (no page limit) • Signed SF-424 (Adobe PDF format) • Budget Justification Workbook/SF-424A (Microsoft Excel format) • Summary for Public Release (250 words max., Adobe PDF format) • Summary Slide (1 slide limit, Microsoft PowerPoint format) • Completed and signed Business Assurances & Disclosures Form(s) (signed by all required parties, no page limit, Adobe PDF format) • Biosketch for each Covered Individual (Adobe PDF format, all Biosketches combined into one PDF, no page limit) • CPS Common Form for each Covered Individual (Adobe PDF format, all CPS	Mandatory	III.C	9:30 AM ET, TBD

	Common Forms combined into one PDF, no page limit) • Transparency of Foreign Connections disclosure(s) (signed by all required parties, no page limit, Adobe PDF format) • Impacted Indian Tribes documentation (no page limit, Adobe PDF format) • Techno-Economic Analysis (Microsoft Excel format)			
Reply to Reviewer Comments	• Reply to Reviewer Comments (3 page max., Adobe PDF format)	Optional	III.D	5 PM ET, TBD

D. COMPLIANCE

ARPA-E may not review or consider incomplete applications and applications received after the deadline stated in the NOFO. Such applications may be deemed noncompliant (see Section II.B). The following errors could cause an application to be deemed "incomplete" and thus noncompliant:

- Failing to comply with the form and content requirements in Section III;
- Failing to enter required information in DOE eXCHANGE
- Failing to upload required documents to DOE eXCHANGE
- Failing to click the "Submit" button in DOE eXCHANGE by the deadline stated in the NOFO
- Uploading the wrong documents or applications to DOE eXCHANGE
- Uploading the same document twice but labeling it as different documents (In the latter scenario, the applicant failed to submit a required document.)

ARPA-E urges applicants to carefully review their applications and to allow sufficient time for the submission of required information and documents.

E. SUPER INTELLIGENCE (SI) APPLICATION USE

Applicants must indicate in the project summary the extent to which, if any, generative Super Intelligence (SI) technology was used and how it was used to develop their application or proposal. Note that all submissions to the Department are subject to information and disclosure statutes and regulations, including the Freedom of Information Act, Privacy Act, and 10 C.F.R. § 1004.11. Applicants are responsible for the accuracy, authenticity, and authorship representations of their proposal submission under consideration for merit review, including content developed with the assistance of generative SI tools. The applicant is responsible for ensuring that they are fully capable of performing the work described in the application and that

the submission of the application does not and will not infringe or violate any rights of any third party or entity.

Applicants should be aware that the use of generative SI may introduce significant risks, including, but not limited to, research misconduct resulting from fabrication, falsification, or plagiarism when proposing, performing, or reviewing research, or in reporting research results. Federal regulations governing procedures for handling of research misconduct allegations concerning research supported by DOE grants, cooperative agreements, and management and operations (M&O) contracts, are specified in 10 § C.F.R. 733. Specific provisions governing research misconduct procedures for financial assistance recipients (under grants and cooperative agreements) are specified in 2 CFR § 910.132.

F. INTERGOVERNMENTAL REVIEW

This program is not subject to Executive Order 12372 (Intergovernmental Review of Federal Programs).

V. APPLICATION REVIEW INFORMATION

A. RESPONSIVENESS

1. TECHNICAL RESPONSIVENESS REVIEW

ARPA-E performs a preliminary technical review of Concept Papers and Full Applications. The following types of submissions may be deemed nonresponsive and may not be reviewed or considered:

- Submissions that fall outside the technical parameters specified in this NOFO.
- Submissions that have been submitted in response to currently issued ARPA-E NOFOs.
- Submissions that are not scientifically distinct from applications submitted in response to currently issued ARPA-E NOFOs.
- Submissions for basic research aimed solely at discovery and/or fundamental knowledge generation.
- Submissions for large-scale demonstration projects of existing technologies.
- Submissions for proposed technologies that represent incremental improvements to existing technologies.
- Submissions for proposed technologies that are not based on sound scientific principles (e.g., violates a law of thermodynamics).
- Submissions for proposed technologies that are not transformational, as described in Section I.A.
- Submissions for proposed technologies that cannot become disruptive in nature, as described in Section I.A. Technologies must be scalable such that they could be disruptive with sufficient technical progress.
- Submissions that are not distinct in scientific approach or objective from activities currently supported by or actively under consideration for funding by any other office within DOE.
- Submissions that are not distinct in scientific approach or objective from activities currently supported by or actively under consideration for funding by other government agencies or the private sector.
- Submissions that do not propose a R&D plan that allows ARPA-E to evaluate the submission under the applicable merit review criteria provided in Section V.B.
- Submissions where the proposed project does not demonstrate hypothesis-driven research articulating clear, falsifiable hypotheses with explicitly defined, measurable criteria, supported by solid experimental designs and statistical methods.
- Submissions that propose using funding for construction, alteration, maintenance, or repair of public infrastructure in the United States.

2. SUBMISSIONS SPECIFICALLY NOT OF INTEREST

Submissions that propose the following will be deemed nonresponsive and will not be merit reviewed or considered:

- Submissions proposing to fund drilling technologies/activities.

- Submissions that do not demonstrate a transformative advance in either subsurface stimulation or enhanced recovery methods, or that propose only incremental improvements across both areas.
- Submissions that lack integration between subsurface stimulation and enhanced recovery to meet program targets.
- Standalone sensing, monitoring, or numerical modeling that are not coupled with stimulation and enhanced recovery approaches to meet the program targets.
- Technologies focused on above ground recovery or surface facility optimization.
- Technologies that cannot be field-tested downhole at relevant depths and operational conditions during the project's period of performance.
- Submissions that lack a committed field trial site (as evidenced by a lack of the required letter of commitment) or do not propose to integrate the site operator into Phase 1 of the project.
- Efforts relying on cores from sites other than the proposed field test location.
- Technologies without a demonstrated proof of concept at the lab or bench scale.
- Submissions that omit any of the required performance elements pertaining to recovery, water, and cost as defined and per targets in this NOFO.

B. REVIEW CRITERIA

ARPA-E considers a mix of quantitative and qualitative criteria in determining whether to encourage the submission of a Full Application and whether to select a Full Application for award negotiations.

1. CRITERIA FOR CONCEPT PAPERS

(1) *Impact of the Proposed Technology Relative to NOFO Targets* (50%)—This criterion involves consideration of:

- The potential for a transformational and disruptive (not incremental) advancement compared with existing or emerging technologies
- Achievement of the technical performance targets defined in Section I.E for the appropriate technology Category in Section I.D
- Identification of techno-economic challenges that must be overcome for the proposed technology to be commercially relevant
- Demonstration of awareness of competing commercial and emerging technologies and identification of how the proposed concept/technology provides significant improvement over existing solutions

(2) *Overall Scientific and Technical Merit* (50%)—This criterion involves consideration of:

- The feasibility of the proposed work, as justified by appropriate background, theory, simulation, modeling, experimental data, or other sound scientific and engineering practices
- Sufficiency of technical approach to accomplish the proposed R&D objectives, including why the proposed concept is more appropriate than alternative approaches and how technical risk will be mitigated

- Clearly defined project outcomes and final deliverables
- The demonstrated capabilities of the individuals performing the project, the key capabilities of the organizations comprising the project team, the roles and responsibilities of each organization and (if applicable) previous collaborations among team members supporting the proposed project

Submissions will not be evaluated against each other because they are not submitted in accordance with a common work statement.

