Department of Energy (DOE)
Office of Energy Efficiency and Renewable Energy (EERE)

"Innovative Design Concepts for Standard Modular Hydropower and Pumped-Storage Hydropower"

Funding Opportunity Announcement (FOA) Number: DE-FOA-0001836
FOA Type: Initial
CFDA Number: 81.087

FOA Issue Date:	August 8th, 2018
FOA Informational Webinar (Topic Areas 1 and 2):	September 5th, 2018
Standard Modular Hydropower Resources Webinar (Topic Area 1 Only):	September 6th, 2018
Submission Deadline for Concept Papers:	September 28th, 2018, 5:00pm ET
Submission Deadline for Full Applications:	November 30th, 2018, 5:00pm ET
Expected Submission Deadline for Replies to Reviewer Comments:	January 18th, 2019 5:00pm ET
Expected Date for EERE Selection Notifications:	March/April 2019
Expected Timeframe for Award Negotiations	May/June 2019

- Applicants must submit a Concept Paper by 5:00pm ET on the due date listed above to be eligible to submit a Full Application.

- To apply to this FOA, applicants must register with and submit application materials through EERE Exchange at https://eere-Exchange.energy.gov, EERE's online application portal.

- Applicants must designate primary and backup points-of-contact in EERE Exchange with whom EERE will communicate to conduct award negotiations. If an application is selected for award negotiations, it is not a commitment to issue an award. It is imperative that the applicant/selectee be responsive during award negotiations and meet negotiation deadlines. Failure to do so may result in cancelation of further award negotiations and rescission of the Selection.

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I. Funding Opportunity Description

Hydropower and pumped storage are key components to strengthening the American economy and energy security, and DOE's Water Power Technologies Office (WPTO) is poised to ensure that they continue to generate clean electricity and contribute to the reliability and resiliency of the U.S. electric system. WPTO is committed to lowering the cost and build time of hydropower and pumped storage systems, further increasing their ability to provide essential reliability services and contribute to the resilience of the grid, and continuing to reduce their environmental impacts and permitting timelines. Realizing this potential, however, will require deep technological and scientific innovations, from radically new designs and manufacturing techniques to significant advancements in both power system and hydrological modeling. This funding opportunity seeks to address challenges specifically related to design concepts for new Standard Modular Hydropower (SMH) systems and new use cases for pumped-storage hydropower (PSH) that can improve electricity system reliability, resilience, and economics.

A. Topic Area 1 – Facility Design Concepts for Standard Modular Hydropower Development

1. Background

Hydroelectric generation accounts for roughly 6% of United States electricity consumption, supplied by nearly 2,400 plants in 48 states with 80 Gigawatt (GW) of cumulative installed capacity. Small hydropower plants, defined broadly in this document as hydropower plants with less than 10 Megawatt (MW) of nameplate capacity, currently represent 3.8 GW of national hydropower capacity distributed across more than 1,700 plants. Small hydropower plants provide many benefits, including carbon-free electricity, stable and predictable power output, non-consumptive water use, and reliance on a renewable and self-replenishing fuel supply. Though the pace of building new projects has slowed over the past decade, significant growth opportunities remain for developing small hydropower.

A complex and uncertain aspect of new hydropower development is the balancing of project costs with the protection and preservation of important river functions and attributes. Small, low-head sites in particular are difficult to develop cost effectively and with minimal environmental impacts. This was evident in the 2016 *Hydropower Vision Report*, which used a comprehensive electric sector expansion model to predict that no

hydropower development will take place at previously undeveloped sites without innovative—even transformational—advances in technologies and designs to reduce costs and meet environmental performance objectives.[1] The *Hydropower Vision* analysis suggested that approximately 16 GW of hydropower growth at new stream-reaches could be possible with the development of technology solutions that balance efficiency, economics, and environmental sustainability.

In 2016, Oak Ridge National Laboratory (ORNL) initiated a DOE-funded multi-year research and development effort titled *Standard Modular Hydropower (SMH) Technology Acceleration* to define standardization, modularity, and environmental compatibility as three enabling principles of a low-cost, environmentally sustainable hydropower growth strategy.[2] These principles have been defined as follows:

- **Standardization:** Guidelines, rules, and specifications (i.e., standards) to maximize compatibility, acceptance, interoperability, quality, safety, and repeatability while minimizing environmental disturbance. In a hydropower context, standardization of design, review, regulation, manufacturing, operations, maintenance, and other features is intended to reduce site specificity and project costs.
- **Modularity:** The physical or virtual organization of a hydropower facility into discrete functional units, known as modules. In SMH, the entire facility is envisioned as a modular structure, with generation, passage, and foundation modules assembled to deliver energy and environmental benefits at many different sites.
- **Environmental Compatibility:** Siting and developing hydropower facilities with an understanding that streams provide valuable environmental benefits that must be preserved. SMH development must embody an understanding of how coupled stream-hydropower systems can minimize disturbances to landscape features, water quantity, connectivity, geomorphology, water quality, and biota.

Topic Area 1 of this funding opportunity seeks to stimulate innovative designs for small, low-head hydropower facilities capable of lowering the capital costs and reducing the environmental impacts of development at new stream-reaches. Building on the SMH Technology Acceleration project, DOE will use competitive awards to engage the private sector in the practical engineering application of SMH concepts. Transformational innovation is desired specifically in the site identification, conceptual, and detailed design phases of the technology development lifecycle, as outlined in Figure 1. Upon completion, the hydropower industry will have scientifically-vetted SMH facility designs that can operate at significantly lower costs with smaller environmental footprints. Development of such modular facility designs will provide a critical benchmark for the technical, economic, and environmental feasibility of transformative new technologies and structures.

[1] For more information see https://www.energy.gov/eere/water/downloads/hydropower-vision-report-full-report
[2] For more information on the SMH project visit https://hydropower.ornl.gov/smh/

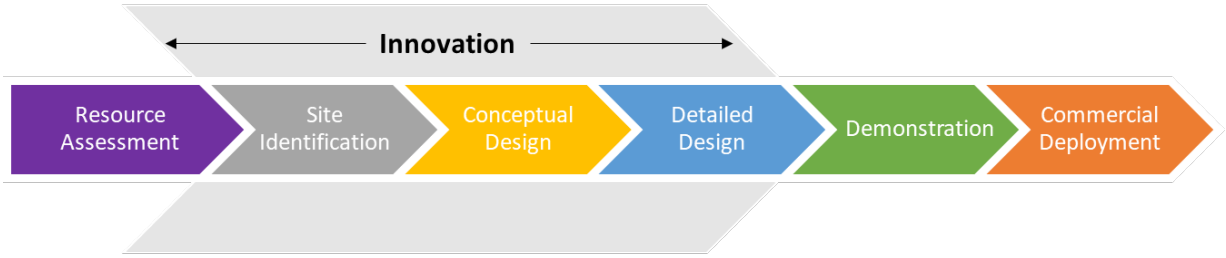

Figure 1. Topic Area 1 of this FOA seeks transformational innovation only in the phases of development identified in the box labeled 'innovation' – SMH site identification and facility design.

2. Description

For Topic Area 1, WPTO seeks applications from individuals or organizations interested in applying SMH concepts towards the development of new stream-reach (i.e., greenfield) sites. Applicants will identify a preliminary site and propose a detailed work plan to develop, validate and refine a facility design capable of generating up to 10 MW and being replicable at multiple sites. Facility designs are defined herein as the detailed engineering drawings, analytical calculations, and numerical modeling used to demonstrate the technical, environmental, and economic viability of modular hydropower facilities. Facility designs must be replicable at a minimum of three (3) sites with no major changes to design features while maintaining environmental compatibility.

The facility design must incorporate a combination of foundation, passage, and generation modules. Modules are defined as individual standardized units that can be used to construct a more complex structure. A conceptual schematic of a standard modular facility is shown in Figure 2, where the basic building blocks of the facility are individual modules that can scale across an individual site and across many sites. Applicants should incorporate existing generation and passage modular technology into their facility design, and propose innovations in the foundation module. Proposed modules should meet the following characteristics:

- Generation: Generation modules generate hydroelectric power from flowing water under pressure. Applications should incorporate generation modules into their proposed facility designs that fully contain an intake, turbine, generator, and outlet in a single pre-assembled functional unit.
- Passage: Applications should include a strategy to ensure compatibility of the proposed facility design with the target stream environment, including modules that pass fish (upstream and downstream), sediment (downstream), and recreational craft (downstream) across the facility without degrading water quality.

- Foundation: Foundation modules anchor passage and generation modules to the streambed and banks. Applicants should propose novel methods of designing and installing foundation modules using low-cost geotechnical approaches. Examples of innovative geotechnical approaches include methods that minimize dewatering during construction, avoid the use of cofferdams, and enable construction and access from a single abutment (i.e., left or right stream bank).

The balance of plant controls and electrical equipment necessary to enable successful operation of the facility operation are not a target of this FOA. Applicants are encouraged, however, to include a brief description of how scalable interconnection and control modules can interface with their facility design.

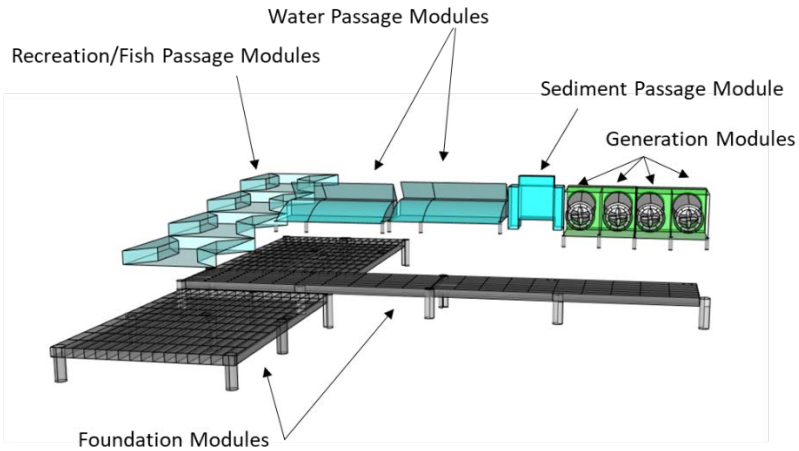

Figure 2. Conceptual schematic showing an exploded view of the primary modules of a standard modular hydropower facility design. View is from downstream to upstream.

With funding from DOE, ORNL has produced a set of guidelines and tools to help industry stakeholders apply SMH concepts in practice:

- Exemplary Design Envelope Specification (EDES) - A framework for technology-neutral conceptual design of modular hydropower technology. The EDES specifies the objectives, requirements, constraints, and performance of exemplary modules, and identifies functional relationships that must be incorporated into facility designs to minimize disruptions of the river continuum. Applicants should ensure their facility designs are consistent with the EDES principles and concepts as outlined in Chapter 2.[3]
- SMH Explorer - A geo-visual analytics platform that empowers user-guided, energy-water-environment-module data analysis and inquiries in support of SMH

[3] Full document available at https://hydropower.ornl.gov/smh/docs/ORNL-SMH-Exemplary-Design-Envelope-Specification.pdf

development. The tool can be used to establish scoping level insights into the type of foundation, generation, water quality, fish passage, recreation, and sediment modules that may be necessary should SMH development be pursued on a stream-reach.[4]

Applicants are strongly encouraged to utilize these resources in the development of their application. Once selected, awardees will work closely with ORNL to refine facility designs through the custom application of these tools and resources to their modular concepts.

At the end of the period of performance, awardees will produce a detailed conceptual design of a modular hydropower facility, including (1) individual engineering drawings of all modules, (2) engineering drawings of an assembled modular facility, (3) analytical predictions of individual and integrated module technical and environmental performance, (4) a detailed module integration and construction plan, and (5) a techno-economic analysis outlining the modeled costs and benefits of the modular facility.

Awardees will be funded to develop modular facility designs that are purely conceptual. No testing or demonstration of any modules or modular facilities will be allowed using award funds.

3. Performance Targets

WPTO is seeking facility designs that can meet the following performance targets for Topic Area 1:

- Nameplate capacity of up to 10 MW, capable of passing up to 5,000 cfs at a hydraulic head of up to 30 ft.
- Modeled installed capital cost of less than $3,500/kilowatt (kW)
- Estimated construction timeline of less than 2 years, from site preparation to commissioning
- Replicable at multiple sites in the United States
- Safe and timely passage of fish, sediment, and recreational craft
- Non-degradation of water quality
- Additional co-benefits beyond energy generation (e.g. water quality enhancement, invasive species control, hydrologic restoration, recreation opportunities, etc.)

4. Technical Assistance

WPTO has a specific objective for the research solicited herein to understand and disseminate insight into cost reduction potential and stakeholder acceptance of SMH technology. Accordingly, DOE is directly funding ORNL to provide technical assistance to

[4] SMH Explorer is available at https://hydropower.ornl.gov/smh/explorer

awardees to ensure that the following programmatic research and development activities associated with the awards are accomplished:

- Cost analyses:
  - Estimation of cost targets for development
  - Economic modeling to set initial capital costs and levelized cost of energy (LCOE) estimates
- Stakeholder engagement:
  - Facilitate stakeholder discussion and understanding of facility design innovations
  - Assessment of stakeholder acceptance of facility design innovations

The detailed tasking and phasing of this essential technical assistance will be determined during the award negotiation period. ORNL will enter into necessary and appropriate non-disclosure agreements with awardees to ensure that awardee business sensitive data are protected.

ORNL may also provide up to 1000 hours (500 hours/year) of technical assistance to each awardee. Applicants must indicate their intent and plan for using ORNL technical assistance within proposed tasks. An awardee that has requested this assistance in their application should anticipate entering into a Cooperative Research and Development Agreement (CRADA) with ORNL, with the initial and detailed collaborative work scope to be established during the award negotiation period and finalized thereafter when the CRADA is executed. This technical assistance may include the following activities:

- Site scoping and identification:
  - Accumulation of data necessary to inform facility design, including analysis of aquatic species presence, sediment dynamics, recreation passage needs, and water quality
  - Identification of environmental criteria to set engineering design criteria
  - Identification/screening of sites with similar energy, hydrologic, biologic, and environmental characteristics using ORNL's Site Classification Tool
- Design and modeling support:
  - Assist in setting specifications for foundation, fish passage, sediment passage, recreation passage, water passage, and/or generation modules
  - Support to develop analytical predictions of individual and integrated module technical and environmental performance
  - Support to develop techno-economic models that enable tradeoff assessments between design decisions

Note that ORNL staff cannot be consulted during the application phase of this Topic Area under this FOA. **DOE and ORNL will host a joint webinar on September 6. Webinar details will be posted on EERE Exchange.**

5. Information Recommended for Application

Applications should include the following details:

- Description of the reference site used to establish the initial facility design. The reference site will be used for information purposes only; it is not required that an applicant have a preliminary permit or license. The site must be located in the United States. Information related to the reference site should include, at a minimum:
  - Latitude and longitude
  - Flow duration estimate
  - Design head estimate
  - Annual energy production estimates
- Methodology for assessing environmental attributes of the reference site and identification of design targets for fish, sediment, and recreation passage.
- Detailed description of the operating principles of each generation, passage, and foundation module. If available, applications must include references of prior testing, validation, or deployment.
- Preliminary diagrams and sketches of the facility design, including:
  - Individual modules
  - All modules integrated as a facility
  - Methods for transporting, integrating and assembling modules
- Preliminary costs and discussion concerning the cost effectiveness of the proposed facility design, including assumptions used in estimating the costs for design, engineering, construction, and operation of the modular facility. Applications must make the case that the facility design can meet established cost targets at multiple sites.
- Identification and prioritization of technical assistance from ORNL.

6. Teaming Partner List

Under Topic Area 1, WPTO strongly encourages collaboration across sectors to achieve innovation in small hydropower facility designs. WPTO will compile a Teaming Partner List that can be used by technology developers, geotechnical and structural firms, and hydropower developers who can contribute innovation in any of the areas outlined (e.g. modules, novel geotechnical approaches, environmentally compatible site development) and want to find partners in other areas. The Teaming Partner List is a tool to facilitate the formation of new project teams. Participation is not a requirement of this FOA and is completely voluntary.

Any organization that would like to be included on this list should submit the following information to WPTOFOA1836@ee.doe.gov with the subject line "Teaming Partner Information": Organization Name, Contact Name, Contact Address, Contact Email, Contact Phone, Organization Type, Area of Technical Expertise, and Brief Description of

Capabilities. By submitting the above Teaming Partner Information, you consent to the publication of the above-referenced information as part of the Teaming Partner List.

The Teaming Partner List will be available on EERE Exchange at https://eere-Exchange.energy.gov under DE-FOA-0001836. The Teaming Partner List will be updated periodically until the close of the Full Application period to reflect new Teaming Partners who have provided their information. By facilitating this Teaming Partner List, EERE does not endorse or otherwise evaluate the qualifications of the entities that self-identify themselves for placement on the Teaming Partner List. EERE will not pay for the provision of any information, nor will it compensate any respondents for the development of such information.

All work under EERE funding agreements must be performed in the United States. See Section IV.J.3 and Appendix C.

B. Topic Area 2 – New Use Cases for Pumped-Storage Hydropower

1. Background

Pumped storage hydropower comprises over 95% of the electrical energy storage in the United States today. Despite its significant contribution to grid-scale storage, new pumped storage hydropower plants are not being built in the U.S. Only one new pumped storage facility has been built since 2000, despite dramatic increases in storage supportive policies in the last ten years.[5] Existing pumped storage operations are shifting to adapt to new resources, market structures, demand patterns, and pricing signals.[6] Pumped storage technology in conventional configurations and uses (e.g. multi-hundred megawatt open- and closed-loop configurations) are complex, custom-designed civil engineering projects which may entail significant regulatory, cost, schedule, and geotechnical risks.