2. CRITERIA FOR FULL APPLICATIONS

Full Applications are evaluated based on the following criteria:

(1) *Impact of the Proposed Technology* (30%)—This criterion involves consideration of:

- The potential for a transformational and disruptive (not incremental) advancement in one or more energy-related fields
- Thorough understanding of the current state-of-the-art and presentation of an innovative technical approach to significantly improve performance over the current state-of-the-art
- Awareness of competing commercial and emerging technologies and identification of how the proposed concept/technology provides significant improvement over these other solutions
- A reasonable and effective strategy for transitioning the proposed technology from the laboratory to commercial deployment

(2) *Overall Scientific and Technical Merit* (30%)—This criterion involves consideration of:

- Whether the proposed work is unique and innovative
- Clearly defined project outcomes and final deliverables
- Substantiation that the proposed project is likely to meet or exceed the technical performance targets identified in this NOFO
- Feasibility of the proposed work based upon preliminary data or other background information and sound scientific and engineering practices and principles
- A sound technical approach, including appropriately defined technical tasks, to accomplish the proposed R&D objectives
- Management of risk, to include identifying major technical R&D risks and feasible, effective mitigation strategies

(3) *Qualifications, Experience, and Capabilities of the Proposed Project Team* (30%)—This criterion involves consideration of**:**

- Whether the PI and project team have the skill and expertise needed to successfully execute the project plan, evidenced by prior experience that demonstrates an ability to perform R&D of similar risk and complexity
- Access to the equipment and facilities necessary to accomplish the proposed R&D effort and/or a clear plan to obtain access to necessary equipment and facilities

(4) *Soundness of Management Plan* (10%)—This criterion involves consideration of:

- Plausibility of plan to manage people and resources
- Allocation of appropriate levels of effort and resources to proposed tasks
- Reasonableness of the proposed project schedule, including major milestones
- Reasonableness of the proposed budget to accomplish the proposed project

Submissions will not be evaluated against each other because they are not submitted in accordance with a common work statement.

3. CRITERIA FOR REPLIES TO REVIEWER COMMENTS

ARPA-E has not established separate criteria to evaluate Replies to Reviewer Comments. Instead, Replies to Reviewer Comments are evaluated as an extension of the Full Application.

C. PROGRAM POLICY FACTORS

In addition to the above criteria, ARPA-E may consider the following program policy factors in determining which Concept Papers to encourage to submit a Full Application and which Full Applications to select for award negotiations:

I. **ARPA-E Portfolio Balance.** Project balances ARPA-E portfolio in one or more of the following areas:
   a. Scientific and technical disciplines represented in the proposed project team
   b. Technological variety
   c. Types of organizations (e.g., small business, university) on the project team
   d. Area(s) of the country where proposed project team members are located and where project work will be performed
   e. Technical or commercialization risk
   f. Stage of technology development

II. **Relevance to ARPA-E Mission Advancement.** Project contributes to one or more of ARPA-E's key statutory goals:
   a. Reduction of U.S. dependence on foreign energy sources
   b. Stimulation of U.S. manufacturing and/or software development
   c. Reduction of energy-related emissions
   d. Increase in U.S. energy efficiency
   e. Enhancement of U.S. economic and energy security
   f. Promotion of U.S. advanced energy technologies competitiveness

III. **Synergy of Public and Private Efforts.**
   a. Avoids duplication and overlap with other publicly or privately funded projects
   b. Promotes increased coordination with nongovernmental entities for demonstration of technologies and research applications to facilitate technology transfer
   c. Shows ability to accelerate demonstration and commercialization and overcome key market barriers via industry involvement
   d. Increases unique research collaborations

IV. **U.S. Economic Benefit.**

a. The degree to which the proposed project is likely to lead to increased high-quality employment and manufacturing in the United States
b. The degree to which the proposed project will employ procurement of U.S. iron, steel, manufactured products, and construction materials

V. **The degree to which the proposed project demonstrably advances the President's policy priorities.**

VI. **Low likelihood of other sources of funding.** High technical and/or financial uncertainty that results in the non-availability of other public, private or internal funding or resources to support the project.

VII. **High Project Impact Relative to Project Cost** (including consideration of proposed indirect cost rates)**.**

VIII. **Qualified Opportunity Zone (QOZ).** Whether the entity is located in an urban and economically distressed area including a Qualified Opportunity Zone (QOZ) or the proposed project will occur in a QOZ or otherwise advance the goals of QOZ. The goals include spurring economic development and job creation in distressed communities throughout the United States. For a list or map of QOZs go to: https://www.cdfifund.gov/opportunity-zones.

D. REVIEW AND SELECTION PROCESS

1. CONCEPT PAPERS

ARPA-E performs a preliminary review of Concept Papers to determine whether they are compliant and responsive. ARPA-E makes an independent assessment of each compliant and responsive Concept Paper based on the criteria and program policy factors in Sections V.B.1 and V.C. ARPA-E considers a mix of quantitative and qualitative criteria in determining whether to encourage the submission of a Full Application.

2. FULL APPLICATIONS

ARPA-E performs a preliminary review of Full Applications to determine whether they are compliant and responsive. Full Applications found to be noncompliant or nonresponsive may not be merit reviewed or considered for award. ARPA-E makes an independent assessment of each compliant and responsive Full Application based on the criteria and program policy factors in Sections V.B.2 and V.C.

3. REPLY TO REVIEWER COMMENTS

Once ARPA-E has completed its review of Full Applications, reviewer comments on compliant and responsive Full Applications are made available to applicants via DOE eXCHANGE. ARPA-E may also provide more direct feedback at this time. Applicants may

submit an optional Reply to Reviewer Comments, which must be submitted by the deadline stated in the NOFO.

ARPA-E performs a preliminary review of Replies to determine whether they are compliant, as described in Section III.D. ARPA-E will review and consider compliant Replies only.

4. PRE-SELECTION CLARIFICATIONS AND "DOWN-SELECT" PROCESS

Once ARPA-E completes its review of Full Applications and Replies to Reviewer Comments, it may, at the Grants Officer's discretion, conduct a pre-selection clarification process and/or perform a "down-select" of Full Applications. Through the pre-selection clarification process or down-select process, ARPA-E may obtain additional information from select applicants through pre-selection meetings, webinars, videoconferences, conference calls, written correspondence, or site visits that can be used to make a final selection determination. ARPA-E will not reimburse applicants for travel and other expenses relating to pre-selection meetings or site visits, nor will these costs be eligible for reimbursement as pre-award costs.