Critical limitations to new development include:

- **Certainty on return on investment:** It is not clear how to evaluate the revenue opportunities of a large storage asset on a forward basis. Establishing investment certainty over the lifetime of the asset is particularly difficult, compounded by the unpredictability evidenced by the rapid change in the electric system. Most utility

[5] 2014 *Hydropower Market Report,* https://www.energy.gov/eere/water/downloads/2014-hydropower-market-report. US Department of Energy Global Energy Storage Database. http://www.energystorageexchange.org/

[6] Responses to *Request for Information: Expanding Hydropower and Pumped Storage's Contribution to Grid Reliability and Resiliency*, DE-FOA-0001886. February 21, 2018.

and system planning timeframes are only about 20 years. In addition, pumped storage assets, due to their large generating and storage capacity, have the potential to influence market prices as price-makers rather than price-takers, which complicates how market operators interact with and take advantage of these assets. Modeling efforts for storage have advanced, and a recently established project within the Water Power Technologies Office will focus exclusively on improving the practice of valuation for pumped storage.[7]

- **Length of time to commissioning:** The timeframe from site design to commissioning, including permitting, is over 10 years. This presents a significant competitive disadvantage to pumped storage, as the delay prevents developments from responding to a current system opportunity. The lack of certainty for return on investment is even further diminished by needing insight into long-term revenue streams beginning at least 10 years from project initiation. In comparison, provided the controls and communications are established, today's battery storage technologies can be sited and commissioned in less than a year.
- **High initial and total capital costs:** As the electricity system undergoes a transformation, grid-supporting technologies will be required. Supporting technologies on a bulk system scale with transmission-level commitments are evaluated and planned for, but rarely constructed. A portion of this challenge is structural: the significant upfront capital costs of very large supporting assets presents initiation risk and drives decisions toward incremental commitments. Over its lifetime, pumped storage assets may be very cost effective, but they still require substantial initial investment. To meaningfully drive down the total cost of pumped storage, technology and structural strategies must achieve reductions in the initial costs for project development.
- **Siting opportunity and available value streams:** The typically large scale of pumped storage technologies will push development toward large water bodies and locational coincidence of substations for interconnection opportunities. There are several other considerations to siting a pumped storage system that will affect costs and timelines, including environmental effects, scaled development, and integration with other infrastructure to access new revenues and benefits beyond traditional electricity revenues.

2. Description

To address the critical barriers mentioned above, Topic Area 2 explores new use cases for pumped storage hydropower that can improve electricity system resilience, reliability, and economics. Applicants are expected to propose innovative technology concepts, analysis, or enhanced modeling capabilities that define a new, updated role for pumped storage in the evolving electricity system in the United States.

[7] https://www.energy.gov/eere/water/articles/notice-opportunity-technical-assistance-techno-economic-studies-pumped-storage

This Topic Area is aligned with WPTO's new grid research initiative to focus investments on innovations which will optimize hydropower resources for a secure, sustainable, cost-effective, and reliable electricity system, and responds to FY18 Congressional direction to offer a competitive funding opportunity for pumped storage hydropower. This Topic Area is also consistent with DOE's Beyond Batteries initiative, which drives technology beyond cost reductions toward improved performance and enhanced provision of services to the grid.

This Topic Area also builds on a previous FY16 FOA, DE-FOA-0001455**,** which issued four awards for new pumped storage innovations that met specific technology characteristics, with the comparable goal of reducing pumped storage costs and timelines. The new emphasis in this FOA, however, is on an increase in value rather than a reduction in levelized costs.

WPTO is therefore soliciting applications for awards in two sub-topic areas:

- *Sub-topic 2.1 – Innovative conceptual designs for pumped storage systems*
- *Sub-topic 2.2 – Modeling and analyzing the role of pumped storage in asset and system optimization*

(a) Sub-topic 2.1: Innovative Conceptual Designs for Pumped Storage Systems

This sub-topic includes novel pumped storage technology concepts that can be competitive in the current and future electricity system. Analysis by DOE in the *Hydropower Vision* has shown that it may be possible to build 35 GW or more of PSH in the US by if certain cost reductions can be achieved and market conditions favor flexible generators.[8]

This FOA is targeting applications for new use-cases that address identified key barriers and suggest opportunities for successful deployment. Concepts of interest include configurations, layouts, and technical designs that can markedly reduce costs of deployment and operation (e.g., time to commissioning); expand siting opportunities through non-traditional applications; or expand the value proposition of pumped storage developments by providing additional non-electric value streams or avoided costs to other entities.

[8] See for example Figure 3-8. Capacity growth of pumped storage hydropower in select deployment scenarios, p. 266 of the *Hydropower Vision*. http://energy.gov/eere/water/articles/hydropower-vision-new-chapter-america-s-1st-renewable-electricity-source

i. Minimum Thresholds

This FOA intends to engage early-stage technology design concepts that present a significant departure from pumped storage layouts available today. To that end, minimum thresholds for project performance are intended to balance innovation with assurance that all applications are capable of delivering the essential elements of electrical storage through a water medium.

Responsive applications should:

- Identify how the conceptual design meets the minimum eligibility thresholds and if relevant, the preferred characteristics indicated in the sections below;
- Demonstrate that achieving one or more of the performance targets is possible, should the technology reach full commercialization scale;
- Propose work that will have a substantial, measurable impact to developing the conceptual design toward the performance target(s); and
- Include detailed justification to support cost estimates

***Table 1**. Minimum Thresholds*

Project Element	Minimum Threshold
Project size	Minimum 1 MW power output, preferably with scale-up capabilities.
Project service lifetime	No minimum lifetime required, as a shorter lifetime may present opportunities for substantial cost reductions. Lifetime must be estimated and justified.
Cycling capability	Capable of multiple starts and stops per day.
Overall roundtrip efficiency	Minimum 60% for each cycle.
Energy storage	Minimum 2 hours at full power output.
Hydraulic connection	Closed and open-loop technologies are eligible.

Applicants are required to demonstrate that the new technology design can meet the minimum technical specifications indicated above.

ii. Performance Targets

Responsive application will address one or more of the four critical barriers below (cost, timeline to commissioning, siting, value improvements). All applicants must respond to the capital cost barrier by providing a cost estimate, with detailed justification (including but not limited to methodology) to substantiate the proposed estimates; applicants are strongly encouraged to describe the

application's responsiveness to all relevant barriers. Proposed concept designs that would advance a performance target but that clearly require unacceptable performance qualities in other categories (e.g. extreme environmental effects) are not of interest.

- **Cost:** Estimated costs of pumped storage projects for resource planning purposes vary widely. A representative sample of utility integrated resource plans across the country utilized a range of $2,400 to $3,600/kW, with most values near $3,000/kW.[9] Modeling conducted on behalf of the WPTO indicates that for new pumped storage hydropower projects to be built, the point of breakthrough in rapid cost-competitive deployment is achieved at $1,500/kW.[10]
- **Timeline to Commissioning***:* In order to be competitive and reduce development uncertainties, the timeline from design and commitment to operational commissioning will likely need to be reduced dramatically from current levels to a timeframe less than 5 years, including permitting. A five-year outlook is the minimum timeframe required to be competitive with other technologies and meet a resource planning and procurement horizon. Reductions in the timeline to commissioning can be realized in a number of different ways, including advancements in construction techniques, standardized or modular design, or entirely new approaches that dramatically and consistently reduce commissioning timeframes.
- **Siting:** Historical Army Corps of Army Corps of Engineers studies have indicated that the technical potential for PSH in the U.S. exceeds 1,000 GW, and over 100 GW of preliminary permit applications have been submitted to the Federal Energy Regulatory Commission over the last 40 years.[11] Traditional siting opportunities are well-established and are appropriate for existing approaches to pumped storage design. New siting layouts must be a radical departure from normative approaches, unlocking new sites, scales, and potentially integration with electricity infrastructure. Examples may include reduced environmental impacts, such as minimized plant footprint, lower water utilization and access requirements; or expanded project siting options, such as utilization of existing infrastructure, very low or very high head designs. Siting advances must be replicable and not limited to highly specific circumstances or an exclusive site.
- **Value Improvements and Hybrid Approaches:** Novel applications of pumped storage technologies are helping to drive pumped storage development at

[9] Forthcoming report from PNNL, "Energy Storage in Integrated Resource Plans," 2018.
[10] Results from purpose-specific NREL Regional Energy Deployment System (ReEDS) capacity expansion model runs to illustrate PSH valuation scenarios.
[11] See 1.3.2. Pumped Storage Hydropower Development Pipeline, *2017 Hydropower Market Report*, prepared by ORNL. https://www.energy.gov/eere/water/articles/energy-department-releases-2017-hydropower-market-report

slightly smaller scales outside of the United States. In these instances, incorporation of pumping and generating capabilities into other infrastructure or other water management purposes can create new value streams, such as desalination and water delivery.[12] Novel approaches to pumped storage development within this category must represent a substantial change in traditional project design and demonstrably capture revenues, avoided costs or benefits that add up to a non-marginal percentage of the total derived project value.

Table 2: Performance Targets

Area of Focus	Performance Targets
Cost Reduction	$1,500/kW
Timeline to Commissioning	Less than five (5) years from complete project design and site selection to commissioning.
Siting	Radical departure in pumped storage siting norms that is replicable and requires research and feasibility assessments in order to mature
Value Improvements and Hybrid Approaches	Identification of project non-power value streams of substantial economic benefit or equivalent to 20% of revenues of standard pumped storage

Responsive applications must demonstrate that the relevant performance target is achievable if the proposed technology concept is developed to full commercialization, and how the work conducted under the application materially advances the project conceptual design toward the target.

WPTO intends to manage these projects as a portfolio, both in the selection process and during the period of performance. The portfolio of projects may include work being/to be performed at the National Labs and other entities.

iii. Anticipated Outcomes

At the end of the period of performance, it is expected that awardees will produce a detailed conceptual design of a pumped storage hydropower innovation. The results will be presented in the form of a report that includes engineering design, modeling, and analysis in the following areas:

- **Technical Concept Feasibility,** including analysis/results (including lab tests performed if any) demonstrating applicable improvements in the technical

[12] Ibid, p. 39.

performance attributes of the proposed storage innovation (e.g. roundtrip efficiency (RTE), system life, siting requirements, operational mode details), engineering design drawings of the conceptual design, and if relevant, system design drawings and an integration plan related to associated in-situ infrastructure.

- **Achievements toward Performance Target,** including a detailed accounting of work conducted to advance the technology, the material effect of that work in achieving progress toward the performance target, and an assessment of critical barriers to further technology development and deployment.
- **Techno-Economic Analysis***,* including a complete accounting of equipment, construction, and operations and maintenance (O&M) costs and benefits, with supporting analysis demonstrating the potential should the technology reach commercial maturity.
- **Technology Comparison,** a detailed comparison of the innovation with typical conventional pumped storage systems with details of the advantages and disadvantages/limitations of each.

(b) Sub-topic 2.2: Modeling and Analyzing the Role of Pumped Storage in Asset and System Optimization

This sub-topic will support analysis of the technical capabilities of pumped storage to improve electricity system resilience, reliability, and economic efficiency, or to improve the performance of other grid assets. For example, modeling enhancements or analysis could explore the ability of storage to support system-wide strategies to manage fast ramps or high peak loads or investigate operational connections between storage and other grid assets such as solar photovoltaic (PV) or wind energy.

Among the family of storage technologies available and pre-commercial today, pumped storage hydropower facilities have distinguishing attributes. Pumped storage is the only storage technology capable of operating at the transmission level. It is capable of generating energy over a substantial duration of time, of providing high-volume injection or absorption of electricity, and of providing a broad range of essential grid reliability services.

Constructed mostly in the 1960s and 1970s, existing pumped storage hydropower plants were originally designed and optimized for daily energy shifting – pumping water from a lower elevation reservoir to a higher elevation reservoir during low load hours and generating during high-load hours when electricity is in greatest demand – to support continuous and efficient operation of large thermal generation resources.[13]

[13] A map of distribution and scale of pumped storage resources is published in the *Hydropower Vision*, p. 185, Figure 2-41.

However, this business model is changing. Today, pumped storage hydropower plants across the country are shifting to new operational paradigms. For certain pumped storage facilities, price swings in the last five years have resulted in an inversion of the traditional pumping-generating pattern, now pumping during the day and generating at night, as evidenced by the submissions to the WPTO's DE-FOA-0001886: Expanding Hydropower and Pumper Storage's Contribution to Grid Resiliency and Reliability Request for Information. In other instances, the timescale is fundamentally different. The traditional daily cycle of high- and low-load is no longer the primary operational driver; instead pumped storage hydropower is used for peak-shaving, intra-hour reliability requirements, or ramping.

If these trends continue, certain price and demand patterns are likely to emerge, some with significant consequences for large-scale storage. Projections from a recent study anticipate higher volatility in prices, very low value energy prices, higher premiums on flexibility and capacity, and inverse pricing spreads over the course of a day to a season. These changes may ripple effects beyond traditional procurement of electricity as energy, capacity, and ancillary services. For example, system operators may increasingly utilize pumped storage facilities as part of the transmission system, to manage transmission utilization and congestion. There are outstanding questions regarding about how well storage assets are afforded access to markets, given their unique operating characteristics, and under what circumstances a storage asset can provide both generation and transmission benefits without compromising market principles.

The optimal future role of pumped storage, both existing and proposed, is still not well-understood. Pumped storage assets can provide a broad range of benefits to the grid and to other assets, but a complete perspective of all of these benefits is rarely illustrated. Typically pumped storage benefits are evaluated at a portfolio-level for a specific purpose, such as transmission planning or resource adequacy over 10-20 years, which does not capture the full operational life (50-60 years) of a pumped storage plant. Capacity and transmission expansion models do not capture many of the services that pumped storage can provide and often overlook externalities. The analytical record is particularly shallow in evaluating pumped storage benefits to other grid assets, due in part to complexity and availability of comprehensive data.[14]

In some instances, a complete perspective on value of pumped storage is limited by the lack of independent, real-world analyses that can be directly applied or used as reference cases. In others, the challenge is rooted in the current tools utilized within operations and planning practices. Models commonly employed in the electric power

[14] A pumped storage hydropower valuation literature review produced by ANL, sections 2.1.2.3 Physical Unit Impact Analysis and 2.4 Gaps Analysis.

sector may not be well adapted to effective evaluation of pumped storage solutions, especially advanced technologies that permit even greater operational flexibility.

Technology innovations for pumped storage have focused on increasing plant flexibility with variable speed pumps and ternary (hydraulic bypass) systems.[15] Proposed pumped storage developments may still be designed with fixed-speed pump design due to cost differential for the upgraded systems and uncertainty about the return on investment of utilizing the potential flexibility afforded by more innovative technologies. In addition, it is not clear whether the same technical benefits of flexibility can be achieved between pumped storage plants and other mechanisms, such as an aggregation of smaller storage solutions or market expansion and design.

Therefore, to reduce the uncertainty regarding future investments and illustrate the value of storage at the bulk scale, this FOA invites applications for analyses and modeling enhancements that would collectively advance an understanding of the capabilities of pumped storage hydropower in electric system optimization or optimization of other grid assets, inclusive of generation and transmission.

This Sub-topic is intended to recruit applications for:

(1) Analyses that would illustrate to what extent, and in which cases, pumped storage hydropower can provide one or more specific material optimization benefits to electric system performance and/or other specific grid assets, or
(2) Modeling enhancements that would make the benefits of pumped storage hydropower more visible, more effectively analyzed, or possible within existing electric system operations and planning practices.

Applications in this sub-topic should evaluate the potential for pumped storage hydropower to provide one or more specific benefits that accrue either to the system or to other assets, in particular benefits that are currently not well understood. An application must articulate its additional value to the current state of knowledge, and make explicit any linkages to benefits to other grid assets. Example linkages include transmission utilization improvements, operating in tandem within the same control footprint, or an adjustment in the merit order (generating stack) that helps other plants operate more efficiently, reduces wear and tear on other machines, uses less fuel, or reduces environmental impacts. Applications should select a real system, rather than theoretical systems and assets, at a meaningful scale. Benefits should be measurable and linked to grid properties such as resilience, reliability, sustainability, or economic efficiency. Table 3 below outlines the requirements for proposed analyses.

[15] See p. 188-189 and Table 2-7, *Hydropower Vision*.

Proposed modeling enhancements should address gaps in effective characterization of new advanced pumped storage or full utilization of pumped storage assets. Applications for modeling enhancements should use the gaps analysis provided in [Appendix E] as a guideline for focus areas with the greatest need and the greatest opportunity for impact. The proposed enhancement is not required to be open source in order to be eligible for award under this sub-topic. However, applications should strike a balance between two objectives: *impact* (that at the conclusion of the work, the enhancement will be used and useful) and *availability* (that others can access the enhancement and understand how well it works without excessive cost). Applicants must describe a licensing and dissemination strategy that will effectively strike a balance between these two objectives.

Applications for modeling enhancements should incorporate operations and planning entities that would take advantage of such enhancements as part of the project team. If the proposed work involves a new feature of an existing model under commercial license, applicants should include a demonstration of support or engagement with the owner of that model. Applicants are strongly encouraged to incorporate partners and stakeholders into the proposed work beyond a demonstration of support.

Responsive applications will:

- Identify how the analysis or modeling enhancement meets the requirements established in Table 3 below or in modeling enhancements Appendix E;
- Demonstrate that the analysis or modeling enhancement would produce an innovative result or an innovative approach within the execution of the work;
- Propose work that will have a substantial, measurable impact on advancing an understanding of the full suite of benefits of pumped storage hydropower; and
- Propose a plan to disseminate the analysis or modeling enhancement to as wide an audience as possible (e.g., publication in the open literature, licensing strategy, such as open source or commercial).

To gauge the extent to which modeling gaps are being addressed, WPTO intends to manage these projects as a portfolio, both in the selection process and during the period of performance. The portfolio of projects may include work being/to be performed at the National Labs and other entities.

Table 3: *Requirements for Proposed Analysis*

Data choice	Data should be appropriate for the work-product goals. For instance, analytical work that focuses on curtailment reduction should use load

	and variable generation forecasts and operating data that accurately capture curtailment challenges.
Project Team	Where an analysis would describe the optimization of an asset or a system, the project team should include the owner or operator of that asset or system, at minimum evidenced by a letter of support. Applicants are strongly encouraged to incorporate partners and stakeholders into the proposed work beyond a demonstration of support.
Benefits	Benefits must be measurable and linked to grid properties such as resilience, reliability, sustainability, or economic efficiency. For economic benefits, the results should clearly show the lasting value provided to all stakeholders – measured by net benefits such as lower electricity cost, efficient utilization of renewables and load, and others as applicable.
Assumptions and Definitions for Proposed Analysis	• Analyses should be representative of a real system, rather than theoretical systems and assets. • The analysis baseline should be representative of existing or expected near-term conditions (e.g., 2020 RPS-based generation mix). • Models used to represent variable generation (e.g., wind and PV solar) should be realistic in terms of generation mix as well as spatial and temporal accuracy (e.g., the variability is not over- or under-represented, plant siting does not skew the results). • The approach to generator retirement should be clearly stated (e.g., if additional generation is added to a model, is some of the existing generation retired, and if so, how were the retirement choices determined?). • The underlying generation mix assumptions for forward-looking grid representations should be clearly defined (e.g., scenario X captures 2030 RPS requirements, scenario Y increases the amount of renewable generation from the current 20% on an annual energy basis to 40%). • Where unexpected forced outages are used in the analysis or modeling efforts, the nature of the forced outage should be described (e.g., fixed in time and amplitude across scenarios or varies from scenario to scenario). • The relevant geographic region should be clearly defined along with the regions connections and reliance on surrounding systems.

	• The generation mix for the baseline and each scenario should be clearly identified by generation type (e.g., airframe-derivative, open cycle combustion turbines) and capacity. The generation mix of interconnected systems to the relevant region should also be reported. • The flexibility assumptions (e.g., ramp rate per minute as a percentage of rated capacity, minimum stable level, and start time) for each type (and size class, if applicable) of generation should be clearly stated. • The capacity reserve for the system (and each scenario or sensitivity) should be clearly stated. • Peak variable generation penetration should be reported both in terms of time of occurrence and percent of peak load. • The type of pumped storage hydropower technology should be clearly defined (synchronous, inverter-based, variable speed pumping, and so forth).

i. Work to be Conducted

At the end of the period of performance:

- *Analysis*: Awardees will produce a detailed, written technical report that describes the project team, data inputs, methodological approach, tools and models utilized, results of the analysis, dissemination plans, challenges in executing the work, and remaining gaps. All projects awardees will present publicly-sharable results in-person to WPTO and involved national laboratories at project conclusion at a summit event.
- *Modeling enhancement:* Awardees will produce a detailed written technical report that describes the modeling enhancement, its applicability and effect, dissemination and engagement, and remaining gaps. If the work is open-source, additional requirements for disposition of source code may apply. All applicants should anticipate provisions relating to Intellectual Property (IP) as part of award negotiation. All awardees will demonstrate the modeling enhancements in-person to WPTO and involved national laboratories at project conclusion.

C. Applications Specifically Not of Interest

The following types of applications will be deemed nonresponsive and will not be reviewed or considered (See Section III.D of the FOA):

Topic Area 1

- Applications for proposed technologies that are not based on sound scientific principles (e.g., violates the laws of thermodynamics).
- Applications that fall outside the technical parameters specified in the FOA, including but not limited to:
  - Applications that propose testing, demonstration, or deployment of any kind.
  - Applications for facility designs at non-powered dams, canals, conduits, or other locations with existing hydraulic infrastructure.
  - Applications for research and development of individual modules (e.g. generation)
- Applications for marine or in-river hydrokinetic technologies.

Topic Area 2

- Applications for proposed technologies that are not based on sound scientific principles (e.g., violates the laws of thermodynamics).
- Applications that fall outside the technical parameters as specified in the topic area description of the FOA, including but not limited to:
  - Applications that advance innovation that is highly site specific and not broadly applicable.
  - Applications that are related to permitting and development of a specific site.

D. Authorizing Statutes

The programmatic authorizing statute is EPACT 2005 Section 931(a)(2)(D). Awards made under this announcement will fall under the purview of 2 CFR Part 200 as amended by 2 CFR Part 910.

II. Award Information

A. Award Overview

i. Estimated Funding

EERE expects to make approximately $9,000,000 of Federal funding available for new awards under this FOA, subject to the availability of appropriated funds. EERE anticipates making up to 14 awards under this FOA. EERE may

issue one, multiple, or no awards. Individual awards may vary between $500,000 to $1,250,000.

EERE may issue awards in one, multiple, or none of the following topic areas:

Topic Area 1 – Facility Design Concepts for Standard Modular Hydropower Development: EERE expects to make approximately $2,000,000 of Federal funding available for new awards under Topic Area 1 of this FOA, subject to the availability of appropriated funds. EERE anticipates making approximately 2 awards under Topic Area 1 of this FOA. EERE may issue one, multiple, or no awards. Individual awards may vary between $700,000 and $1,000,000.

Topic Area 2 – New Use Cases for Pumped Storage Hydropower
EERE expects to make approximately $7,000,000 of Federal funding available for new awards under Topic Area 2 of this FOA, subject to the availability of appropriated funds. EERE anticipates making approximately 7-12 awards under Topic Area 2. EERE may issue one, multiple, or no awards. Under Sub-topic area 2.1, EERE anticipates 3-4 awards with an award amount of $750,000 - $1,250,000. Under Subtopic 2.2, EERE anticipates 4-8 awards with an award amount of $500,000-$1,000,000.

EERE may establish more than one budget period for each award and fund only the initial budget period(s). Funding for all budget periods, including the initial budget period, is not guaranteed. Before the expiration of the initial budget period(s), EERE may perform a down-select among different recipients and provide additional funding only to a subset of recipients.

ii. Period of Performance

Topic Area 1 – Facility Design Concepts for Standard Modular Hydropower Development
EERE anticipates making awards that will run up to 24 months in length for Topic Area 1, comprised of one or more budget periods. Project continuation will be contingent upon satisfactory performance and go/no-go decision review. At the go/no-go decision points, EERE will evaluate project performance, project schedule adherence, meeting milestone objectives, compliance with reporting requirements, and overall contribution to the program goals and objectives. As a result of this evaluation, EERE will make a determination to continue the project, re-direct the project, or discontinue funding the project.

Topic Area 2 – New Use Cases for Pumped Storage Hydropower

EERE anticipates making awards that will run up to 24 months in length for Sub-topic area 2.1 and 12-18 months in length for Sub-topic area 2.2, comprised of one or more budget periods. Project continuation will be contingent upon satisfactory performance and go/no-go decision review. At the go/no-go decision points, EERE will evaluate project performance, project schedule adherence, meeting milestone objectives, compliance with reporting requirements, and overall contribution to the program goals and objectives. As a result of this evaluation, EERE will make a determination to continue the project, re-direct the project, or discontinue funding the project.

iii. New Applications Only

EERE will accept only new applications under this FOA. EERE will not consider applications for renewals of existing EERE-funded awards through this FOA.

B. EERE Funding Agreements

Through Cooperative Agreements and other similar agreements, EERE provides financial and other support to projects that have the potential to realize the FOA objectives. EERE does not use such agreements to acquire property or services for the direct benefit or use of the United States Government.

i. Cooperative Agreements

EERE generally uses Cooperative Agreements to provide financial and other support to Prime Recipients.

Through Cooperative Agreements, EERE provides financial or other support to accomplish a public purpose of support or stimulation authorized by Federal statute. Under Cooperative Agreements, the Government and Prime Recipients share responsibility for the direction of projects.

EERE has substantial involvement in all projects funded via Cooperative Agreement. See Section VI.B.9 of the FOA for more information on what substantial involvement may involve.

ii. Funding Agreements with FFRDCs

In most cases, Federally Funded Research and Development Centers (FFRDC) are funded independently of the remainder of the Project Team. The FFRDC then executes an agreement with any non-FFRDC Project Team members to arrange work structure, project execution, and any other matters. Regardless of these arrangements, the entity that applied as the Prime Recipient for the project will remain the Prime Recipient for the project.

III. Eligibility Information

To be considered for substantive evaluation, an applicant's submission must meet the criteria set forth below. If the application does not meet these initial requirements, it will be considered non-responsive, removed from further evaluation, and ineligible for any award.

A. Eligible Applicants

i. Individuals

U.S. citizens and lawful permanent residents are eligible to apply for funding as a Prime Recipient or Subrecipient.

ii. Domestic Entities

For-profit entities, educational institutions, and nonprofits that are incorporated (or otherwise formed) under the laws of a particular State or territory of the United States are eligible to apply for funding as a Prime Recipient or Subrecipient. 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.

State, local, and tribal government entities are eligible to apply for funding as a Prime Recipient or Subrecipient.

For Topic Area 1, DOE/NNSA Federally Funded Research and Development Centers (FFRDCs), are eligible to apply for funding as a Subrecipient, but not as a Prime Recipient. ORNL is not eligible to apply for funding as a Prime Recipient or Subrecipient.

For Topic Area 2, DOE/NNSA Federally Funded Research and Development Centers (FFRDCs) are not eligible to apply for funding as a Prime Recipient or Subrecipient.

Non-DOE/NNSA FFRDCs are eligible to apply for funding as a Subrecipient, but are not eligible to apply as a Prime Recipient.

Federal agencies and instrumentalities (other than DOE) are eligible to apply for funding as a Subrecipient, but are not eligible to apply as a Prime Recipient.

iii. Foreign Entities

Foreign entities, whether for-profit or otherwise, are eligible to apply for funding under this FOA. Other than as provided in the "Individuals" or "Domestic Entities" sections above, all Prime Recipients receiving funding under this FOA must be incorporated (or otherwise formed) under the laws of a State or territory of the United States. If a foreign entity applies for funding as a Prime Recipient, it must designate in the Full Application a subsidiary or affiliate incorporated (or otherwise formed) under the laws of a State or territory of the United States to be the Prime Recipient. The Full Application must state the nature of the corporate relationship between the foreign entity and domestic subsidiary or affiliate.

Foreign entities may request a waiver of the requirement to designate a subsidiary in the United States as the Prime Recipient in the Full Application (i.e., a foreign entity may request that it remains the Prime Recipient on an award). To do so, the Applicant must submit an explicit written waiver request in the Full Application. Appendix C lists the necessary information that must be included in a request to waive this requirement. The applicant does not have the right to appeal EERE's decision concerning a waiver request.

In the waiver request, the applicant must demonstrate to the satisfaction of EERE that it would further the purposes of this FOA and is otherwise in the economic interests of the United States to have a foreign entity serve as the Prime Recipient. EERE may require additional information before considering the waiver request.

A foreign entity may receive funding as a Subrecipient.

iv. Incorporated Consortia

Incorporated consortia, which may include domestic and/or foreign entities, are eligible to apply for funding as a Prime Recipient or Subrecipient. For consortia incorporated (or otherwise formed) under the laws of a State or territory of the United States, please refer to "Domestic Entities" above. For consortia incorporated in foreign countries, please refer to the requirements in "Foreign Entities" above.

Each incorporated consortium must have an internal governance structure and a written set of internal rules. Upon request, the consortium must provide a written description of its internal governance structure and its internal rules to the EERE Contracting Officer.

v. Unincorporated Consortia

Unincorporated Consortia, which may include domestic and foreign entities, must designate one member of the consortium to serve as the Prime Recipient/consortium representative. The Prime Recipient/consortium representative must be incorporated (or otherwise formed) under the laws of a State or territory of the United States. The eligibility of the consortium will be determined by the eligibility of the Prime Recipient/consortium representative under Section III.A of the FOA.

Upon request, unincorporated consortia must provide the EERE Contracting 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 agreement binds the individual consortium members together and should discuss, among other things, 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; and
- Provisions for ownership and rights in intellectual property developed previously or under the agreement.

B. Cost Sharing

The cost share must be at least 20% of the total allowable costs for research and development projects (i.e., the sum of the Government share, including FFRDC costs if applicable, and the recipient share of allowable costs equals the total

allowable cost of the project) and must come from non-Federal sources unless otherwise allowed by law. (See 2 CFR 200.306 and 2 CFR 910.130 for the applicable cost sharing requirements.)

To assist applicants in calculating proper cost share amounts, EERE has included a cost share information sheet and sample cost share calculation as Appendices B and C to this FOA.

i. Legal Responsibility

Although the cost share requirement applies to the project as a whole, including work performed by members of the project team other than the Prime Recipient, the Prime Recipient is legally responsible for paying the entire cost share. The Prime Recipient's cost share obligation is expressed in the Assistance 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 project period, the Prime Recipient is required to contribute at least the cost share percentage of total expenditures incurred through the date of termination.

The Prime Recipient is solely responsible for managing cost share contributions by the Project Team and enforcing cost share obligation assumed by Project Team members in subawards or related agreements.

ii. Cost Share Allocation

Each Project Team is free to determine how best to allocate the cost share requirement among the team members. 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.

iii. Cost Share Types and Allowability

Every cost share contribution must be allowable under the applicable Federal cost principles, as described in Section IV.J.1 of the FOA. In addition, cost share must be verifiable upon submission of the Full Application.

Project Teams may provide cost share in the form of cash or in-kind contributions. Cost share may be provided by the Prime Recipient, Subrecipients, or third parties (entities that do not have a role in performing

the scope of work). Vendors/Contractors may not provide cost share. Any partial donation of goods or services is considered a discount and is not allowable.

Cash contributions include, but are not limited to: personnel costs, fringe costs, supply and equipment costs, indirect costs and other direct costs.

In-kind contributions are those where a value of the contribution can be readily determined, verified and justified but where no actual cash is transacted in securing the good or service comprising the contribution. Allowable in-kind contributions include, but are not limited to: the donation of volunteer time or the donation of space or use of equipment.

Project teams may use funding or property received from state or local governments to meet the cost share requirement, so long as the funding was not provided to the state or local government by the Federal Government.

The Prime Recipient may not use the following sources to meet its cost share obligations including, but not limited to:

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

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 Prime Recipient's records, and necessary and reasonable for proper and efficient accomplishment of the project. As all sources of cost share are considered part of total project cost, the cost share dollars will be scrutinized under the same Federal regulations as Federal dollars to the project. Every cost share contribution must be reviewed and approved in advance by the Contracting Officer and incorporated into the project budget before the expenditures are incurred.

Applicants are encouraged to refer to 2 CFR 200.306 as amended by 2 CFR 910.130 & 10 CFR 603.525-555 for additional guidance on cost sharing.

iv. Cost Share Contributions by FFRDCs

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 another non-Federal source.

v. Cost Share Verification

Applicants are required to provide written assurance of their proposed cost share contributions in their Full Applications.

Upon selection for award negotiations, applicants are required to provide additional information and documentation regarding their cost share contributions. Please refer to Appendix A of the FOA.

vi. Cost Share Payment

EERE requires Prime Recipients to contribute the cost share amount incrementally over the life of the award. Specifically, the Prime Recipient's cost share for each billing period must always reflect the overall cost share ratio negotiated by the parties (i.e., the total amount of cost sharing on each invoice when considered cumulatively with previous invoices must reflect, at a minimum, the cost sharing percentage negotiated). As FFRDC funding will be provided directly to the FFRDC(s) by DOE, Prime Recipients will be required to provide project cost share at a percentage commensurate with the FFRDC costs, on a budget period basis, resulting in a higher interim invoicing cost share ratio than the total award ratio.

In limited circumstances, and where it is in the government's interest, the EERE Contracting Officer may approve a request by the Prime Recipient to meet its cost share requirements on a less frequent basis, such as monthly or quarterly. Regardless of the interval requested, the Prime Recipient must be up-to-date on cost share at each interval. Such requests must be sent to the Contracting Officer during award negotiations and include the following information: (1) a detailed justification for the request; (2) a proposed schedule of payments, including amounts and dates; (3) a written commitment to meet that schedule; and (4) such evidence as necessary to

demonstrate that the Prime Recipient has complied with its cost share obligations to date. The Contracting Officer must approve all such requests before they go into effect.

C. Compliance Criteria

Concept Papers and Full Applications must meet all Compliance criteria listed below or they will be considered noncompliant. EERE will not review or consider noncompliant submissions, including Concept Papers, Full Applications, and Replies to Reviewer Comments that were: submitted through means other than EERE Exchange; submitted after the applicable deadline; and/or submitted incomplete. EERE will not extend the submission deadline for applicants that fail to submit required information due to server/connection congestion.

i. Compliance Criteria

1. ***Concept Papers***

   Concept Papers are deemed compliant if:

   - The Concept Paper complies with the content and form requirements in Section IV.C of the FOA; and
   - The applicant successfully uploaded all required documents and clicked the "Submit" button in EERE Exchange by the deadline stated in this FOA.

2. ***Full Applications***

   Full Applications are deemed compliant if:

   - The applicant submitted a compliant Concept Paper;
   - The Full Application complies with the content and form requirements in Section IV.D of the FOA; and
   - The applicant successfully uploaded all required documents and clicked the "Submit" button in EERE Exchange by the deadline stated in the FOA.