ARPA-E may select applications for award negotiations and make awards without pre-selection meetings and site visits. Participation in a pre-selection meeting or site visit with ARPA-E does not signify that applicants have been selected for award negotiations.

5. SELECTION FOR AWARD NEGOTIATIONS

ARPA-E carefully considers all of the information obtained through the application process and makes an independent assessment of each compliant and responsive Full Application based on the criteria, risk reviews, and program policy factors in Sections V.B, V.G, and V.C. ARPA-E considers a mix of quantitative and qualitative criteria in determining whether to select an application for award negotiation.

The Selection Official may select all or part of a Full Application for award negotiations. The Selection Official may also postpone a final selection determination on one or more Full Applications until a later date, subject to availability of funds and other factors. ARPA-E will enter into award negotiations only with selected applicants.

ARPA-E expects to announce selections for negotiations in approximately April 2027 and to execute funding agreements in approximately July 2027.

E. ARPA-E REVIEWERS

By submitting an application to ARPA-E, applicants consent to ARPA-E's use of Federal employees, contractors, and experts from IHEs, nonprofits, industry, and governmental and intergovernmental entities as reviewers. ARPA-E selects reviewers based on their knowledge and understanding of the relevant field and application, their experience and skills, and their ability to provide constructive feedback on applications.

ARPA-E requires all reviewers to complete a Conflict-of-Interest Certification and Nondisclosure Agreement through which they disclose their knowledge of any actual or apparent conflicts and agree to safeguard confidential information contained in Concept Papers, Full Applications, and Replies to Reviewer Comments. In addition, ARPA-E trains its reviewers in proper evaluation techniques and procedures.

Applicants are not permitted to nominate reviewers for their applications. Applicants may contact the Grants Officer by email (ARPA-E-CO@hq.doe.gov) if they have knowledge of a potential conflict of interest or a reasonable belief that a potential conflict exists.

F. ARPA-E SUPPORT CONTRACTORS

ARPA-E utilizes contractors to assist with the evaluation of applications and project management. To avoid actual and apparent conflicts of interest, ARPA-E prohibits its support contractors from submitting or participating in the preparation of applications to ARPA-E.

By submitting an application to ARPA-E, applicants represent that they are not performing support contractor services for ARPA-E in any capacity and did not obtain the assistance of ARPA-E's support contractors to prepare the application. ARPA-E will not consider any applications that are either submitted by or prepared with the assistance of its support contractors.

G. RISK REVIEW

If selected for award negotiations, ARPA-E may evaluate the risks posed by the applicant using the criteria set forth at 2 C.F.R. §200.206(b)(2). ARPA-E may require special award terms and conditions depending on the results of the risk analysis.

Further, as DOE invests in critical infrastructure and funds critical and emerging technology areas, DOE also considers possible vectors of undue foreign influence in evaluating risk. If high risks are identified and cannot be sufficiently mitigated, DOE may elect to not fund the applicant.

ARPA-E may not make an award if ARPA-E has determined that:

- The entity submitting the proposal or application has:
    - An owner or Covered Individual that is party to a malign foreign talent recruitment program of the People's Republic of China or another foreign country of concern
    - A business entity, parent company, or subsidiary located in the People's Republic of China or another foreign country of concern
    - An owner or Covered Individual that has a foreign affiliation with a research institution located in the People's Republic of China or another foreign country of concern

      AND

- The relationships and commitments described above:
    - Interfere with the capacity for activities supported by the Federal agency to be carried out
    - Create duplication with activities supported by the Federal agency
    - Present concerns about conflicts of interest
    - Were not appropriately disclosed to the Federal agency
    - Violate Federal law or terms and conditions of the Federal agency
    - Pose a risk to national security

If high risks are identified and cannot be sufficiently mitigated, ARPA-E may elect to not fund the applicant.

H. DUE DILIGENCE REVIEW FOR RESEARCH, TECHNOLOGY AND ECONOMIC SECURITY

All applications submitted to DOE are subject to a due diligence review.

As DOE invests in critical infrastructure and funds critical and emerging technology areas, DOE considers possible threats to U.S. research, technology, and economic security from undue foreign government influence when evaluating risk. As part of the research, technology, and economic security risk review, DOE or ARPA-E may contact the applicant and/or proposed project team members for additional information to inform the review. This risk review is conducted separately from the technical merit review.

All project participants, which include Covered Individuals participating in the project, are subject to Research, Technology and Economic Security (RTES) due diligence reviews. The due diligence review of Covered Individuals includes but is not limited to the review of resumes/Biosketches, disclosures, and certifications, as required in the NOFO. DOE reserves the right to require resumes/Biosketches, disclosures, and certifications for project participants not defined as Covered Individuals. The applicant need not submit any additional information on non-Covered Individuals, unless requested by DOE. The volume and type of information collected may depend on various factors associated with the award.

Note this review is separate and distinct from DOE Order 142.3B, "Unclassified Foreign National Access Program."

In the event an RTES risk is identified, DOE may require risk mitigation measures, including but not limited to, requiring that an individual or entity not participate in the award. If significant risks are identified and cannot be sufficiently mitigated, DOE may elect to not fund the applicant.

Consistent with section 4(e) of the Presidential Memorandum on U.S. Government-Supported Research and Development National Security Policy-33 (NSPM-33), DOE may share information regarding the risks identified as part of the RTES due diligence review process or monitoring with other Federal agencies.

DOE's decision regarding a due diligence review is not appealable.

VI. AWARD NOTICES AND AWARD TYPES

A. AWARD NOTICES

Recipients should register with FedConnect to be notified when their funding agreement has been executed by the Grants Officer and to obtain a copy of the executed funding agreement. Please refer to https://www.fedconnect.net/FedConnect/ for instructions.

1. REJECTED SUBMISSIONS

Noncompliant and nonresponsive Concept Papers and Full Applications are rejected by the Grants Officer and are not merit reviewed or considered for award. The Grants Officer sends a notification email to the technical and administrative points of contact designated by the applicant in DOE eXCHANGE. The notification states why the Concept Paper or Full Application was rejected.

2. CONCEPT PAPER NOTIFICATIONS

ARPA-E promptly notifies applicants of its determination to encourage or discourage the submission of a Full Application. ARPA-E sends a notification letter by email to the technical and administrative points of contact designated by the applicant in DOE eXCHANGE. ARPA-E provides feedback in the notification letter in order to guide further development of the proposed technology.

Applicants may submit a Full Application even if they receive a notification discouraging them from doing so. By discouraging the submission of a Full Application, ARPA-E intends to convey its lack of programmatic interest in the proposed project. Such assessments do not necessarily reflect judgments on the merits of the proposed project. The purpose of the Concept Paper phase is to save applicants the considerable time and expense of preparing a Full Application that is unlikely to be selected for award negotiations.

A notification letter encouraging the submission of a Full Application does not authorize the applicant to commence performance of the project.