3. ***Replies to Reviewer Comments***

   Replies to Reviewer Comments are deemed compliant if:

   - The Reply to Reviewer Comments complies with the content and form requirements in Section IV.E of the FOA; and

- The applicant successfully uploaded all required documents to EERE Exchange by the deadline stated in the FOA.

D. Responsiveness Criteria

All "Applications Specifically Not of Interest," as described in Section I.C of the FOA, are deemed nonresponsive and are not reviewed or considered.

E. Other Eligibility Requirements

i. Requirements for DOE/NNSA and non-DOE/NNSA Federally Funded Research and Development Centers Included as a Subrecipient

DOE/NNSA and non-DOE/NNSA FFRDCs may be proposed as a Subrecipient on another entity's application in Topic Area 1 subject to the following guidelines:

1. **Authorization for non-DOE/NNSA FFRDCs**
   The Federal agency sponsoring the FFRDC must authorize in writing the use of the FFRDC on the proposed project and this authorization must be submitted with the application. The use of a FFRDC must be consistent with its authority under its award.

2. ***Authorization for DOE/NNSA FFRDCs***
   The cognizant Contracting Officer for the FFRDC must authorize in writing the use of the FFRDC on the proposed project and this authorization must be submitted with the application. The following wording is acceptable for this authorization:

   Authorization is granted for the [Enter Laboratory Name] Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complementary to the missions of the laboratory, and will not adversely impact execution of the DOE assigned programs at the laboratory.

3. ***Value/Funding***
   The value of and funding for the FFRDC portion of the work will not normally be included in the award to a successful applicant. Usually, DOE will fund a DOE/NNSA FFRDC contractor through the DOE Field Work

Proposal system and non-DOE/NNSA FFRDC through an interagency agreement with the sponsoring agency.

4. ***Cost Share***
   Although the FFRDC portion of the work is usually excluded from the award to a successful applicant, the applicant's cost share requirement will be based on the total cost of the project, including the applicant's and the FFRDC's portions of the project.

5. ***Responsibility***
   The Prime Recipient will be 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 Prime Recipient and the FFRDC contractor.

6. ***Limit on FFRDC Effort***

   The scope of work to be performed by the FFRDC in Topic Area 1 may not be more significant than the scope of work to be performed by the applicant.

F. Limitation on Number of Concept Papers and Full Applications Eligible for Review

Applicants may submit more than one Full Application to this FOA, provided that each application describes a unique, scientifically distinct project, and provided that an eligible Concept Paper was submitted for each Full Application.

G. Questions Regarding Eligibility

EERE will not make eligibility determinations for potential applicants prior to the date on which applications to this FOA must be submitted. The decision whether to submit an application in response to this FOA lies solely with the applicant.

IV. Application and Submission Information

A. Application Process

The application process will include two phases: a Concept Paper phase and a Full Application phase. **Only applicants who have submitted an eligible Concept Paper will be eligible to submit a Full Application**. At each phase, EERE performs an

initial eligibility review of the applicant submissions to determine whether they meet the eligibility requirements of Section III of the FOA. EERE will not review or consider submissions that do not meet the eligibility requirements of Section III. All submissions must conform to the following form and content requirements, including maximum page lengths (described below) and must be submitted via EERE Exchange at https://eere-exchange.energy.gov/, unless specifically stated otherwise. **EERE will not review or consider submissions submitted through means other than EERE Exchange, submissions submitted after the applicable deadline, and incomplete submissions**. EERE will not extend deadlines for applicants who fail to submit required information and documents due to server/connection congestion. A control number will be issued when an applicant begins the EERE Exchange application process. This control number must be included with all Application documents, as described below.

The Concept Paper, Full Application, and Reply to Reviewer Comments must conform to the following requirements:

- Each must be submitted in Adobe PDF format unless stated otherwise.
- Each must be written in English.
- All pages must be formatted to fit on 8.5 x 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 point or larger (except in figures or tables, which may be 10 point font). A symbol font may be used to insert Greek letters or special characters, but the font size requirement still applies. References must be included as footnotes or endnotes in a font size of 10 or larger. Footnotes and endnotes are counted toward the maximum page requirement.
- 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.
- Each submission must not exceed the specified maximum page limit, including cover page, charts, graphs, maps, and photographs when printed using the formatting requirements set forth above and single spaced. If applicants exceed the maximum page lengths indicated below, EERE will review only the authorized number of pages and disregard any additional pages.

Applicants are responsible for meeting each submission deadline. **Applicants are strongly encouraged to submit their Concept Papers and Full 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, Full Application, or Reply to Reviewer Comments. Once the Concept Paper, Full Application, or Reply to Reviewer Comments is submitted in EERE Exchange, applicants may revise or update that submission until the expiration of the applicable deadline. If changes are made, the applicant must resubmit the Concept Paper, Full Application, or Reply to Reviewer Comments before the applicable deadline.

EERE urges applicants to carefully review their Concept Papers, and Full Applications and to allow sufficient time for the submission of required information and documents. All Full Applications that pass the initial eligibility review will undergo comprehensive technical merit review according to the criteria identified in Section V.A of the FOA.

i. Additional Information on EERE Exchange

EERE Exchange is designed to enforce the deadlines specified in this FOA. The "Apply" and "Submit" buttons will automatically disable at the defined submission deadlines. Should applicants experience problems with EERE Exchange, the following information may be helpful.

Applicants that experience issues with submission PRIOR to the FOA deadline: In the event that an applicant experiences technical difficulties with a submission, the Application should contact the EERE Exchange helpdesk for assistance (EERE-ExchangeSupport@hq.doe.gov). The EERE Exchange helpdesk and/or the EERE Exchange system administrators will assist Applicants in resolving issues.

Applicants that experience issue with submissions that result in late submissions: In the event that an applicant experiences technical difficulties so severe that they are unable to submit their application by the deadline, the applicant should contact the EERE Exchange helpdesk for assistance (EERE-ExchangeSupport@hq.doe.gov). The EERE Exchange helpdesk and/or the EERE Exchange system administrators will assist the applicant in resolving all issues (including finalizing submission on behalf of and with the applicant's concurrence). PLEASE NOTE, however, those applicants who are unable to submit their application on time due to their waiting until the last minute when network traffic is at its heaviest to submit their materials will not be able to use this process.

B. Application Forms

The application forms and instructions are available on EERE Exchange. To access these materials, go to https://eere-Exchange.energy.gov and select the appropriate funding opportunity number.

Note: The maximum file size that can be uploaded to the EERE Exchange website is 10MB. Files in excess of 10MB cannot be uploaded, and hence cannot be submitted for review. If a file exceeds 10MB but is still within the maximum page limit specified in the FOA, it must be broken into parts and denoted to that effect. For example:
ControlNumber_LeadOrganization_Project_Part_1
ControlNumber_LeadOrganization_Project_Part_2, etc.

C. Content and Form of the Concept Paper

To be eligible to submit a Full Application, applicants must submit a Concept Paper by the specified due date and time.

i. Concept Paper Content Requirements

EERE will not review or consider ineligible Concept Papers (see Section III of the FOA).

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

The Concept Paper must conform to the following content requirements:

Section	Page Limit	Description
Cover Page	1 page maximum	The cover page should include the project title, the specific FOA Topic Area being addressed (if applicable), both the technical and business points of contact, names of all team member organizations, and any statements regarding confidentiality.
Technology Description	3 pages maximum	Applicants are required to describe succinctly: • **(Topic Area 1 Only):** Basic sketch and brief description of the proposed facility design, including its basic operating principles and how it is unique and innovative;

		• **(Topic Area 1 Only):** Description of foundation, generation, and passage modules that will be used within the modular facility; • **(Topic Area 2 Only):** The proposed work, if successfully accomplished, would materially advance the technology concept design towards the stated performance targets in **sub-topic 2.1** or the modeling and analysis requirements in **sub-topic 2.2**. • The proposed technology, including its basic operating principles and how it is unique and innovative; • The proposed technology's target level of performance (applicants should provide technical data or other support to show how the proposed target could be met); • The current state-of-the-art in the relevant field and application, including key shortcomings, limitations, and challenges; • How the proposed technology will overcome the shortcomings, limitations, and challenges in the relevant field and application; • The potential impact that the proposed project would have on the relevant field and application; • The key technical risks/issues associated with the proposed technology development plan; and • The impact that EERE funding would have on the proposed project.
Addendum	3 pages maximum	Applicants are required to describe succinctly the qualifications, experience, and capabilities of the proposed Project Team, including: • **(Topic Area 1 Only):** Whether the applicant has worked together with its teaming partners on prior projects or programs; and • Whether the Principal Investigator (PI) and Project Team have the skill and expertise needed to successfully execute the project plan; • Whether the applicant has prior experience which demonstrates an ability to perform tasks of similar risk and complexity; • Whether the applicant has adequate access to equipment and facilities necessary to accomplish the effort and/or clearly explain how it intends to obtain access to the necessary equipment and facilities. Applicants may provide graphs, charts, or other data to supplement their Technology Description.

EERE makes an independent assessment of each Concept Paper based on the criteria in Section V.A of the FOA. EERE will encourage a subset of applicants to submit Full Applications. Other applicants will be discouraged from submitting a Full Application. An applicant who receives a "discouraged" notification may still submit a Full Application. EERE will review all eligible Full Applications. However, by discouraging the submission of a Full Application, EERE intends to convey its lack of programmatic interest in the proposed project in an effort to save the applicant the time and expense of preparing an application that is unlikely to be selected for award negotiations.

EERE may include general comments provided from reviewers on an applicant's Concept Paper in the encourage/discourage notification posted on EERE Exchange at the close of that phase.

D. Content and Form of the Full Application

Applicants must submit a Full Application by the specified due date and time to be considered for funding under this FOA. Applicants must complete the following application forms found on the EERE Exchange website at https://eere-Exchange.energy.gov/, in accordance with the instructions.

Applicants will have approximately 30 days from receipt of the Concept Paper Encourage/Discourage notification on EERE Exchange to prepare and submit a Full Application. Regardless of the date the applicant receives the Encourage/Discourage notification, the submission deadline for the Full Application remains the date and time stated on the FOA cover page.

All Full Application documents must be marked with the Control Number issued to the applicant.

i. Full Application Content Requirements

EERE will not review or consider ineligible Full Applications (see Section III of the FOA).

Each Full Application shall be limited to a single concept or technology. Unrelated concepts and technologies shall not be consolidated in a single Full Application.

Full Applications must conform to the following requirements:

Submission	Components	File Name
Full Application (PDF, unless stated otherwise)	Technical Volume (See Chart in Section IV.D.2)	ControlNumber_LeadOrganization_TechnicalVolume
	Statement of Project Objectives (Microsoft Word format) (10 page limit)	ControlNumber_LeadOrganization_SOPO
	SF-424	ControlNumber_LeadOrganization_App424
	Budget Justification (EERE 335) (Microsoft Excel format. Applicants must use the template available in EERE Exchange)	ControlNumber_LeadOrganization_Budget_Justification
	Summary for Public Release (1 page limit)	ControlNumber_LeadOrganization_Summary
	Summary Slide (1 page limit, Microsoft PowerPoint format)	ControlNumber_LeadOrganization_Slide
	Subrecipient Budget Justification, if applicable (EERE 335) (Microsoft Excel format. Applicants must use the template available in EERE Exchange)	ControlNumber_LeadOrganization_Subrecipient_Budget_Justification
	Budget for FFRDC, if applicable (see below for required forms)	ControlNumber_LeadOrganization_FWP
	Authorization from cognizant Contracting Officer for FFRDC, if applicable	ControlNumber_LeadOrganization_FFRDCAuth
	SF-LLL Disclosure of Lobbying Activities	ControlNumber_LeadOrganization_SF-LLL
	Foreign Entity and Performance of Work in the United States waiver requests, if applicable	ControlNumber_LeadOrganization_Waiver
	U.S. Manufacturing Plans	ControlNumber_LeadOrganization_USMP
	Data Management Plan	ControlNumber_LeadOrganization_DMP

Note: The maximum file size that can be uploaded to the EERE Exchange website is 10MB. Files in excess of 10MB cannot be uploaded, and hence cannot be submitted for review. If a file exceeds 10MB but is still within the maximum page limit specified in the FOA it must be broken into parts and denoted to that effect. For example:

ControlNumber_LeadOrganization_TechnicalVolume_Part_1
ControlNumber_LeadOrganization_TechnicalVolume_Part_2, etc.

EERE will not accept late submissions that resulted from technical difficulties due to uploading files that exceed 10MB.

EERE provides detailed guidance on the content and form of each component below.

ii. Technical Volume

The Technical Volume must be submitted in Adobe PDF format. The Technical Volume must conform to the following content and form requirements, including maximum page lengths. If applicants exceed the maximum page lengths indicated below, EERE will review only the authorized number of pages and disregard any additional pages. This volume must address the Merit Review Criteria as discussed in Section V.A of the FOA. Save the Technical Volume in a single PDF file using the following convention for the title: "ControlNumber_LeadOrganization_TechnicalVolume".

Applicants must provide sufficient citations and references to the primary research literature to justify the claims and approaches made in the Technical Volume. However, EERE and reviewers are under no obligation to review cited sources.

The Technical Volume to the Full Application for both Topic Areas may not be more than 25 pages, including the cover page, table of contents, and all citations, charts, graphs, maps, photos, or other graphics, and must include all of the information in the table below. The applicant should consider the weighting of each of the evaluation criteria (see Section V.A of the FOA) when preparing the Technical Volume.

SECTION/PAGE LIMIT	DESCRIPTION
	The cover page should include the project title, the specific FOA Topic Area being addressed, both the technical and business points of contact, names of all team member organizations, and any statements regarding confidentiality.

Project Overview (This section should constitute approximately 10% of the Technical Volume)	The Project Overview should contain the following information: • Background: The applicant should discuss the background of their organization, including the history, successes, and current research and development status (i.e., the technical baseline) relevant to the technical topic being addressed in the Full Application. • Project Goal: The applicant should explicitly identify the targeted improvements of the proposed facility design or technology over traditional hydropower designs or the baseline technology and the critical success factors in achieving that goal. • DOE Impact: The applicant should discuss the impact that DOE funding would have on the proposed project. Applicants should specifically explain how DOE funding, relative to prior, current, or anticipated funding from other public and private sources, is necessary to achieve the project objectives.
Technical Description, Innovation, and Impact (This section should constitute approximately 30% of the Technical Volume)	The Technical Description should contain the following information: • Relevance and Outcomes: The applicant should provide a detailed description of the technology, including the scientific and other principles and objectives that will be pursued during the project. This section should describe the relevance of the proposed project to the goals and objectives of the FOA, including the potential to meet specific DOE technical targets or other relevant performance targets. The applicant should clearly specify the expected outcomes of the project. • Feasibility: The applicant should demonstrate the technical feasibility of the proposed technology and capability of achieving the anticipated performance targets, including a description of previous work done and prior results. • Innovation and Impacts: The applicant should describe the current state of the art in the applicable field, the specific innovation of the proposed technology, the advantages of proposed facility design over conventional approaches or technology over current and emerging technologies, and the overall impact on advancing the state of the art/technical baseline if the project is successful. **Topic Area 1 Applications** should also include the following information: • Description of the reference site used to establish the initial facility design. The reference site will be used for information purposes only; it is not required that an applicant have a preliminary permit or license. The site must be located in the United States. Information related to the reference site should include, at a minimum: o Latitude and longitude o Flow duration estimate o Design head estimate o Annual energy production estimates

	• Methodology for assessing environmental attributes of the reference site and identification of design targets for fish, sediment, and recreation passage. • Detailed description of the operating principles of each generation, passage, and foundation module. If available, applications must include references of prior testing, validation, or deployment. • Preliminary diagrams and sketches of the facility design, including: o Individual modules o All modules integrated as a facility o Methods for transporting, integrating and assembling modules • Preliminary costs and discussion concerning the cost effectiveness of the proposed facility design, including assumptions used in estimating the costs for design, engineering, construction, and operation of the modular facility. Applications must make the case that the facility design can meet established cost targets at multiple sites. • Identification and prioritization of technical assistance from ORNL.
Workplan and Market Transformation Plan (This section should constitute approximately 40% of the Technical Volume)	The Workplan should include a summary of the Project Objectives, Technical Scope, Work Breakdown Structure, Milestones, Go/No-Go Decision Points, and Project Schedule. A detailed Statement of Project Objectives (SOPO) is separately requested. The Workplan should contain the following information: • Project Objectives: The applicant should provide a clear and concise (high-level) statement of the goals and objectives of the project as well as the expected outcomes. • Technical Scope Summary: The applicant should provide a summary description of the overall work scope and approach to achieve the objective(s). The overall work scope is to be divided by performance periods that are separated by discrete, approximately annual decision points (see below for more information on go/no-go decision points). The applicant should describe the specific expected end result of each performance period. • Work Breakdown Structure (WBS) and Task Description Summary: The Workplan should describe the work to be accomplished and how the applicant will achieve the milestones, will accomplish the final project goal(s), and will produce all deliverables. The Workplan is to be structured with a hierarchy of performance period (approximately annual), task and subtasks, which is typical of a standard work breakdown structure (WBS) for any project. The Workplan shall contain a concise description of the specific activities to be conducted over the life of the project. The description shall be a full explanation and disclosure of the project being proposed (i.e., a statement such as “we will then complete a proprietary process” is unacceptable). It is the applicant’s responsibility to prepare an adequately detailed task plan to describe the proposed project and the plan for addressing the

	objectives of this FOA. The summary provided should be consistent with the SOPO. The SOPO will contain a more detailed description of the WBS and tasks. • Milestone Summary: The applicant should provide a summary of appropriate milestones throughout the project to demonstrate success. A milestone may be either a progress measure (which can be activity based) or a SMART technical milestone. SMART milestones should be **S**pecific, **M**easurable, **A**chievable, **R**elevant, and **T**imely, and must demonstrate a technical achievement rather than simply completing a task. Unless otherwise specified in the FOA, the minimum requirement is that each project must have at least one milestone per quarter for the duration of the project with at least one SMART technical milestone per year (depending on the project, more milestones may be necessary to comprehensively demonstrate progress). The applicant should also provide the means by which the milestone will be verified. The summary provided should be consistent with the Milestone Summary Table in the SOPO. • Go/No-Go Decision Points: The applicant should provide a summary of project-wide go/no-go decision points at appropriate points in the Workplan. A go/no-go decision point is a risk management tool and a project management best practice to ensure that, for the current phase or period of performance, technical success is definitively achieved and potential for success in future phases or periods of performance is evaluated, prior to actually beginning the execution of future phases. Unless otherwise specified in the FOA, the minimum requirement is that each project must have at least one project-wide go/no-go decision point for each budget period (12 to 18-month period) of the project. The Applicant should also provide the specific technical criteria to be used to make the go/no-go decision. The summary provided should be consistent with the SOPO. Go/no-go decision points are considered "SMART" and can fulfill the requirement for an annual SMART milestone. • End of Project Goal: The applicant should provide a summary of the end of project goal(s). Unless otherwise specified in the FOA, the minimum requirement is that each project must have one SMART end of project goal. The summary provided should be consistent with the SOPO. • Project Schedule (Gantt Chart or similar): The applicant should provide a schedule for the entire project, including task and subtask durations, milestones, and go/no-go decision points. • Project Management: The applicant should discuss the team's proposed management plan, including the following: o The overall approach to and organization for managing the work o The roles of each Project Team member

	○ Any critical handoffs/interdependencies among Project Team members ○ The technical and management aspects of the management plan, including systems and practices, such as financial and project management practices ○ The approach to project risk management ○ A description of how project changes will be handled ○ If applicable, the approach to Quality Assurance/Control ○ How communications will be maintained among Project Team members • Market Transformation Plan: The applicant should provide a market transformation plan, including the following: ○ Identification of target market, competitors, and if applicable distribution channels for proposed technology ○ Known or perceived barriers to market penetration, including a mitigation plan ○ Identification of commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, U.S. manufacturing plan etc., and product distribution.
Technical Qualifications and Resources (Approximately 20% of the Technical Volume)	The Technical Qualifications and Resources should contain the following information: • Describe the Project Team's unique qualifications and expertise, including those of key Subrecipients. • Describe the Project Team's existing equipment and facilities that will facilitate the successful completion of the proposed project; include a justification of any new equipment or facilities requested as part of the project. • This section should also include relevant, previous work efforts, demonstrated innovations, and how these enable the applicant to achieve the project objectives. • Describe the time commitment of the key team members to support the project. • Attach one-page resumes for key participating team members as an appendix. Resumes do not count towards the page limit. Multi-page resumes are not allowed. • Describe the technical services to be provided by DOE/NNSA FFRDCs, if applicable. • Attach letters of commitment from all Subrecipient/third party cost share providers as an appendix. Letters of commitment do not count towards the page limit. • Attach any letters of commitment from partners/end users as an appendix (1 page maximum per letter). Letters of commitment do not count towards the page limit.

	• For multi-organizational or multi-investigator projects, describe succinctly: o The roles and the work to be performed by each PI and Key Participant; o Business agreements between the applicant and each PI and Key Participant; o How the various efforts will be integrated and managed; o Process for making decisions on scientific/technical direction; o Publication arrangements; o Intellectual Property issues; and o Communication plans

iii. Statement of Project Objectives

Applicants are required to complete a Statement of Project Objectives (SOPO). A SOPO template is available on EERE Exchange at https://eere-Exchange.energy.gov/. The SOPO, including the Milestone Table, must not exceed 10 pages when printed using standard 8.5 x 11 paper with 1" margins (top, bottom, left, and right) with font not smaller than 12 point. Save the SOPO in a single Microsoft Word file using the following convention for the title "ControlNumber_LeadOrganization_SOPO".

iv. SF-424: Application for Federal Assistance

Complete all required fields in accordance with the instructions on the form. The list of certifications and assurances in Field 21 can be found at http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms, under Certifications and Assurances. Note: The dates and dollar amounts on the SF-424 are for the complete project period and not just the first project year, first phase or other subset of the project period. Save the SF-424 in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_App424".

v. Budget Justification Workbook (EERE 335)

Applicants are required to complete the Budget Justification Workbook. This form is available on EERE Exchange at https://eere-Exchange.energy.gov/. Prime Recipients must complete each tab of the Budget Justification Workbook for the project as a whole, including all work to be performed by the Prime Recipient and its Subrecipients and Contractors). Applicants should

include costs associated with required annual audits and incurred cost proposals in their proposed budget documents. The "Instructions and Summary" included with the Budget Justification Workbook will auto-populate as the applicant enters information into the Workbook. Applicants must carefully read the "Instructions and Summary" tab provided within the Budget Justification Workbook. Save the Budget Justification Workbook in a single Microsoft Excel file using the following convention for the title "ControlNumber_LeadOrganization_Budget_Justification".

vi. Summary/Abstract for Public Release

Applicants are required to submit a one-page summary/abstract of their project. The project summary/abstract must contain a summary of the proposed activity suitable for dissemination to the public. It should be a self-contained document that identifies the name of the applicant, the project director/principal investigator(s), the project title, the objectives of the project, a description of the project, including methods to be employed, the potential impact of the project (e.g., benefits, outcomes), and major participants (for collaborative projects). This document must not include any proprietary or sensitive business information as DOE may make it available to the public after selections are made. The project summary must not exceed 1 page when printed using standard 8.5 x 11 paper with 1" margins (top, bottom, left, and right) with font not smaller than 12 point. Save the Summary for Public Release in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Summary".

vii. Summary Slide

Applicants are required to provide a single PowerPoint slide summarizing the proposed project. The slide must be submitted in Microsoft PowerPoint format. This slide is used during the evaluation process. Save the Summary Slide in a single file using the following convention for the title "ControlNumber_LeadOrganization_Slide".

The Summary Slide template requires the following information:

- A technology Summary;
- A description of the technology's impact;
- Proposed project goals;
- Any key graphics (illustrations, charts and/or tables);
- The project's key idea/takeaway;

- Project title, Prime Recipient, Principal Investigator, and Key Participant information; and
- Requested EERE funds and proposed applicant cost share.

viii. Subrecipient Budget Justification (EERE 335) (if applicable)

Applicants must provide a separate budget justification, EERE 335 (i.e., budget justification for each budget year and a cumulative budget) for each subrecipient that is expected to perform work estimated to be more than $250,000 or 25 percent of the total work effort (whichever is less). The budget justification must include the same justification information described in the "Budget Justification" section above. Save each subrecipient budget justification in a Microsoft Excel file using the following convention for the title "ControlNumber_LeadOrganization_Subrecipient_Budget_Justification".

ix. Budget for DOE/NNSA FFRDC (if applicable)

If a DOE/NNSA FFRDC contractor is to perform a portion of the work, the applicant must provide a DOE Field Work Proposal (FWP) in accordance with the requirements in DOE Order 412.1, Work Authorization System. DOE Order 412.1 and DOE O 412.1 (Field Work Proposal form) area available at the following link, under "DOE Budget Forms": https://www.directives.doe.gov/directives-documents/400-series/0412.1-BOrder-a-admchg1/@@images/file. Save the FWP in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_FWP".

x. Authorization for non-DOE/NNSA or DOE/NNSA FFRDCs (if applicable)

The Federal agency sponsoring the FFRDC must authorize in writing the use of the FFRDC on the proposed project and this authorization must be submitted with the application. The use of a FFRDC must be consistent with the contractor's authority under its award. Save the Authorization in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_FFRDCAuth".

xi. SF-LLL: Disclosure of Lobbying Activities (required)

Prime Recipients and Subrecipients may not use any Federal funds to influence or attempt to influence, directly or indirectly, congressional action on any legislative or appropriation matters.

Prime Recipients and Subrecipients are required to complete and submit SF-LLL, "Disclosure of Lobbying Activities" (https://www.grants.gov/web/grants/forms/sf-424-individual-family.html) to ensure that non-Federal funds have not been paid and will not 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; or
- An employee of a Member of Congress.

Save the SF-LLL in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_SF-LLL".

xii. Waiver Requests: Foreign Entities and Performance of Work in the United States (if applicable)

1. **Foreign Entity Participation:**
   As set forth in Section III.A.3, all Prime Recipients receiving funding under this FOA must be incorporated (or otherwise formed) under the laws of a State or territory of the United States. To request a waiver of this requirement, the applicant must submit an explicit waiver request in the Full Application. Appendix C lists the necessary information that must be included in a request to waive this requirement.

2. ***Performance of Work in the United States***
   As set forth in Section IV.J.iii, all work under EERE funding agreements must be performed in the United States. This requirement does not apply to the purchase of supplies and equipment, so a waiver is not required for foreign purchases of these items. However, the Prime Recipient should make every effort to purchase supplies and equipment within the United States. Appendix C lists the necessary information that must be included in a request to waive the Performance of Work in the United

States requirement.

xiii. U.S. Manufacturing Commitments

As part of the application, applicants are required to submit a U.S. Manufacturing Plan. The U.S. Manufacturing Plan represents the applicant's measurable commitment to support U.S. manufacturing as a result of its award.

The weight given to the U.S. Manufacturing Plans during the review and selection process varies based on the particular FOA. Applicants should review Section V.A of this FOA to determine the weight given to the U.S. Manufacturing Plans under this FOA.

A U.S. Manufacturing Plan should contain the following or similar preamble: "If selected for funding, the applicant agrees to the following commitments as a condition of that funding:" and, after the preamble, the plan should include one or more specific and measureable commitments. For example, an applicant may commit particular types of products to be manufactured in the U.S. In addition to or instead of making a commitment tied to a particular product, the applicant may make other types of commitments still beneficial to U.S. manufacturing. An applicant may commit to a particular investment in a new or existing U.S. manufacturing facility, keep certain activities based in the U.S. (i.e., final assembly) or support a certain number of jobs in the U.S. related to the technology and manufacturing. For an applicant which is likely to license the technology to others, especially universities for which licensing may be the exclusive means of commercialization the technology, the U.S. manufacturing plan may indicate the applicant's plan and commitment to use a licensing strategy that would likely support U.S. manufacturing.

When an applicant that is a domestic small business, domestic educational institution, or nonprofit organization is selected for an award, the U.S. Manufacturing Plan submitted by the applicant becomes part of the terms and conditions of the award. The applicant/awardee may request a waiver or modification of the U.S. Manufacturing Plan from DOE upon a showing that the original U.S. Manufacturing Plan is no longer economically feasible.

When an applicant that is a domestic large business is selected for an award, a class patent waiver applies as set forth in Section VIII. L. 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, educational institutions, and nonprofits by law. In order to avail itself of the class patent waiver, a domestic large business must agree that any products embodying or produced through the use of an invention conceived or first actually reduced to practice under the award will be substantially manufactured in the United States, unless DOE agrees that the commitments proposed in the U.S. Manufacturing Plan are sufficient.

For other entity types that are selected for award, please see Section VIII.L regarding U.S. manufacturing commitments.

1. **FFRDCs**

   DOE FFRDCs are subject to the U.S. Manufacturing requirements set forth in their Management and Operating Contracts. All other FFRDCs are subject to the U.S. Manufacturing requirements as set forth above, based on their size and for-profit status.

xiv. Data Management Plan

Applicants are required to submit a Data Management Plan with their Full Application. The Data Management Plan is a document that outlines the proposed plan for data sharing or preservation. Submission of a Data Management Plan with the Full Application is required; failure to submit a complete Data Management Plan may result in a determination of non-compliance for your Full Application. Guidance for preparing a Data Management Plan is included in Appendix D of the FOA.

E. Content and Form of Replies to Reviewer Comments

EERE will provide applicants with reviewer comments following evaluation of all eligible Full Applications. Applicants will have a brief opportunity to review the comments and to prepare a short Reply to Reviewer Comments responding to comments however they desire or supplementing their Full Application. The Reply to Reviewer Comments is an optional submission; applicants are not required to submit a Reply to Reviewer Comments. EERE will post the Reviewer Comments in EERE Exchange. The expected submission deadline is on the cover page of the FOA; however, it is the applicant's responsibility to monitor EERE Exchange in the event that the expected date changes. The deadline will not be extended for applicants who are unable to timely submit their reply due to failure to check EERE Exchange

or relying on the expected date alone. Applicants should anticipate having approximately three (3) business days to submit Replies to Reviewer Comments.

EERE will not review or consider ineligible Replies to Reviewer Comments (see Section III of the FOA). EERE will review and consider each eligible Full Application, even if no Reply is submitted or if the Reply is found to be ineligible.

Replies to Reviewer Comments must conform to the following content and form requirements, including maximum page lengths, described below. If a Reply to Reviewer Comments is more than three pages in length, EERE will review only the first five (5) pages and disregard any additional pages.

SECTION	PAGE LIMIT	DESCRIPTION
Text	3 pages max	Applicants may respond to one or more reviewer comments or supplement their Full Application.
Optional	2 page max	Applicants may use this page however they wish; text, graphs, charts, or other data to respond to reviewer comments or supplement their Full Application are acceptable.

F. Post-Award Information Requests

If selected for award, EERE reserves the right to request additional or clarifying information for any reason deemed necessary, including but not limited to:

- Indirect cost information
- Other budget information
- Commitment Letters from Third Parties Contributing to Cost Share, if applicable
- Name and phone number of the Designated Responsible Employee for complying with national policies prohibiting discrimination (See 10 CFR 1040.5)
- Representation of Limited Rights Data and Restricted Software, if applicable
- Environmental Questionnaire

G. Dun and Bradstreet Universal Numbering System Number and System for Award Management

Each applicant (unless the applicant is an individual or Federal awarding agency that is excepted from those requirements under 2 CFR §25.110(b) or (c), or has an

exception approved by the Federal awarding agency under 2 CFR §25.110(d)) is required to: (1) Be registered in the System for Award Management (SAM) at https://www.sam.gov before submitting its application; (2) provide a valid Dun and Bradstreet Universal Numbering System (DUNS) number in its application; and (3) continue to maintain an active SAM registration with current information at all times during which it has an active Federal award or an application or plan under consideration by a Federal awarding agency. DOE may not make a Federal award to an applicant until the applicant has complied with all applicable DUNS and SAM requirements and, if an applicant has not fully complied with the requirements by the time DOE is ready to make a Federal award, the DOE may determine that the applicant is not qualified to receive a Federal award and use that determination as a basis for making a Federal award to another applicant.

H. Submission Dates and Times

Concept Papers, Full Applications, and Replies to Reviewer Comments must be submitted in EERE Exchange no later than 5 p.m. Eastern on the dates provided on the cover page of this FOA.

I. Intergovernmental Review

This FOA is not subject to Executive Order 12372 – Intergovernmental Review of Federal Programs.

J. Funding Restrictions

i. Allowable Costs

All expenditures must be allowable, allocable, and reasonable in accordance with the applicable Federal cost principles.

Refer to the following applicable Federal cost principles for more information:

- FAR Part 31 for For-Profit entities; and
- 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

ii. Pre-Award Costs

Selectees must request prior written approval to charge pre-award costs. Pre-award costs are those incurred prior to the effective date of the Federal award directly pursuant to the negotiation and in anticipation of the Federal award where such costs are necessary for efficient and timely performance of the scope of work. Such costs are allowable only to the extent that they would have been allowable if incurred after the date of the Federal award and **only** with the written approval of the Federal awarding agency, through the Contracting Officer assigned to the award.

Pre-award costs cannot be incurred prior to the Selection Official signing the Selection Statement and Analysis. Pre-award costs can only be incurred if such costs would be reimbursable under the agreement if incurred after award.

Pre-Award expenditures are made at the Selectee's risk; EERE is not obligated to reimburse costs: (1) in the absence of appropriations; (2) if an award is not made; or (3) if an award is made for a lesser amount than the Selectee anticipated.

Pre-Award Costs Related to National Environmental Policy Act (NEPA) Requirements

EERE's decision whether and how to distribute Federal funds under this FOA is subject to NEPA. Applicants should carefully consider and should seek legal counsel or other expert advice before taking any action related to the proposed project that would have an adverse effect on the environment or limit the choice of reasonable alternatives prior to EERE completing the NEPA review process.

EERE does not guarantee or assume any obligation to reimburse costs where the Prime Recipient incurred the costs prior to receiving written authorization from the Contracting Officer. If the applicant elects to undertake activities that may have an adverse effect on the environment or limit the choice of reasonable alternatives prior to receiving such written authorization from the Contracting Officer, the applicant is doing so at risk of not receiving Federal funding and such costs may not be recognized as allowable cost share. Likewise, if a project is selected for negotiation of award, and the Prime Recipient elects to undertake activities that are not authorized for Federal funding by the Contracting Officer in advance of EERE completing a NEPA review, the Prime Recipient is doing so at risk of not receiving Federal Funding and such

costs may not be recognized as allowable cost share. Nothing contained in the pre-award cost reimbursement regulations or any pre-award costs approval letter from the Contracting Officer override these NEPA requirements to obtain the written authorization from the Contracting Officer prior to taking any action that may have an adverse effect on the environment or limit the choice of reasonable alternatives.

iii. Performance of Work in the United States

1. **Requirement**
   All work performed under EERE Awards must be performed in the United States. This requirement does not apply to the purchase of supplies and equipment; however, the Prime Recipient should make every effort to purchase supplies and equipment within the United States. The Prime Recipient must flow down this requirement to its Subrecipients.