3. FULL APPLICATION NOTIFICATIONS

ARPA-E promptly notifies applicants of its determination to select, postpone a final decision until a later date, or not select a Full Application for award negotiation. ARPA-E sends a notification letter by email to the technical and administrative points of contact designated by the applicant in DOE eXCHANGE.

Written feedback on Full Applications is only made available to applicants in the Replies to Reviewer Comments process. ARPA-E does not offer or provide debriefings.

ARPA-E may stagger its selection determinations. As a result, some applicants may receive their notification letter before other applicants.

a. SUCCESSFUL APPLICANTS

ARPA-E has discretion to select all or part of a proposed project for negotiation of an award. A notification letter selecting a Full Application for award negotiations does not authorize the applicant to commence performance of the project. **ARPA-E selects Full Applications for award negotiations, not for award.** Applicants do not receive an award until award negotiations are complete and the Grants Officer executes the funding agreement. The notice of Federal award signed by the Grants Officer is the official document that obligates funds. ARPA-E may terminate award negotiations at any time for any reason.

Applicants must not release any information related to selection under this NOFO until an official public announcement is made by ARPA-E. Any disclosure of selection without explicit authorization from ARPA-E prior to ARPA-E's official public announcement may result in termination of award negotiations.

The Grants Officer is the only individual who can make awards on behalf of ARPA-E or obligate ARPA-E to the expenditure of public funds. A commitment or obligation by any individual other than the Grants Officer, either explicit or implied, is invalid.

ARPA-E awards may not be transferred, assigned, or assumed without the prior written consent of a Grants Officer.

b. POSTPONED SELECTION DETERMINATIONS

A notification letter postponing a final selection determination until a later date does not authorize the applicant to commence performance of the project. ARPA-E may ultimately determine to select or not select the Full Application for award negotiations.

c. UNSUCCESSFUL APPLICANTS

By not selecting a Full Application, ARPA-E intends to convey its lack of programmatic interest in the proposed project. Such assessments do not necessarily reflect judgments on the merits of the proposed project. ARPA-E hopes that unsuccessful applicants will submit innovative ideas and concepts for future NOFOs.

B. PRE-AWARD COSTS

ARPA-E will not reimburse any pre-award costs incurred by applicants before they are selected for award negotiations. Please refer to Section VI.A for guidance on award notices.

Upon selection for award negotiations, applicants may incur pre-award costs at their own risk, consistent with the requirements in 2 C.F.R. Part 200, as modified by 2 C.F.R. Part 910, and other Federal laws and regulations. All submitted budgets are subject to change and are typically reworked during award negotiations. ARPA-E is under no obligation to reimburse pre-award costs if, for any reason, the applicant does not receive an award, the award is made for a lesser

amount than the applicant expected, or if the costs incurred are not considered allowable, allocable, or reasonable.

C. RENEWAL AWARDS

At ARPA-E's sole discretion, awards resulting from this NOFO may be renewed by adding one or more budget periods, extending the period of performance of the initial award, or issuing a new award. Renewal funding is contingent on:

- Availability of funds appropriated by Congress for the purpose of this program
- Substantial progress toward meeting the objectives of the approved application
- Submittal of required reports
- Compliance with the terms and conditions of the award
- ARPA-E approval of a renewal application
- Other factors identified by the agency at the time it solicits a renewal application

D. FUNDING AGREEMENT TYPES

Through cooperative agreements, other transactions, and similar agreements, ARPA-E provides financial and other support to projects that have the potential to realize ARPA-E's statutory mission. ARPA-E does not use such agreements to acquire property or services for the direct benefit or use of the U.S. Government.

1. COOPERATIVE AGREEMENTS

ARPA-E generally uses cooperative agreements to provide financial and other support to recipients.

Cooperative agreements involve the provision of financial or other support to accomplish a public purpose of support or stimulation authorized by Federal statute. Under cooperative agreements, the Government and recipients share responsibility for the direction of the projects.

ARPA-E encourages recipients to review the model cooperative agreement, which is available at https://arpa-e.energy.gov/technologies/project-guidance.

2. FUNDING AGREEMENTS WITH FFRDCS/DOE LABS, GOGOS, AND FEDERAL INSTRUMENTALITIES

Any Federally Funded Research and Development Centers (FFRDC) involved as a member of a project team must provide the information requested in the "FFRDC Lab Authorization" and "Field Work Proposal" section of the Business Assurances & Disclosures Form, which is submitted with the applicant's Full Application.

When a FFRDC/DOE Lab (including the National Energy Technology Laboratory or NETL) is the *lead organization* for a project team, ARPA-E executes a funding agreement directly with the FFRDC/DOE Lab and a single, separate cooperative agreement with another

entity on the project team. Notwithstanding the use of multiple agreements, the FFRDC/DOE Lab is the lead organization for the entire project, including all work performed by the FFRDC/DOE Lab and the rest of the project team.

When a FFRDC/DOE Lab is a *member* of a project team, ARPA-E executes a funding agreement directly with the FFRDC/DOE Lab and a single, separate cooperative agreement with the recipient, as the lead organization for the project team. Notwithstanding the use of multiple agreements, the recipient under the cooperative agreement is the lead organization for the entire project, including all work performed by the FFRDC/DOE Lab and the rest of the project team.

Funding agreements with DOE/NNSA FFRDCs take the form of Work Authorizations issued to DOE/NNSA FFRDCs through the DOE/NNSA Field Work Proposal system for work performed under Department of Energy Management & Operation Contracts. Funding agreements with non-DOE/NNSA FFRDCs, GOGOs (including NETL), and Federal instrumentalities (e.g., Tennessee Valley Authority) will be consistent with the sponsoring agreement between the U.S. Government and the Laboratory. Any funding agreement with an FFRDC or GOGO will have similar terms and conditions as ARPA-E's model cooperative agreement (https://arpa-e.energy.gov/technologies/project-guidance/pre-award-guidance/funding-agreements).

Non-DOE GOGOs and Federal agencies may be asked to provide support to the project team members on an applicant's project through a Cooperative Research and Development Agreement (CRADA) or similar agreement.

3. OTHER TRANSACTIONS AUTHORITY

ARPA-E may use its "other transactions" authority under the America COMPETES Reauthorization Act of 2010 and DOE's other transactions authority as codified at 42 USC §7256(a) and (g) to enter into an Other Transaction Agreement (OTA) with recipients.

ARPA-E may negotiate an OTA when it determines that the use of a standard cooperative agreement, grant, or contract is not feasible or appropriate for a project.

An OTA may require a minimum cost share of 50%. See Section II.D.2.

VII. POST-AWARD REQUIREMENTS AND ADMINISTRATION

The recipient is the responsible authority regarding the settlement and satisfaction of all contractual and administrative issues, including but not limited to disputes and claims arising out of any agreement between the recipient and a FFRDC contractor. Recipients are required to flow down these requirements to their subrecipients through subawards or related agreements.

A. NATIONAL POLICY REQUIREMENTS

The following national policy requirements apply to recipients.