2. **Failure to Comply**
   If the Prime Recipient fails to comply with the Performance of Work in the United States requirement, EERE may deny reimbursement for the work conducted outside the United States and such costs may not be recognized as allowable recipient cost share. The Prime Recipient is responsible should any work under this Award be performed outside the United States, absent a waiver, regardless of if the work is performed by the Prime Recipient, Subrecipients, contractors or other project partners.

3. **Waiver**
   There may be limited circumstances where it is in the interest of the project to perform a portion of the work outside the United States. To seek a waiver of the Performance of Work in the United States requirement, the applicant must submit a written waiver request to EERE. Appendix C lists the necessary information that must be included in a request to waive the Performance of Work in the United States requirement.

   The applicant must demonstrate to the satisfaction of EERE that a waiver would further the purposes of the FOA and is in the economic interests of the United States. EERE may require additional information before considering a waiver request. Save the waiver request(s) in a single PDF file titled "ControlNumber_PerformanceofWork_Waiver". The applicant does not have the right to appeal EERE's decision concerning a waiver

request.

iv. Construction

Recipients are required to obtain written authorization from the Contracting Officer before incurring any major construction costs.

v. Foreign Travel

Topic Area 1

Foreign travel costs are not allowable under this Topic Area.

Topic Area 2

If international travel is proposed for your project, please note that your organization must comply with the International Air Transportation Fair Competitive Practices Act of 1974 (49 USC 40118), commonly referred to as the "Fly America Act," and implementing regulations at 41 CFR 301-10.131 through 301-10.143. The law and regulations require air transport of people or property to, from, between, or within a country other than the United States, the cost of which is supported under this award, to be performed by or under a cost-sharing arrangement with a U.S. flag carrier, if service is available. Foreign travel costs are allowable only with the written prior approval of the Contracting Officer assigned to the award.

vi. Equipment and Supplies

To the greatest extent practicable, all equipment and products purchased with funds made available under this FOA should be American-made. This requirement does not apply to used or leased equipment.

Property disposition will be required at the end of a project if the current fair market value of property exceeds $5,000. The rules for property disposition are set forth in 2 CFR 200.310 – 200.316 as amended by 2 CFR 910.360.

vii. Lobbying

Recipients and Subrecipients may not use any Federal funds to influence or attempt to influence, directly or indirectly, congressional action on any legislative or appropriation matters.

Recipients and Subrecipients are required to complete and submit SF-LLL, "Disclosure of Lobbying Activities"

(https://www.grants.gov/web/grants/forms/sf-424-individual-family.html) to ensure that non-Federal funds have not been paid and will not 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; or
- An employee of a Member of Congress.

viii. Risk Assessment

Prior to making a Federal award, the DOE is required by 31 U.S.C. 3321 and 41 U.S.C. 2313 to review information available through any OMB-designated repositories of government-wide eligibility qualification or financial integrity information, such as SAM Exclusions and "Do Not Pay."

In addition, DOE evaluates the risk(s) posed by applicants before they receive Federal awards. This evaluation may consider: results of the evaluation of the applicant's eligibility; the quality of the application; financial stability; quality of management systems and ability to meet the management standards prescribed in this part; history of performance; reports and findings from audits; and the applicant's ability to effectively implement statutory, regulatory, or other requirements imposed on non-Federal entities.

In addition to this review, DOE must comply with the guidelines on government-wide suspension and debarment in 2 CFR 180, and must require non-Federal entities to comply with these provisions. These provisions restrict Federal awards, subawards and contracts with certain parties that are debarred, suspended or otherwise excluded from or ineligible for participation in Federal programs or activities.

ix. Invoice Review and Approval

DOE employs a risk-based approach to determine the level of supporting documentation required for approving invoice payments. Recipients may be required to provide some or all of the following items with their requests for reimbursement:

- Summary of costs by cost categories
- Timesheets or personnel hours report
- Invoices/receipts for all travel, equipment, supplies, contractual, and other costs

- UCC filing proof for equipment acquired with project funds by for-profit recipients and subrecipients
- Explanation of cost share for invoicing period
- Analogous information for some subrecipients
- Other items as required by DOE

V. Application Review Information

A. Technical Review Criteria

Topic Area 1 – Facility Design Concepts for Standard Modular Hydropower Development

i. Concept Papers

Concept Papers are evaluated based on consideration the following factors.

Concept Paper Criterion: Overall FOA Responsiveness and Viability of the Project (Weight: 100%)

- The applicant clearly describes the proposed facility design, how it is unique and innovative, and how it will efficiently and cost-effectively overcome the challenges inherent to small hydropower development;
- The applicant has identified risks and challenges, including possible mitigation strategies, and has shown the impact that EERE funding and the proposed project would have on the relevant field and application;
- The applicant has the qualifications, experience, capabilities and other resources necessary to complete the proposed project; and
- The proposed work, if successfully accomplished, would clearly meet the performance targets stated in the FOA.

ii. Full Applications

Applications will be evaluated against the merit review criteria shown below. All sub-criteria are of equal weight.

Criterion 1: Technical Merit, Innovation, and Impact (50%)

Technical Merit and Innovation

- Extent to which the proposed facility design is innovative.
- Degree to which the current state of the art and the proposed advancement are clearly described.
- Extent to which the application specifically and convincingly demonstrates how the applicant will move the state of the art to the proposed advancement.
- Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious and revolutionary, including relevant data, calculations and discussion of prior work in the literature with analyses that support the viability of the proposed work.
- Extent to which the SMH Exemplary Design Envelope Specification was utilized in the design and application of each module.
- Extent to which design concepts for integrating modules into the streambed minimize disturbance and lower cost compared to conventional approaches.
- Extent to which applicants incorporate concepts of stream compatibility into the facility design.
- Extent to which the facility design is replicable across multiple sites.

Impact of Technology Advancement

- The potential impact of the project on advancing the state-of-the-art.
- Demonstration that proposed the facility design can meet cost reductions and construction timelines outlined in the FOA.

Criterion 2: Project Research Approach and Workplan (30%)

Research Approach and Workplan

- Quality of methodology for integrating SMH principles of standardization, modularity, and environmental compatibility into the facility design.
- Degree to which the approach and critical path have been clearly described and thoughtfully considered.
- Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed Workplan and SOPO will succeed in meeting the project goals.
- Integration of ORNL technical assistance into task structure.

Identification of Technical Risks

- Discussion and demonstrated understanding of the key technical risk areas involved in the proposed work and the quality of the mitigation strategies to address them.

Baseline, Metrics, and Deliverables

- The level of clarity in the definition of the baseline, metrics, and milestones.
- Relative to a clearly defined experimental baseline, the strength of the quantifiable metrics, milestones, and a mid-point deliverables defined in the application, such that meaningful interim progress will be made.

Criterion 3: Team and Resources (20%)

- The capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a high probability of success.
- The qualifications, relevant expertise, and time commitment of the individuals on the team, particularly:
  - Track record of pursuing development of small hydropower sites, developing innovative technologies for small hydropower, and/or designing hydraulic infrastructure;
  - Evidence of prior work in assessing environmental functionalities of streams; and
  - Evidence of previous collaborative engagement with regulatory agencies.
- The degree to which the proposed consortia/team demonstrates the ability to facilitate and expedite further development and commercial deployment of the proposed technologies.
- The level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan.
- The reasonableness of the budget and spend plan for the proposed project and objectives.

iii. Criteria for Replies to Reviewer Comments

EERE has not established separate criteria to evaluate Replies to Reviewer Comments. Instead, Replies to Reviewer Comments are attached to the original applications and evaluated as an extension of the Full Application.

Topic Area 2 – New Use Cases for Pumped-Storage Hydropower

i. Concept Papers

Concept Papers are evaluated based on consideration the following factors.

Concept Paper Criterion: Overall FOA Responsiveness and Viability of the Project (Weight: 100%)

- The proposed work, if successfully accomplished, would materially advance the technology concept design towards the stated performance targets in sub-topic 2.1 or the modeling and analysis requirements in sub-topic 2.2;
- The applicant clearly describes the proposed technology, describes how the technology is unique and innovative, and how the technology will advance the current state-of-the-art;
- The applicant has identified risks and challenges, including possible mitigation strategies, and has shown the impact that EERE funding and the proposed project would have on the relevant field and application;
- The applicant has the qualifications, experience, capabilities and other resources necessary to complete the proposed project; and
- The proposed work, if successfully accomplished, would clearly meet the objectives as stated in the FOA.

ii. Full Applications

Applications will be evaluated against the merit review criteria shown below.

Criterion 1: Technical Merit, Innovation, and Impact (50%)

Technical Merit and Innovation

- Extent to which the proposed technology or process is innovative;
- Degree to which the current state of the technology and the proposed advancement are clearly described;
- Extent to which applications propose an innovation that would require an extreme environmental and/or social effect;
- Extent to which the application specifically and convincingly demonstrates how the applicant will move the state of the art to the proposed advancement;
- Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious and revolutionary, including relevant data, calculations and discussion of prior work in the literature with analyses that support the viability of the proposed work;

- Extent to which applications are responsive to the minimum eligibility thresholds, performance targets, and objectives as outlined for each topic area in the FOA description

Impact of Technology Advancement

- How the project supports the topic area objectives and target specifications and metrics; and
- The potential impact of the project on advancing the state-of-the-art.
- The potential for transformational innovation as opposed to incremental advances in existing products or solutions.
- The potential for broad applicability or transferability of the proposed solution.

Criterion 2: Project Research and Market Transformation Plan (30%)

Research Approach and Workplan

- Degree to which the approach and critical path have been clearly described and thoughtfully considered; and
- Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed Workplan and SOPO will succeed in meeting the project goals.
- Extent to which the application proposes a convincing strategy to disseminate the results of the project to a broad audience

Identification of Technical Risks

- Discussion and demonstrated understanding of the key technical risk areas involved in the proposed work and the quality of the mitigation strategies to address them.

Baseline, Metrics, and Deliverables

- The level of clarity in the definition of the baseline, metrics, and milestones; and
- Relative to a clearly defined experimental baseline, the strength of the quantifiable metrics, milestones, and a mid-point deliverables defined in the application, such that meaningful interim progress will be made.
- Comprehensive and effective demonstration of cost estimates.

Criterion 3: Team and Resources (20%)

- The capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a high probability of success.
- The qualifications, relevant expertise, and time commitment of the individuals on the team;
- The sufficiency of the facilities to support the work;
- The degree to which the proposed consortia/team demonstrates the ability to facilitate and expedite further development and commercial deployment of the proposed technologies;
- The level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan; and
- The reasonableness of the budget and spend plan for the proposed project and objectives.

iii. Criteria for Replies to Reviewer Comments

EERE has not established separate criteria to evaluate Replies to Reviewer Comments. Instead, Replies to Reviewer Comments are attached to the original applications and evaluated as an extension of the Full Application.

B. Standards for Application Evaluation

Applications that are determined to be eligible will be evaluated in accordance with this FOA, by the standards set forth in EERE's Notice of Objective Merit Review Procedure (76 Fed. Reg. 17846, March 31, 2011) and the guidance provided in the "Department of Energy Merit Review Guide for Financial Assistance," which is available at: https://energy.gov/management/downloads/merit-review-guide-financial-assistance-and-unsolicited-proposals-current.

C. Other Selection Factors

i. Program Policy Factors

In addition to the above criteria, the Selection Official may consider the following program policy factors in determining which Full Applications to select for award negotiations:

- The degree to which the proposed project exhibits technological diversity when compared to the existing DOE project portfolio and other projects selected from the subject FOA;
- The degree to which the proposed project, including proposed cost share, optimizes the use of available EERE funding to achieve programmatic objectives;
- The level of industry involvement and demonstrated ability to accelerate commercialization and overcome key market barriers;
- The degree to which the proposed project is likely to lead to increased employment and manufacturing in the United States;
- The degree to which the proposed project will accelerate transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty; and
- The degree to which the proposed project, or group of projects, represent a desired geographic distribution (considering past awards and current applications

D. Evaluation and Selection Process

i. Overview

The evaluation process consists of multiple phases; each includes an initial eligibility review and a thorough technical review. Rigorous technical reviews of eligible submissions are conducted by reviewers that are experts in the subject matter of the FOA. Ultimately, the Selection Official considers the recommendations of the reviewers, along with other considerations such as program policy factors, in determining which applications to select.

ii. Pre-Selection Interviews

As part of the evaluation and selection process, EERE may invite one or more applicants to participate in Pre-Selection Interviews. Pre-Selection Interviews are distinct from and more formal than pre-selection clarifications (See Section V.D.3 of the FOA). The invited applicant(s) will meet with EERE representatives to provide clarification on the contents of the Full Applications and to provide EERE an opportunity to ask questions regarding the proposed project. The information provided by applicants to EERE through Pre-Selection Interviews contributes to EERE's selection decisions.

EERE will arrange to meet with the invited applicants in person at EERE's offices or a mutually agreed upon location. EERE may also arrange site visits at certain applicants' facilities. In the alternative, EERE may invite certain applicants to participate in a one-on-one conference with EERE via webinar, videoconference, or conference call.

EERE will not reimburse applicants for travel and other expenses relating to the Pre-Selection Interviews, nor will these costs be eligible for reimbursement as pre-award costs.

EERE may obtain additional information through Pre-Selection Interviews that will be used to make a final selection determination. EERE may select applications for funding and make awards without Pre-Selection Interviews. Participation in Pre-Selection Interviews with EERE does not signify that applicants have been selected for award negotiations.

iii. Pre-Selection Clarification

EERE may determine that pre-selection clarifications are necessary from one or more applicants. Pre-selection clarifications are distinct from and less formal than pre-selection interviews. These pre-selection clarifications will solely be for the purposes of clarifying the application, and will be limited to information already provided in the application documentation. The pre-selection clarifications may occur before, during or after the merit review evaluation process. Information provided by an applicant that is not necessary to address the pre-selection clarification question will not be reviewed or considered. Typically, a pre-selection clarification will be carried out through either written responses to EERE's written clarification questions or video or conference calls with EERE representatives.

The information provided by applicants to EERE through pre-selection clarifications is incorporated in their applications and contributes to the merit review evaluation and EERE's selection decisions. If EERE contacts an applicant for pre-selection clarification purposes, it does not signify that the applicant has been selected for negotiation of award or that the applicant is among the top ranked applications.

EERE will not reimburse applicants for expenses relating to the pre-selection clarifications, nor will these costs be eligible for reimbursement as pre-award costs.

iv. Recipient Integrity and Performance Matters

DOE, prior to making a Federal award with a total amount of Federal share greater than the simplified acquisition threshold, is required to review and consider any information about the applicant that is in the designated integrity and performance system accessible through SAM (currently FAPIIS) (see 41 U.S.C. 2313).

The applicant, at its option, may review information in the designated integrity and performance systems accessible through SAM and comment on any information about itself that a Federal awarding agency previously entered and is currently in the designated integrity and performance system accessible through SAM.

DOE will consider any written comments by the applicant, in addition to the other information in the designated integrity and performance system, in making a judgment about the applicant's integrity, business ethics, and record of performance under Federal awards when completing the review of risk posed by applicants as described in 2 C.F.R. § 200.205.

v. Selection

The Selection Official may consider the technical merit, the Federal Consensus Board's recommendations, program policy factors, and the amount of funds available in arriving at selections for this FOA.

E. Anticipated Notice of Selection and Award Dates

EERE anticipates notifying applicants selected for negotiation of award by March/April 2019 and making awards by May/June 2019.

VI. Award Administration Information

A. Award Notices

i. Ineligible Submissions

Ineligible Concept Papers and Full Applications will not be further reviewed or considered for award. The Contracting Officer will send a notification letter by email to the technical and administrative points of contact

designated by the applicant in EERE Exchange. The notification letter will state the basis upon which the Concept Paper or the Full Application is ineligible and not considered for further review.

ii. Concept Paper Notifications

EERE will notify applicants of its determination to encourage or discourage the submission of a Full Application. EERE will post these notifications to EERE Exchange.

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, EERE 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 encouraging the submission of a Full Application does not authorize the applicant to commence performance of the project. Please refer to Section IV.J.2 of the FOA for guidance on pre-award costs.

iii. Full Application Notifications

EERE will notify applicants of its determination via a notification letter by email to the technical and administrative points of contact designated by the applicant in EERE Exchange. The notification letter will inform the applicant whether or not its Full Application was selected for award negotiations. Alternatively, EERE may notify one or more applicants that a final selection determination on particular Full Applications will be made at a later date, subject to the availability of funds or other factors.

iv. Successful Applicants

Receipt of a notification letter selecting a Full Application for award negotiations does not authorize the applicant to commence performance of the project. If an application is selected for award negotiations, it is not a commitment by EERE to issue an award. Applicants do not receive an award until award negotiations are complete and the Contracting Officer executes the funding agreement, accessible by the Prime Recipient in FedConnect.

The award negotiation process will take approximately 60 days. Applicants must designate a primary and a backup point-of-contact in EERE Exchange with whom EERE will communicate to conduct award negotiations. The applicant must be responsive during award negotiations (i.e., provide requested documentation) and meet the negotiation deadlines. If the applicant fails to do so or if award negotiations are otherwise unsuccessful, EERE will cancel the award negotiations and rescind the Selection. EERE reserves the right to terminate award negotiations at any time for any reason.

Please refer to Section IV.J.2 of the FOA for guidance on pre-award costs.

v. Alternate Selection Determinations

In some instances, an applicant may receive a notification that its application was not selected for award and EERE designated the application to be an alternate. As an alternate, EERE may consider the Full Application for Federal funding in the future. A notification letter stating the Full Application is designated as an alternate does not authorize the applicant to commence performance of the project. EERE may ultimately determine to select or not select the Full Application for award negotiations.

vi. Unsuccessful Applicants

EERE shall promptly notify in writing each applicant whose application has not been selected for award or whose application cannot be funded because of the unavailability of appropriated funds.

B. Administrative and National Policy Requirements

i. Registration Requirements

There are several one-time actions before submitting an application in response to this FOA, and it is vital that applicants address these items as soon as possible. Some may take several weeks, and failure to complete them could interfere with an applicant's ability to apply to this FOA, or to meet the negotiation deadlines and receive an award if the application is selected. These requirements are as follows:

1. **EERE Exchange**
   Register and create an account on EERE Exchange at https://eere-Exchange.energy.gov.
   This account will then allow the user to register for any open EERE FOAs that are currently in EERE Exchange. It is recommended that each organization or business unit, whether acting as a team or a single entity, use only one account as the contact point for each submission. Applicants should also designate backup points of contact so they may be easily contacted if deemed necessary. **This step is required to apply to this FOA.**

   The EERE Exchange registration does not have a delay; however, **the remaining registration requirements below could take several weeks to process and are necessary for a potential applicant to receive an award under this FOA**.

2. ***DUNS Number***
   Obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number (including the plus 4 extension, if applicable) at http://fedgov.dnb.com/webform.

3. ***System for Award Management***
   Register with the System for Award Management (SAM) at https://www.sam.gov. Designating an Electronic Business Point of Contact (EBiz POC) and obtaining a special password called an MPIN are important steps in SAM registration. Please update your SAM registration annually.

4. ***FedConnect***
   Register in FedConnect at https://www.fedconnect.net. To create an organization account, your organization's SAM MPIN is required. For more information about the SAM MPIN or other registration requirements, review the FedConnect Ready, Set, Go! Guide at https://www.fedconnect.net/FedConnect/Marketing/Documents/FedConnect_Ready_Set_Go.pdf.

5. ***Grants.gov***
   Register in Grants.gov (http://www.grants.gov) to receive automatic updates when Amendments to this FOA are posted. However, please note that Concept Papers, and Full Applications will not be accepted through Grants.gov.

6. ***Electronic Authorization of Applications and Award Documents***
   Submission of an application and supplemental information under this FOA through electronic systems used by the Department of Energy, including EERE Exchange and FedConnect.net, constitutes the authorized representative's approval and electronic signature.

ii. Award Administrative Requirements

The administrative requirements for DOE grants and cooperative agreements are contained in 2 CFR Part 200 as amended by 2 CFR Part 910.

iii. Foreign National Access to DOE Sites

All applicants that ultimately enter into an award resulting from this FOA will be subject to the following requirement concerning foreign national involvement. Upon DOE's request, Prime Recipients must provide information to facilitate DOE's responsibilities associated with foreign national access to DOE sites, information, technologies, and equipment. A foreign national is defined as any person who was born outside the jurisdiction of the United States, is a citizen of a foreign government, and has not been naturalized under U.S. law. If the Prime Recipient or Subrecipients, contractors or vendors under the award, anticipate utilizing a foreign national person in the performance of an award, the Prime Recipient is responsible for providing to the Contracting Officer specific information of the foreign national(s) to satisfy compliance with all of the requirements for access approval.

iv. Subaward and Executive Reporting

Additional administrative requirements necessary for DOE grants and cooperative agreements to comply with the Federal Funding and Transparency Act of 2006 (FFATA) are contained in 2 CFR Part 170. Prime Recipients must register with the new FFATA Subaward Reporting System database and report the required data on their first tier Subrecipients. Prime Recipients must report the executive compensation for their own executives as part of their registration profile in SAM.

v. National Policy Requirements

The National Policy Assurances that are incorporated as a term and condition of award are located at: http://www.nsf.gov/awards/managing/rtc.jsp.

vi. Environmental Review in Accordance with National Environmental Policy Act (NEPA)

EERE's decision whether and how to distribute federal funds under this FOA is subject to the National Environmental Policy Act (42 USC 4321, *et seq.*). NEPA requires Federal agencies to integrate environmental values into their decision-making processes by considering the potential environmental impacts of their proposed actions. For additional background on NEPA, please see DOE's NEPA website, at http://nepa.energy.gov/.

While NEPA compliance is a Federal agency responsibility and the ultimate decisions remain with the Federal agency, all recipients selected for an award will be required to assist in the timely and effective completion of the NEPA process in the manner most pertinent to their proposed project. If DOE determines certain records must be prepared to complete the NEPA review process (e.g., biological evaluations or environmental assessments), the costs to prepare the necessary records may be included as part of the project costs.

vii. Applicant Representations and Certifications

1. **Lobbying Restrictions**
   By accepting funds under this award, the Prime Recipient agrees that none of the funds obligated on the award shall be expended, directly or indirectly, to influence Congressional action on any legislation 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.

2. **Corporate Felony Conviction and Federal Tax Liability Representations**
   In submitting an application in response to this FOA, the applicant represents that:

   a. It is **not** a corporation that has been convicted of a felony criminal violation under any Federal law within the preceding 24 months, and
   b. It is **not** a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative

remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

For purposes of these representations the following definitions apply:

A Corporation includes any entity that has filed articles of incorporation in any of the 50 states, the District of Columbia, or the various territories of the United States [but not foreign corporations]. It includes both for-profit and non-profit organizations.

3. Nondisclosure and Confidentiality Agreements Representations
In submitting an application in response to this FOA the applicant represents that:

a. 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 contactors 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.

b. 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:

(1) *''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.''

(2) The limitation above shall 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.

(3) Notwithstanding the provision listed in paragraph (a), a nondisclosure or 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 United States Government, may contain provisions appropriate to the particular activity for which such document is to be used. Such form or agreement shall, 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 United States Government. Such nondisclosure or confidentiality forms shall also make it clear that they do not bar disclosures to Congress, or to an authorized official of an executive agency or the Department of Justice, that are essential to reporting a substantial violation of law.

viii. Statement of Federal Stewardship

EERE will exercise normal Federal stewardship in overseeing the project activities performed under EERE Awards. Stewardship Activities include, but are not limited to, conducting site visits; reviewing performance and financial reports, providing assistance and/or temporary intervention in usual circumstances to correct deficiencies that develop during the project; assuring compliance with terms and conditions; and reviewing technical performance after project completion to ensure that the project objectives have been accomplished.

ix. Statement of Substantial Involvement

EERE has substantial involvement in work performed under Awards made as a result of this FOA. EERE does not limit its involvement to the administrative requirements of the Award. Instead, EERE has substantial involvement in the direction and redirection of the technical aspects of the project as a whole. Substantial involvement includes, but is not limited to, the following:

1. EERE shares responsibility with the recipient for the management, control, direction, and performance of the Project.

2. EERE may intervene in the conduct or performance of work under this Award for programmatic reasons. Intervention includes the interruption or modification of the conduct or performance of project activities.

3. EERE may redirect or discontinue funding the Project based on the outcome of EERE's evaluation of the Project at that the Go/No Go decision point(s).

4. EERE participates in major project decision-making processes.

x. Subject Invention Utilization Reporting

In order to ensure that Prime Recipients and Subrecipients holding title to subject inventions are taking the appropriate steps to commercialize subject inventions, EERE may require that each Prime Recipient holding title to a subject invention submit annual reports for 10 years from the date the subject invention was disclosed to EERE on the utilization of the subject invention and efforts made by Prime Recipient or their licensees or assignees to stimulate such utilization. The reports must include information regarding the status of development, date of first commercial sale or use, gross royalties received by the Prime Recipient, and such other data and information as EERE may specify.

xi. Intellectual Property Provisions

The standard DOE financial assistance intellectual property provisions applicable to the various types of recipients are located at http://energy.gov/gc/standard-intellectual-property-ip-provisions-financial-assistance-awards.

xii. Reporting

Reporting requirements are identified on the Federal Assistance Reporting Checklist, attached to the award agreement. The checklist can be accessed at https://www.energy.gov/eere/funding/eere-funding-application-and-management-forms

xiii. Go/No-Go Review

Each project selected under this FOA will be subject to a periodic project evaluation referred to as a Go/No-Go Review. Federal funding beyond the Go/No Go decision point (continuation funding), is contingent on (1) the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority; (2) meeting the objectives, milestones, deliverables, and decision point criteria of recipient's approved project and obtaining approval from EERE to continue work on the project; and (3) the submittal of required reports in accordance with the Statement of Project Objectives.

As a result of the Go/No Go Review, DOE may, at its discretion, authorize the following actions: (1) continue to fund the project, contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority; (2) recommend redirection of work under the project; (3) place a hold on federal funding for the project, pending further supporting data or funding; or (4) discontinue funding the project because of insufficient progress, change in strategic direction, or lack of funding.

The Go/No-Go decision is distinct from a non-compliance determination. In the event a recipient fails to comply with the requirements of an award, EERE may take appropriate action, including but not limited to, redirecting, suspending or terminating the award.

xiv. Conference Spending

The recipient shall not expend any funds on a conference not directly and programmatically related to the purpose for which the grant or cooperative agreement was awarded that would defray the cost to the United States Government of a conference held by any Executive branch department, agency, board, commission, or office for which the cost to the United States Government would otherwise exceed $20,000, thereby circumventing 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 conference.

xv. UCC Financing Statements

Per 2 CFR 910.360 (Real Property and Equipment) when a piece of equipment is purchased by a for-profit recipient or subrecipient with Federal Funds, and when the Federal share of the financial assistance agreement is more than $1,000,000, the recipient or subrecipient must:

Properly record, and consent to the Department's ability to properly record if the recipient fails to do so, UCC financing statement(s) for all equipment in excess of $5,000 purchased with project funds. These financing statement(s) must be approved in writing by the contracting officer prior to the recording, and they shall provide notice that the Recipient's title to all equipment (not real property) purchased with Federal funds under the financial assistance agreement is conditional pursuant to the terms of this section, and that the Government retains an undivided reversionary interest in the equipment. The UCC financing statement(s) must be filed before the Contracting Officer may reimburse the recipient for the Federal share of the equipment unless otherwise provided for in the relevant financial assistance agreement. The recipient shall further make any amendments to the financing statements or additional recordings, including appropriate continuation statements, as necessary or as the contracting officer may direct.

VII. Questions/Agency Contacts

Upon the issuance of a FOA, EERE personnel are prohibited from communicating (in writing or otherwise) with applicants regarding the FOA except through the established question and answer process as described below. Specifically, questions regarding the content of this FOA must be submitted to: WPTOFOA1836@ee.doe.gov. Questions must be submitted not later than 3 business days prior to the application due date and time.

All questions and answers related to this FOA will be posted on EERE Exchange at: https://eere-exchange.energy.gov. **Please note that you must first select this specific FOA Number in order to view the questions and answers specific to this FOA**. EERE will attempt to respond to a question within 3 business days, unless a similar question and answer has already been posted on the website.

Questions related to the registration process and use of the EERE Exchange website should be submitted to: EERE-ExchangeSupport@hq.doe.gov.

VIII. Other Information

A. FOA Modifications

Amendments to this FOA will be posted on the EERE Exchange website and the Grants.gov system. However, you will only receive an email when an amendment or a FOA is posted on these sites if you register for email notifications for this FOA in Grants.gov. EERE recommends that you register as soon after the release of the FOA as possible to ensure you receive timely notice of any amendments or other FOAs.

B. Informational Webinar

EERE will conduct two informational webinar during the FOA process. It will be held after the initial FOA release but before the due date for Concept Papers.

Attendance at the FOA informational Webinar for Topic Areas 1 and 2 is not mandatory and will not positively or negatively impact the overall review of any applicant submissions . As the webinar will be open to all applicants who wish to participate, applicants should refrain from asking questions or communicating information that would reveal confidential and/or proprietary information specific to their project. Specific dates for the webinar can be found on the cover page of the FOA.

Attendance at the Standard Modular Hydropower Resources Webinar (Topic Area 1 Only) is strongly encouraged. As the webinar will be open to all applicants who wish to participate, applicants should refrain from asking questions or communicating information that would reveal confidential and/or proprietary information specific to their project. Specific dates for the webinar can be found on the cover page of the FOA.

C. Government Right to Reject or Negotiate

EERE reserves the right, without qualification, to reject any or all applications received in response to this FOA and to select any application, in whole or in part, as a basis for negotiation and/or award.

D. Commitment of Public Funds

The Contracting Officer is the only individual who can make awards or commit the Government to the expenditure of public funds. A commitment by anyone other than the Contracting Officer, either express or implied, is invalid.

E. Treatment of Application Information

In general, EERE will only use data and other information contained in applications for evaluation purposes, unless such information is generally available to the public or is already the property of the Government.

Applicants should not include trade secrets or commercial or financial information that is privileged or confidential in their application unless such information is necessary to convey an understanding of the proposed project or to comply with a requirement in the FOA.

The use of protective markings such as "Do Not Publicly Release – Trade Secret" or "Do Not Publicly Release – Confidential Business Information" is encouraged. However, applicants should be aware that the use of protective markings is not dispositive as to whether information will be publicly released pursuant to the Freedom of Information Act, 5 U.S.C. §552, et. seq., as amended by the OPEN Government Act of 2007, Pub. L. No. 110-175. (See Section I of this document, "Notice of Potential Disclosure Under the Freedom of Information Act (FOIA)" for additional information regarding the public release of information under the Freedom of Information Act.

Applicants are encouraged to employ protective markings in the following manner:

The cover sheet of the application must be marked as follows and identify the specific pages containing trade secrets or commercial or financial information that is privileged or confidential:

> Notice of Restriction on Disclosure and Use of Data:
> Pages [list applicable pages] of this document may contain trade secrets or commercial or financial information that is privileged or confidential, and 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.

[End of Notice]

The header and footer of every page that contains trade secrets or commercial or financial information that is privileged must be marked as follows: "May contain trade secrets or commercial or financial information that is privileged or confidential and exempt from public disclosure."

In addition, each line or paragraph containing trade secrets or commercial or financial information that is privileged or confidential must be enclosed in brackets.

F. Evaluation and Administration by Non-Federal Personnel

In conducting the merit review evaluation, the Go/No-Go Review and Peer Review, the Government may seek the advice of qualified non Federal personnel as reviewers. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The applicant, by submitting its application, consents to the use of non-Federal reviewers/administrators. Non-Federal reviewers must sign conflict of interest and non-disclosure agreements prior to reviewing an application. Non-Federal personnel conducting administrative activities must sign a non-disclosure agreement.

G. Notice Regarding Eligible/Ineligible Activities

Eligible activities under this FOA include those which describe and promote the understanding of scientific and technical aspects of specific energy technologies, but not those which encourage or support political activities such as the collection and dissemination of information related to potential, planned or pending legislation.

H. Notice of Right to Conduct a Review of Financial Capability

EERE reserves the right to conduct an independent third party review of financial capability for applicants that are selected for negotiation of award (including personal credit information of principal(s) of a small business if there is insufficient information to determine financial capability of the organization).

I. Notice of Potential Disclosure Under Freedom of Information Act (FOIA)

Under the Freedom of Information Act, (FOIA), 5 U.S.C. §552, et. seq., as amended by the OPEN Government Act of 2007, Pub. L. No. 110-175, any information received from the Applicant is considered to be an agency record, and as such, subject to public release under FOIA. The purpose of the FOIA is to afford the public the right to request and receive agency records unless those agency records are protected from disclosure under one or more of the nine FOIA exemptions. Decisions to disclose or withhold information received from the Applicant are based upon the applicability of one or more of the nine FOIA exemptions, not on the existence or nonexistence of protective markings or designations. Only the agency's designated FOIA Officer may determine if information received from the Applicant may be withheld pursuant to one of the nine FOIA exemptions. All FOIA requests received by DOE are processed in accordance with 10 C.F.R. Part 1004.

J. Requirement for Full and Complete Disclosure

Applicants are required to make a full and complete disclosure of all information requested. Any failure to make a full and complete disclosure of the requested information may result in:

- The termination of award negotiations;
- The modification, suspension, and/or termination of a funding agreement;
- The initiation of debarment proceedings, debarment, and/or a declaration of ineligibility for receipt of Federal contracts, subcontracts, and financial assistance and benefits; and
- Civil and/or criminal penalties.

K. Retention of Submissions

EERE 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 EERE for funding, applicants consent to EERE's retention of their submissions.

L. Title to Subject Inventions

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

- Domestic Small Businesses, Educational Institutions, and Nonprofits: Under the Bayh-Dole Act (35 U.S.C. § 200 et seq.), domestic small businesses, educational institutions, 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 inventions unless a waiver is granted (see below).
- Class Patent Waiver:

DOE has issued a class waiver that applies to this FOA. Under this class waiver, domestic large businesses may elect title to their subject inventions similar to the right provided to the domestic small businesses, educational institutions, and nonprofits by law. In order to avail itself of the class waiver, a domestic large business must agree that any products embodying or produced through the use of a subject invention first created or reduced to practice under this program will be substantially manufactured in the United States, unless DOE agrees that the commitments proposed in the U.S. Manufacturing Plan are sufficient.