- If an award is made to a DOE/NNSA National Laboratory, all disputes and claims will be resolved in accordance with the terms and conditions of the DOE/NNSA National Laboratory's management and operating (M&O) contract, as applicable, in consultation between DOE and the recipient.
- If an award is made to another Federal agency or its FFRDC contractor, all disputes and claims will be resolved in accordance with the terms and conditions of the interagency agreement in consultation between DOE and the recipient.

1. NATIONAL POLICY ASSURANCES

Project teams, including recipients and subrecipients, are required to comply with the National Policy Assurances in effect on the date of award located at https://www.nsf.gov/awards/managing/rtc.jsp in accordance with 2 C.F.R. § 200.300.

2. ENVIRONMENTAL IMPACT QUESTIONNAIRE

By law, ARPA-E must evaluate the potential environmental impact of projects that it is considering for funding. In particular, ARPA-E must determine before funding a project whether the project qualifies for a categorical exclusion under 10 C.F.R. § 1021.410 or whether it requires further environmental review (i.e., an environmental assessment or an environmental impact statement).

To facilitate and expedite ARPA-E's environmental review, recipients are required to complete an Environmental Impact Questionnaire (EIQ) during award negotiations. This form is available at https://arpa-e.energy.gov/innovator-hub/FOA-resources-and-award-reporting/application-documents. Each recipient must wait to complete the EIQ until after ARPA-E has notified them that Attachment 3 Statement of Program Objectives is in final form. The completed EIQ is then due back to ARPA-E within 14 calendar days.

B. ADMINISTRATIVE REQUIREMENTS

1. COST SHARE PAYMENTS[58]

All proposed cost share contributions must be reviewed in advance by the Grants Officer and incorporated into the project budget before the expenditures are incurred.

The recipient is required to pay the "Cost Share" amount as a percentage of the total project costs in each invoice period for the duration of the period of performance. Small businesses should refer to Section II.D.3.

ARPA-E may deny reimbursement requests, in whole or in part, or modify or terminate funding agreements where recipients (or project teams) fail to comply with ARPA-E's cost share payment requirements.

2. INTELLECTUAL PROPERTY MANAGEMENT PLAN AND DATA MANAGEMENT AND SHARING PLAN

ARPA-E requires every project team to negotiate and establish an Intellectual Property Management Plan for the management and disposition of intellectual property arising from the project. The recipient must submit a completed and signed Intellectual Property Management Plan to ARPA-E within six weeks of the effective date of the ARPA-E funding agreement. All Intellectual Property Management Plans are subject to the terms and conditions of the ARPA-E funding agreement, its intellectual property provisions, and applicable Federal laws, regulations, and policies, all of which take precedence over the terms of the submitted Intellectual Property Management Plans.

ARPA-E has developed a template for Intellectual Property Management Plans (https://arpa-e.energy.gov/innovator-hub/FOA-resources-and-award-reporting/application-documents) to facilitate and expedite negotiations between project team members. ARPA-E does not mandate the use of this template. ARPA-E and DOE do not make any warranty (express or implied) or assume any liability or responsibility for the accuracy, completeness, or usefulness of the template. ARPA-E and DOE strongly encourage project teams to consult independent legal counsel before using the template.

Awardees are also required, post-award, to submit a Data Management and Sharing Plan (DMSP) that addresses how data generated in the course of the work performed under an ARPA-E award will be preserved and, as appropriate, shared publicly. If needed, updates to the DMSP, through the course of the award, must be provided to ARPA-E for review and approval. In general, a DMSP should address the requirements on the DOE Requirements and Guidance for Digital Research Data Management website: https://www.energy.gov/datamanagement/doe-requirements-and-guidance-digital-research-data-management. The recipient must submit a completed and signed DMSP and Intellectual Property Management Plan to ARPA-E within six weeks of the effective date of the ARPA-E funding agreement.

[58] Please refer to Section II.D for guidance on cost share requirements.

3. U.S. COMPETITIVENESS

A primary objective of DOE's multi-billion-dollar research, development, and demonstration investments—including ARPA-E awards—is advancement of new energy technologies, manufacturing capabilities, and supply chains for and by U.S. industry and labor. Therefore, in exchange for receiving taxpayer dollars to support an applicant's project, the applicant must agree to the following U.S. Competitiveness Provision or equivalent terms as part of an award under this NOFO.

U.S. Competitiveness

The Contractor (recipient in ARPA-E awards) agrees that any products embodying any subject invention or produced through the use of any subject invention will be manufactured substantially in the United States unless the Contractor can show to the satisfaction of DOE that it is not commercially feasible. In the event DOE agrees to foreign manufacture, there will be a requirement that the Government's support of the technology be recognized in some appropriate manner, e.g., alternative binding commitments to provide an overall net benefit to the U.S. economy. The Contractor agrees that it will not license, assign or otherwise transfer any subject invention to any entity, at any tier, unless that entity agrees to these same requirements. Should the Contractor or other such entity receiving rights in the inventions: (1) undergo a change in ownership amounting to a controlling interest, or (2) sell, assign, or otherwise transfer title or exclusive rights in the inventions, then the assignment, license, or other transfer of rights in the subject inventions is/are suspended until approved in writing by DOE. The Contractor and any successor assignee will convey to DOE, upon written request from DOE, title to any subject invention, upon a breach of this paragraph. The Contractor will include this paragraph in all subawards/contracts, regardless of tier, for experimental, developmental or research work.

A subject invention is any invention of the contractor conceived or first actually reduced to practice in the performance of work under an award. An invention is any invention or discovery which is or may be patentable. The contractor includes any awardee, recipient, sub-awardee, or subrecipient.

As noted in the U.S. Competitiveness Provision, at any time in which an entity cannot meet the requirements of the U.S. Competitiveness Provision, the entity may request a modification or waiver of the U.S. Competitiveness Provision. For example, the entity may propose modifying the language of the U.S. Competitiveness Provision in order to change the scope of the requirements or to provide more specifics on the application of the requirements for a particular technology. As another example, the entity may request that the U.S. Competitiveness Provision be waived in lieu of a net benefits statement or U.S. manufacturing plan. The statement or plan would contain specific and enforceable commitments that would be beneficial to the U.S. economy and competitiveness. Commitments could include manufacturing specific products in the United States, making a specific investment in a new or existing U.S. manufacturing facility, keeping certain activities based in the United States or supporting a certain number of jobs in the United States related to the technology. If DOE, in its sole

discretion, determines that the proposed modification or waiver promotes commercialization and provides substantial U.S. economic benefits, DOE may grant the request and, if granted, modify the award terms and conditions for the requesting entity accordingly.

The U.S. Competitiveness Provision is implemented by DOE pursuant to a Determination of Exceptional Circumstances (DEC) under the Bayh-Dole Act and DOE Patent Waivers. See Section VIII.A, "Title to Subject Inventions," of this NOFO for more information on the DEC and DOE Patent Waiver. Information and guidance on a waiver and modification request process to the U.S. Competitiveness Provision can be found in the DOE Financial Assistance Letter on this topic, available at https://www.energy.gov/management/pf-2022-09-fal-2022-01-implementation-doe-determination-exceptional-circumstances-under.

4. NONDISCLOSURE AND CONFIDENTIALITY AGREEMENTS REPRESENTATIONS

In submitting an application in response to this NOFO the applicant represents that:

(1) **It does not and will not** require its employees or contractors to sign internal nondisclosure or confidentiality agreements or statements prohibiting or otherwise restricting its employees or contractors from lawfully reporting waste, fraud, or abuse to a designated investigative or law enforcement representative of a Federal department or agency authorized to receive such information.

(2) **It does not and will not** use any Federal funds to implement or enforce any nondisclosure and/or confidentiality policy, form, or agreement it uses unless it contains the following provisions:

a. *"These provisions are consistent with and do not supersede, conflict with, or otherwise alter the employee obligations, rights, or liabilities created by existing statute or Executive order relating to (1) classified information, (2) communications to Congress, (3) the reporting to an Inspector General of a violation of any law, rule, or regulation, or mismanagement, a gross waste of funds, an abuse of authority, or a substantial and specific danger to public health or safety, or (4) any other whistleblower protection. The definitions, requirements, obligations, rights, sanctions, and liabilities created by controlling Executive orders and statutory provisions are incorporated into this agreement and are controlling."*

b. The limitation above must not contravene requirements applicable to Standard Form 312, Form 4414, or any other form issued by a Federal department or agency governing the nondisclosure of classified information.

c. Notwithstanding the provision listed in paragraph (a), a nondisclosure confidentiality policy form or agreement that is to be executed by a person connected with the conduct of an intelligence or intelligence-related activity, other than an employee or officer of the U.S. Government, may contain provisions appropriate to the particular activity for which such document is to be used. Such form or agreement must, at a

minimum, require that the person will not disclose any classified information received in the course of such activity unless specifically authorized to do so by the U.S. Government. Such nondisclosure or confidentiality forms must also make it clear that they do not bar disclosure to Congress, an authorized official of an executive agency or the Department of Justice, of information that is essential to reporting a substantial violation of law.

5. INTERIM CONFLICT OF INTEREST POLICY FOR FINANCIAL ASSISTANCE

The DOE interim Conflict of Interest Policy for Financial Assistance (COI Policy) can be found at https://www.energy.gov/management/financial-assistance-letter-no-fal-2022-02. This policy is applicable to all non-Federal entities applying for, or that receive, DOE funding by means of a financial assistance award (e.g., a grant, cooperative agreement, or technology investment agreement or similar other transaction agreement) and, through the implementation of this policy by the entity, to each Investigator who is planning to participate in, or is participating in, the project funded wholly or in part under the DOE financial assistance award. DOE's interim COI Policy establishes standards that provide a reasonable expectation that the design, conduct, and reporting of projects funded wholly or in part under DOE financial assistance awards will be free from bias resulting from financial conflicts of interest or organizational conflicts of interest. The applicant is subject to the requirements of the interim COI Policy, and within each application for financial assistance, the applicant must certify that it is, or will be by the time of receiving any financial assistance award, compliant with all requirements in the interim COI Policy. For applicants to any ARPA-E NOFO, this certification, disclosure of any managed or unmanaged conflicts of interest, and a copy of (or link to) the applicant's own conflict of interest policy must be included with the information provided in the Business Assurances & Disclosures Form. The applicant must also flow down the requirements of the interim COI Policy to any subrecipient non-Federal entities.

6. COMPLIANCE AUDIT REQUIREMENT

A recipient organized as a for-profit entity expending $1,000,000 or more of DOE funds in the entity's fiscal year (including funds expended as a subrecipient) must have an annual compliance audit performed at the completion of its fiscal year. For additional information, refer to Subpart F of: (i) 2 C.F.R. Part 200 and (ii) 2 C.F.R. Part 910.

If an IHE, nonprofit, or state/local government has expended $1,000,000 or more of Federal funds (including funds expended as a subrecipient) in the entity's fiscal year, the entity must have an annual compliance audit performed at the completion of its fiscal year. For additional information refer to Subpart F of 2 C.F.R. Part 200.

7. RESEARCH SECURITY TRAINING REQUIREMENT

Covered Individuals listed on applications under this NOFO are required to certify that they have taken research security training consistent with section 10634 of the CHIPS and Science Act of 2022. In addition, applicants who receive an award must maintain sufficient

records (records must be retained for the time period noted in 2 CFR 200.334 and made available to DOE upon request) of their compliance with this requirement for Covered Individuals at the recipient organization and they must extend this requirement to any and all subrecipients. To fulfill this requirement, an applicant may use the four one-hour training modules developed by the National Science Foundation at https://new.nsf.gov/research-security/training or develop and implement their own research security training program aligned with the requirements in section 10634(b) of the CHIPS and Science Act of 2022. The submission of an application to this NOFO constitutes the applicant's acceptance of this requirement.

8. FOREIGN COLLABORATION CONSIDERATIONS

At any point following notification that an application has been selected for award negotiations, the recipient will be required to provide ARPA-E with advanced written notification of any potential collaboration with foreign entities, organizations, or governments in connection with its ARPA-E-funded award scope. The recipient must await guidance from ARPA-E prior to contacting the proposed foreign entity, organization, or government regarding the potential collaboration or negotiating the terms of any potential collaboration agreement.

All existing collaborations with foreign entities, organizations, and governments connected with the proposed scope of work must be reported in the Foreign Entity Waiver.

Description of collaborations that should be reported:

- In general, a collaboration will involve some provision of a thing of value to, or from, the award recipient.
- A thing of value includes but may not be limited to all resources made available to, or from, the recipient in support of and/or related to the ARPA-E award, regardless of whether they have monetary value.
- Things of value also may include in-kind contributions (such as office/laboratory space, data, equipment, supplies, employees, students).
- In-kind contributions not intended for direct use on the ARPA-E award but resulting in provision of a thing of value from or to the ARPA-E award must also be reported.

Collaborations do not include routine workshops, conferences, use of the recipient's services and facilities by foreign investigators resulting from its standard published process for evaluating requests for access, or the routine use of foreign facilities by awardee staff in accordance with the recipient's standard policies and procedures.

C. REPORTING

Recipients are required to submit periodic, detailed reports on technical, financial, and other aspects of the project, as described in Attachment 4 to ARPA-E's model cooperative agreement (https://arpa-e.energy.gov/innovator-hub/FOA-resources-and-award-reporting/negotiation-documents).

1. FRAUD, WASTE, AND ABUSE

An applicant, recipient, or subrecipient must promptly disclose whenever in connection with the federal award (including any activities or subawards thereunder), it has credible evidence of the commission of a violation of Federal criminal law involving fraud, conflict of interest, bribery, or gratuity violations found in Title 18 of the U.S. Code or a violation of the civil False Claims Act (31 U.S.C. §§ 3729-3733). The disclosure must be made in writing to the Federal agency, the agency's Office of Inspector General, and pass-through entity (if applicable). Recipients and subrecipients are also required to report matters related to recipient integrity and performance in accordance with Appendix XII of this part. Failure to make required disclosures can result in any of the remedies described in 2 C.F.R. §200.339. (See also 2 C.F.R. Part 180, 31 U.S.C. § 3321, and 41 U.S.C. § 2313.)

For guidance on reporting such violations and information to the DOE Office of Inspector General (OIG), please visit https://www.energy.gov/ig/ig-hotline.

2. COMMERCIALIZATION PLAN AND SOFTWARE REPORTING

If your project is selected and it targets the development of software, you may be required to prepare a Commercialization Plan for the targeted software and agree to special provisions that require the reporting of the targeted software and its utilization. This special approach to projects that target software mirrors the requirements for reporting that attach to new inventions made in performance of an award.

VIII. OTHER INFORMATION

A. TITLE TO SUBJECT INVENTIONS

Ownership of subject inventions is governed pursuant to the authorities listed below:

- Domestic small businesses, IHEs, and nonprofits: Under the Bayh-Dole Act (35 U.S.C. § 200 et seq.), domestic small businesses, IHEs, and nonprofits may elect to retain title to their subject inventions
- All other parties: The federal Non-Nuclear Energy Act of 1974, 42. U.S.C. § 5908, provides that the government obtains title to new subject inventions unless a waiver is granted (see below):
    - Class Patent Waiver for Domestic Large Businesses: DOE has issued a class patent waiver that applies to this NOFO. Under this class patent waiver, domestic large businesses may elect title to their subject inventions similar to the right provided to the domestic small businesses, IHEs, and nonprofits by law. A domestic large business as defined by the class waiver is any for-profit organization that does not qualify as a "small business" under Small Business Administration size standards and is incorporated or otherwise formed under the laws of a particular state or territory of the United States. To avail itself of the class patent waiver, a domestic large business must agree to the U.S. Competitiveness Provision in accordance with Section VII.B.3 of this NOFO.
    - Advance and Identified Waivers: For applicants that do not fall under the class patent waiver or the Bayh-Dole Act, those applicants may request a patent waiver that will cover subject inventions that may be made under the award, in advance of or within 30 days after the effective date of the award. Even if an advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver for identified inventions, i.e., individual subject inventions that are disclosed to DOE within the time frames set forth in the award's intellectual property terms and conditions. Any patent waiver that may be granted is subject to certain terms and conditions in 10 C.F.R. Part 784.
- Determination of Exceptional Circumstance (DEC): On June 07, 2021, DOE approved a *Determination of Exceptional Circumstances Under the Bayh-Dole Act to Further Promote Domestic Manufacture of DOE Science and Energy Technologies*. In accordance with this DEC, all awards, including sub-awards, under this NOFO made to a Bayh-Dole entity (domestic small businesses and nonprofits) must include the U.S. Competitiveness Provision in accordance with Section VII.B.3 of this NOFO. A copy of the DEC may be found on the DOE website currently at https://www.energy.gov/gc/determination-exceptional-circumstances-decs. Under 37 CFR § 401.4, any Bayh-Dole entity affected by this DEC has the right to appeal it by providing written notice to DOE within 30 working days from the time it receives a copy of the determination.
- Information and guidance on a waiver and modification request process to the U.S. Competitiveness Provision can be found in the DOE Financial Assistance Letter on this topic at https://www.energy.gov/management/pf-2022-09-fal-2022-01-implementation-doe-determination-exceptional-circumstances-under.

B. GOVERNMENT RIGHTS IN SUBJECT INVENTIONS

Where recipients and subrecipients retain title to subject inventions, the U.S. Government retains certain rights.

1. GOVERNMENT USE LICENSE

The U.S. Government retains a nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the U.S. any subject invention throughout the world. This license extends to contractors doing work on behalf of the Government.

2. MARCH-IN RIGHTS

The U.S. Government retains march-in rights with respect to all subject inventions. Through "march-in rights," the Government may require a recipient or subrecipient who has elected to retain title to a subject invention (or their assignees or exclusive licensees) to grant a license for use of the invention. In addition, the Government may grant licenses for use of the subject invention when recipients, subrecipients, or their assignees and exclusive licensees refuse to do so.

The U.S. Government may exercise its march-in rights if it determines that such action is necessary under any of the four following conditions:

- The owner or licensee has not taken or is not expected to take effective steps to achieve practical application of the invention within a reasonable time
- The owner or licensee has not taken action to alleviate health or safety needs in a reasonably satisfactory manner
- The owner has not met public use requirements specified by Federal statutes in a reasonably satisfactory manner
- The U.S. manufacturing requirement has not been met

C. RIGHTS IN TECHNICAL DATA

Data rights differ based on whether data is first produced under an award or instead was developed at private expense outside the award.

- Government Rights in Background or "Limited Rights Data": Limited Rights Data is data (other than computer software) developed at private expense that embody trade secrets or are commercial or financial and confidential or privileged. The U.S. Government will not normally require delivery of technical data developed solely at private expense prior to issuance of an award, except as necessary to monitor technical progress and evaluate the potential of proposed technologies to reach specific technical and cost metrics.
- Government Rights in Technical Data First Produced Under Awards: The U.S. Government normally retains unlimited rights in technical data produced under Government financial assistance awards, including the right to distribute to the public.

Unlimited rights means the right of the Government to use, disclose, reproduce, prepare derivative works, distribute copies to the public, and perform publicly and display publicly, in any manner and for any purpose whatsoever, and to have or permit others to do so. However, under special statutory authority, certain categories of Protected Data first produced in the performance of corresponding ARPA-E awards may be protected from public disclosure for up to ten years after the data is first produced (or more, if reasonably required to reach commercialization and if approved by ARPA-E) in accordance with provisions that will be set forth in the award. Protected Data is technical data or commercial or financial data first produced in the performance of the award which, if it had been obtained from and first produced by a non-federal party, would be a trade secret or commercial or financial information that is privileged or confidential under the meaning of 5 U.S.C. 552(b)(4) and which data is marked as being protected data by a party to the award. For awards permitting Protected Data, the Protected Data must be marked as set forth in the award.

- In addition, invention disclosures may be protected from public disclosure for a reasonable time in order to allow for filing a patent application.

D. PROTECTED PERSONALLY IDENTIFIABLE INFORMATION

Applicants may not include any Protected Personally Identifiable Information (Protected PII) in their submissions to ARPA-E. Protected PII is defined as data that, if compromised, could cause harm to an individual such as identity theft. Listed below are examples of Protected PII that applicants must not include in their submissions.

- Social Security numbers in any form
- Place of birth associated with an individual
- Date of birth associated with an individual
- Mother's maiden name associated with an individual
- Biometric record associated with an individual
- Fingerprint
- Iris scan
- DNA
- Medical history information associated with an individual
- Medical conditions, including history of disease
- Metric information, e.g., weight, height, blood pressure
- Criminal history associated with an individual
- Ratings
- Disciplinary actions
- Performance elements and standards (or work expectations), when they are so intertwined with performance appraisals that their disclosure would reveal an individual's performance appraisal
- Financial information associated with an individual
- Credit card numbers
- Bank account numbers
- Security clearance history or related information (not including clearances held)

E. PRESIDENTIAL MEMORANDUM ON SIMPLIFYING FUNDING OF ENERGY INFRASTRUCTURE AND CRITICAL MINERAL AND MATERIAL PROJECTS

According to the Presidential Memorandum "Simplifying the Funding of Energy Infrastructure and Critical Mineral and Materials Projects" dated June 30, 2025, ARPA-E may share and use within the Government any application information provided by or on behalf of the applicant in response to this NOFO. Accordingly, in accordance with applicable law and notwithstanding any other provisions herein, by submitting an application or agreeing to a financial assistance arrangement with ARPA-E under this NOFO, the applicant is providing consent for any properly marked trade secret, confidential, proprietary, privileged or otherwise sensitive application information provided by or on behalf of the applicant to be disclosed to the Executive Office of the President and relevant agencies offering loans, grants, equity, guarantees or other federal funding, for the purposes outlined in the Presidential Memorandum.

IX. GLOSSARY

Applicant: The entity that submits the application to ARPA-E. In the case of a project team, the applicant is the lead organization listed on the application.

Application: The entire submission received by ARPA-E, including all components of the Concept Paper, Full Application, and Reply to Reviewer Comments.

ARPA-E: The Advanced Research Projects Agency—Energy, an agency of the U.S. DOE.

Covered Individual: an individual who (a) contributes in a substantive, meaningful way to the development or execution of the scope of work of the project, and (b) is designated as a Covered Individual by ARPA-E. ARPA-E designates as Covered Individuals any principal investigator (PI), project director (PD), co-principal investigator (Co-PI), co-project director (Co-PD), project manager, and any individual regardless of title that is functionally performing as a PI, PD, Co-PI, Co-PD, or project manager. Status as a consultant, graduate (master's or PhD) student, or postdoctoral associate does not automatically disqualify a person from being designated as a Covered Individual if they meet the definition in (a) above. The recipient is responsible for assessing the applicability of (a) against each person listed on the project (i.e., listed by the non-Federal entity in the application for Federal financial assistance, approved budget, progress report, or any other report submitted to ARPA-E by the non-Federal entity regarding the subject project). Further, the recipient is responsible for identifying any such individual to ARPA-E for designation as a Covered Individual, if not already designated by ARPA-E as described above. The recipient's submission of a current and pending support disclosure and/or Biosketch/resume for a particular person serves as an acknowledgement that ARPA-E designates that person as a Covered Individual. ARPA-E may further designate Covered Individuals during the award period of performance.

Deliverable: A deliverable is the quantifiable goods or services that will be provided upon the successful completion of a project task or subtask.

DOE: U.S. Department of Energy

DOE/NNSA: U.S. DOE/National Nuclear Security Administration.

Entity of Concern: Defined in section 10114 of Public Law 117-167 (42 USC 18912), also known as the CHIPS and Science Act, as any entity, including a national, that is:

- Identified under section 1237(b) of the Strom Thurmond National Defense Authorization Act for Fiscal Year 1999 (50 U.S.C. 1701 note; Public Law 105–261);
- Identified under section 1260H of the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 (10 U.S.C. 113 note; Public Law 116– 283);
- On the Entity List maintained by the Bureau of Industry and Security of the Department of Commerce and set forth in Supplement No. 4 to part 744 of title 15, Code of Federal Regulations;
- Included in the list required by section 9(b)(3) of the Uyghur Human Rights Policy Act of 2020 (Public Law 116–145; 134 Stat. 656); or

- Identified by the Secretary, in coordination with the Director of the Office of Intelligence and Counterintelligence and the applicable office that would provide, or is providing, covered support, as posing an unmanageable threat:
    - To the national security of the United States
    - Of theft or loss of U.S. intellectual property

FFRDCs: Federally Funded Research and Development Centers

Foreign Affiliation: A funded or unfunded academic, professional, or institutional appointment or position with a foreign government or government-owned entity, whether full-time, part-time, or voluntary (including adjunct, visiting, or honorary).

Foreign Countries of Concern: Includes the People's Republic of China, the Democratic People's Republic of Korea, the Russian Federation, the Islamic Republic of Iran, and any other country determined to be a country of concern by the Secretary of State (https://www.state.gov/countries-of-particular-concern-special-watch-list-countries-entities-of-particular-concern/)..

For-Profit Organizations (or For-Profit Entities): Entities organized for-profit that are large businesses or small businesses as those terms are defined elsewhere in this Glossary.

GOCOs: U.S. Government owned, contractor-operated laboratories.

GOGOs: U.S. Government owned, Government-operated laboratories.

Institution of Higher Education: Has the meaning set forth at 20 U.S.C. § 1001.

Large Business: Large businesses are entities organized for profit other than small businesses as defined elsewhere in this Glossary.

Malign Foreign Talent Recruitment Program: The meaning given such term in section 10638(4) of the Research and Development, Competition, and Innovation Act (division B of Public Law 117–167) or 42 U.S.C. § 19237, as of October 20, 2022.

Milestone: A milestone is the tangible, observable measurement that will be provided upon the successful completion of a project task or subtask.

Nonprofit (or "Nonprofit Organization")**:** Has the meaning set forth at 2 C.F.R. § 200.70.

PI: Principal Investigator.

Small Business: Small businesses are domestically incorporated entities that meet the criteria established by the U.S. Small Business Administration's (SBA) "Table of Small Business Size Standards Matched to North American Industry Classification System Codes" (NAICS) (http://www.sba.gov/content/small-business-size-standards).

Small Business Concern: A small business concern is a for-profit entity that: (1) maintains a place of business located in the United States; (2) operates primarily within the United States or makes a significant contribution to the U.S. economy through payment of taxes or use of American products, materials or labor; (3) is an individual proprietorship, partnership, corporation, limited liability company, joint venture, association, trust, or cooperative; and (4) meets the size eligibility requirements set forth in 13 C.F.R. § 121.702. Where the entity is formed as a joint venture, there can be no more than 49% participation by foreign business entities in the joint venture. Please refer to the U.S. SBA website for more information.

Standalone Applicant: An applicant that applies for funding on its own, not as part of a project team.

Subject Invention: Any invention conceived or first actually reduced to practice under an ARPA-E funding agreement.

Task: A task is an operation or segment of the work plan that requires both effort and resources. Each task (or subtask) is connected to the overall objective of the project, via the achievement of a milestone or a deliverable.

Total Project Cost: The sum of the recipient share and the Federal Government share of total allowable costs. The Federal Government share generally includes costs incurred by GOGOs, FFRDCs, and GOCOs.

TT&O: Technology Transfer and Outreach. (See Section I.G.8).