- Advance and Identified Waivers: Applicants may request a patent waiver that will cover subject inventions that may be invented 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 EERE within the timeframes 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 CFR 784.
- Determination of Exceptional Circumstances (DEC): Each applicant is required to submit a U.S. Manufacturing Plan as part of its application. If selected, the U.S. Manufacturing Plan shall be incorporated into the award terms and conditions for domestic small businesses and nonprofit organizations. DOE has determined that exceptional circumstances exist that warrants the modification of the standard patent rights clause for small businesses and non-profit awardees under Bayh-Dole to the extent necessary to implement and enforce the U.S. Manufacturing Plan. For example, the commitments and enforcement of a U.S. Manufacturing Plan may be tied to subject inventions. Any Bayh-Dole entity (domestic small business or nonprofit organization) affected by this DEC has the right to appeal it.

M. Government Rights in Subject Inventions

Where Prime Recipients and Subrecipients retain title to subject inventions, the U.S. Government retains certain rights.

i. 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 United States any subject invention throughout the world. This license extends to contractors doing work on behalf of the Government.

ii. 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 Prime 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 to a third party. In addition, the Government may grant licenses for use of the subject invention when a Prime Recipient, Subrecipient, or their assignees and exclusive licensees refuse to do so.

DOE may exercise its march-in rights only 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 satisfied manner;
- The owner has not met public use requirements specified by Federal statutes in a reasonably satisfied manner; or
- The U.S. Manufacturing requirement has not been met.

Any determination that march-in rights are warranted must follow a fact-finding process in which the recipient has certain rights to present evidence and witnesses, confront witnesses and appear with counsel and appeal any adverse decision. To date, DOE has never exercised its march-in rights to any subject inventions.

N. 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.

"Limited Rights Data": The U.S. Government will not normally require delivery of confidential or trade secret-type 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 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. However, pursuant to special statutory authority, certain categories of data generated under EERE awards may be protected from public disclosure for up to five years after the data is generated ("Protected Data"). For awards permitting Protected Data, the protected data must be marked as set forth in the awards intellectual property terms and conditions and a listing of unlimited rights data (i.e., non-protected data) must be inserted into the data clause 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.

O. Copyright

The Prime Recipient and Subrecipients may assert copyright in copyrightable works, such as software, first produced under the award without EERE approval. When copyright is asserted, the Government retains a paid-up nonexclusive, irrevocable worldwide license to reproduce, prepare derivative works, distribute copies to the public, and to perform publicly and display publicly the copyrighted work. This license extends to contractors and others doing work on behalf of the Government.

P. Personally Identifiable Information (PII)

All information provided by the Applicant must to the greatest extent possible exclude Personally Identifiable Information (PII). The term "personally identifiable information" refers to information which can be used to distinguish or trace an individual's identity, such as their name, social security number, biometric records, etc. alone, or when combined with other personal or identifying information which is linked or linkable to a specific individual, such as date and place of birth, mother's maiden name, etc. (See OMB Memorandum M-07-16 dated May 22,

2007, found at:
https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2007/m07-16.pdf

By way of example, Applicants must screen resumes to ensure that they do not contain PII such as personal addresses, phone/cell numbers, personal emails and/or SSNs. In short, if the PII is not essential to the application, it should not be in the application.

Q. Annual Independent Audits

If a for-profit entity is a Prime Recipient and has expended $750,000 or more of DOE awards during the entity's fiscal year, an annual Compliance Audit performed by an independent auditor is required. For additional information, please refer to 2 C.F.R. § 910.501 and Subpart F.

If an educational institution, non-profit organization, or state/local government is a Prime Recipient or Subrecipient and has expended $750,000 or more of Federal awards during the non-Federal entity's fiscal year, then a Single or Program-Specific Audit is required. For additional information, please refer to 2 C.F.R. § 200.501 and Subpart F.

Applicants and sub-recipients (if applicable) should propose sufficient costs in the project budget to cover the costs associated with the audit. EERE will share in the cost of the audit at its applicable cost share ratio.

IX. Appendix A – Cost Share Information

Cost Sharing or Cost Matching

The terms "cost sharing" and "cost matching" are often used synonymously. Even the DOE Financial Assistance Regulations, 2 CFR 200.306, use both of the terms in the titles specific to regulations applicable to cost sharing. EERE almost always uses the term "cost sharing," as it conveys the concept that non-federal share is calculated as a percentage of the Total Project Cost. An exception is the State Energy Program Regulation, 10 CFR 420.12, State Matching Contribution. Here "cost matching" for the non-federal share is calculated as a percentage of the Federal funds only, rather than the Total Project Cost.

How Cost Sharing Is Calculated

As stated above, cost sharing is calculated as a percentage of the Total Project Cost. FFRDC costs must be included in Total Project Costs. Following is an example of how to calculate cost sharing amounts for a project with $1,000,000 in federal funds with a minimum 20% non-federal cost sharing requirement:

- Formula: Federal share ($) divided by Federal share (%) = Total Project Cost
  Example: $1,000,000 divided by 80% = $1,250,000

- Formula: Total Project Cost ($) minus Federal share ($) = Non-federal share ($)
  Example: $1,250,000 minus $1,000,000 = $250,000

- Formula: Non-federal share ($) divided by Total Project Cost ($) = Non-federal share (%)
  Example: $250,000 divided by $1,250,000 = 20%

What Qualifies For Cost Sharing

While it is not possible to explain what specifically qualifies for cost sharing in one or even a couple of sentences, in general, if a cost is allowable under the cost principles applicable to the organization incurring the cost and is eligible for reimbursement under an EERE grant or cooperative agreement, then it is allowable as cost share. Conversely, if the cost is not allowable under the cost principles and not eligible for reimbursement, then it is not allowable as cost share. In addition, costs may not be counted as cost share if they are paid by the Federal Government under another award unless authorized by Federal statute to be used for cost sharing.

The rules associated with what is allowable as cost share are specific to the type of organization that is receiving funds under the grant or cooperative agreement, though are generally the same for all types of entities. The specific rules applicable to:

- FAR Part 31 for For-Profit entities, (48 CFR Part 31); and
- 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

In addition to the regulations referenced above, other factors may also come into play such as timing of donations and length of the project period. For example, the value of ten years of donated maintenance on a project that has a project period of five years would not be fully allowable as cost share. Only the value for the five years of donated maintenance that corresponds to the project period is allowable and may be counted as cost share.

Additionally, EERE generally does not allow pre-award costs for either cost share or reimbursement when these costs precede the signing of the appropriation bill that funds the award. In the case of a competitive award, EERE generally does not allow pre-award costs prior to the signing of the Selection Statement by the EERE Selection Official.

General Cost Sharing Rules on a DOE award

1. Cash Cost Share - encompasses all contributions to the project made by the recipient or subrecipeint(s), for costs incurred and paid for during the project. This includes when an organization pays for personnel, supplies, equipment, etc. for their own company with organizational resources. If the item or service is reimbursed for, it is cash cost share. All cost share items must be necessary to the performance of the project.

2. In Kind Cost Share - encompasses all contributions to the project made by the recipient or subrecipient(s) that do not involve a payment or reimbursement and represent donated items or services. In Kind cost share items include volunteer personnel hours, donated existing equipment, donated existing supplies, etc. The cash value and calculations thereof for all In Kind cost share items must be justified and explained in the Cost Share section of the project Budget Justification (EERE 335). All cost share items must be necessary to the performance of the project. If questions exist, consult your DOE contact before filling out the In Kind cost share section of the Budget Justification (EERE 335).

3. Funds from other Federal sources MAY NOT be counted as cost share. This prohibition includes FFRDC sub-recipients. Non-Federal sources include any source not originally derived from Federal funds. Cost sharing commitment letters from subrecipients must be provided with the original application.

4. Fee or profit, including foregone fee or profit, are not allowable as project costs (including cost share) under any resulting award. The project may only incur those costs that are allowable and allocable to the project (including cost share) as determined in accordance with the applicable cost principles prescribed in FAR Part 31 for For-Profit entities and 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

DOE Financial Assistance Rules 2 CFR Part 200 as amended by 2 CFR Part 910

As stated above, the rules associated with what is allowable cost share are generally the same for all types of organizations. Following are the rules found to be common, but again, the specifics are contained in the regulations and cost principles specific to the type of entity:

(A) Acceptable contributions. All contributions, including cash contributions and third party in-kind contributions, must be accepted as part of the Prime Recipient's cost sharing if such contributions meet all of the following criteria:

(1) They are verifiable from the recipient's records.

(2) They are not included as contributions for any other federally-assisted project or program.

(3) They are necessary and reasonable for the proper and efficient accomplishment of project or program objectives.

(4) They are allowable under the cost principles applicable to the type of entity incurring the cost as follows:

a. For-profit organizations. Allowability of costs incurred by for-profit organizations and those nonprofit organizations listed in Attachment C to OMB Circular A–122 is determined in accordance with the for-profit cost principles in 48 CFR Part 31 in the Federal Acquisition Regulation, except that patent prosecution costs are not allowable unless specifically authorized in the award document. (v) Commercial Organizations. FAR Subpart 31.2—Contracts with Commercial Organizations

b. Other types of organizations. For all other non-federal entities, allowability of costs is determined in accordance with 2 CFR Part 200 Subpart E.

(5) They are not paid by the Federal Government under another award unless authorized by Federal statute to be used for cost sharing or matching.

(6) They are provided for in the approved budget.

(B) Valuing and documenting contributions

(1) Valuing recipient's property or services of recipient's employees. Values are established in accordance with the applicable cost principles, which mean that amounts chargeable to the project are determined on the basis of costs incurred. For real property or equipment used on the project, the cost principles authorize depreciation or use charges. The full value of the item may be applied when the item will be consumed in the performance of the award or fully depreciated by the end of the award. In cases where the full value of a donated capital asset is to be applied as cost sharing or matching, that full value must be the lesser or the following:

a. The certified value of the remaining life of the property recorded in the recipient's accounting records at the time of donation; or
b. The current fair market value. If there is sufficient justification, the Contracting Officer may approve the use of the current fair market value of the donated property, even if it exceeds the certified value at the time of donation to the project. The Contracting Officer may accept the use of any reasonable basis for determining the fair market value of the property.

(2) Valuing services of others' employees. If an employer other than the recipient furnishes the services of an employee, those services are valued at the employee's regular rate of pay, provided these services are for the same skill level for which the employee is normally paid.

(3) Valuing volunteer services. Volunteer services furnished by professional and technical personnel, consultants, and other skilled and unskilled labor may be counted as cost sharing or matching if the service is an integral and necessary part of an approved project or program. Rates for volunteer services must be consistent with those paid for similar work in the recipient's organization. In those markets in which the required skills are not found in the recipient organization, rates must be consistent with those paid for similar work in the labor market in which the recipient competes for the kind of services involved. In either case, paid fringe benefits that are reasonable, allowable, and allocable may be included in the valuation.

(4) Valuing property donated by third parties.

a. Donated supplies may include such items as office supplies or laboratory supplies. Value assessed to donated supplies included in the cost sharing or

matching share must be reasonable and must not exceed the fair market value of the property at the time of the donation.

b. Normally only depreciation or use charges for equipment and buildings may be applied. However, the fair rental charges for land and the full value of equipment or other capital assets may be allowed, when they will be consumed in the performance of the award or fully depreciated by the end of the award, provided that the Contracting Officer has approved the charges. When use charges are applied, values must be determined in accordance with the usual accounting policies of the recipient, with the following qualifications:

   i. The value of donated space must not exceed the fair rental value of comparable space as established by an independent appraisal of comparable space and facilities in a privately-owned building in the same locality.
   ii. The value of loaned equipment must not exceed its fair rental value.

(5) Documentation. The following requirements pertain to the recipient's supporting records for in-kind contributions from third parties:

a. Volunteer services must be documented and, to the extent feasible, supported by the same methods used by the recipient for its own employees.

The basis for determining the valuation for personal services and property must be documented.

X. Appendix B – Sample Cost Share Calculation for Blended Cost Share Percentage

The following example shows the math for calculating required cost share for a project with $2,000,000 in Federal funds with four tasks requiring different Non-federal cost share percentages:

Task	Proposed Federal Share	Federal Share %	Recipient Share %
Task 1 (R&D)	$1,000,000	80%	20%
Task 2 (R&D)	$500,000	80%	20%
Task 3 (Demonstration)	$400,000	50%	50%
Task 4 (Outreach)	$100,000	100%	0%

Federal share ($) divided by Federal share (%) = Task Cost

Each task must be calculated individually as follows:

Task 1
$1,000,000 divided by 80% = $1,250,000 (Task 1 Cost)
Task 1 Cost minus federal share = Non-federal share
$1,250,000 - $1,000,000 = $250,000 (Non-federal share)

Task 2
$500,000 divided 80% = $625,000 (Task 2 Cost)
Task 2 Cost minus federal share = Non-federal share
$625,000 - $500,000 = $125,000 (Non-federal share)

Task 3
$400,000 / 50% = $800,000 (Task 3 Cost)
Task 3 Cost minus federal share = Non-federal share
$800,000 - $400,000 = $400,000 (Non-federal share)

Task 4
Federal share = $100,000
Non-federal cost share is not mandated for outreach = $0 (Non-federal share)

The calculation may then be completed as follows:

Tasks	$ Federal Share	% Federal Share	$ Non-Federal Share	% Non-Federal Share	Total Project Cost
Task 1	$1,000,000	80%	$250,000	20%	$1,250,000
Task 2	$500,000	80%	$125,000	20%	$625,000
Task 3	$400,000	50%	$400,000	50%	$800,000
Task 4	$100,000	100%	$0	0%	$100,000
Totals	$2,000,000		$775,000		$2,775,000

Blended Cost Share %
Non-federal share ($775,000) divided by Total Project Cost ($2,775,000) = 27.9% (Non-federal)
Federal share ($2,000,000) divided by Total Project Cost ($2,775,000) = 72.1% (Federal)

XI. Appendix C – Waiver Requests: Foreign Entity Participation as the Prime Recipient and Performance of Work in the United States

1. Waiver for Foreign Entity Participation as the Prime Recipient

As set forth in Section III.A.3, all Prime Recipients receiving funding under this FOA must be incorporated (or otherwise formed) under the laws of a State or territory of the United States. To request a waiver of this requirement, an applicant must submit an explicit waiver request in the Full Application.

Overall, the applicant must demonstrate to the satisfaction of EERE that it would further the purposes of this FOA and is otherwise in the economic interests of the United States to have a foreign entity serve as the Prime Recipient. A request to waive the *Foreign Entity Participation as the Prime Recipient* requirement must include the following:

- Entity name;
- The rationale for proposing a foreign entity to serve as the Prime Recipient;
- Country of incorporation;
- A description of the project's anticipated contributions to the US economy;
    - How the project will benefit U.S. research, development and manufacturing, including contributions to employment in the U.S. and growth in new markets and jobs in the U.S.;
    - How the project will promote domestic American manufacturing of products and/or services;
- A description of how the foreign entity's participation as the Prime Recipient is essential to the project;
- A description of the likelihood of Intellectual Property (IP) being created from the work and the treatment of any such IP;
- Countries where the work will be performed (Note: if any work is proposed to be conducted outside the U.S., the applicant must also complete a separate request for waiver of the Performance of Work in the United States requirement).

EERE may require additional information before considering the waiver request.

The applicant does not have the right to appeal EERE's decision concerning a waiver request.

2. Waiver for Performance of Work in the United States

As set forth in Section IV.J.3, all work under EERE funding agreements must be performed in the United States. This requirement does not apply to the purchase of supplies and equipment, so a waiver is not required for foreign purchases of these items. However, the Prime Recipient should make every effort to purchase supplies and equipment within the United States. There may be limited circumstances where it is in the interest of the project to perform a portion of the work outside the United States. To seek a waiver of the Performance of Work in the United States requirement, the applicant must submit an explicit waiver request in the Full Application. A separate waiver request must be submitted for each entity proposing performance of work outside of the United States.

Overall, a waiver request must demonstrate to the satisfaction of EERE that it would further the purposes of this FOA and is otherwise in the economic interests of the United States to perform work outside of the United States. A request to waive the *Performance of Work in the United States* requirement must include the following:

- The rationale for performing the work outside the U.S. ("foreign work");
- A description of the work proposed to be performed outside the U.S.;
- An explanation as to how the foreign work is essential to the project;
- A description of the anticipated benefits to be realized by the proposed foreign work and the anticipated contributions to the US economy;
    - The associated benefits to be realized and the contribution to the project from the foreign work;
    - How the foreign work will benefit U.S. research, development and manufacturing, including contributions to employment in the U.S. and growth in new markets and jobs in the U.S.;
    - How the foreign work will promote domestic American manufacturing of products and/or services;
- A description of the likelihood of Intellectual Property (IP) being created from the foreign work and the treatment of any such IP;
- The total estimated cost (DOE and Recipient cost share) of the proposed foreign work;
- The countries in which the foreign work is proposed to be performed; and
- The name of the entity that would perform the foreign work.

EERE may require additional information before considering the waiver request.

The applicant does not have the right to appeal EERE's decision concerning a waiver request.

XII. Appendix D - Data Management Plan

A data management plan ("DMP") explains how data generated in the course of the work performed under an EERE award will be shared and preserved or, when justified, explains why data sharing or preservation is not possible or scientifically appropriate.

DMP Requirements

In order for a DMP to be considered acceptable, the DMP must address the following:

At a minimum, the DMP must describe how data sharing and preservation will enable validation of the results from the proposed work, or how results could be validated if data are not shared or preserved.

The DMP must provide a plan for making all research data displayed in publications resulting from the proposed work digitally accessible at the time of publication. This includes data that are displayed in charts, figures, images, etc. In addition, the underlying digital research data used to generate the displayed data should be made as accessible as possible in accordance with the principles stated above. This requirement could be met by including the data as supplementary information to the published article, or through other means. The published article should indicate how these data can be accessed.

The DMP should consult and reference available information about data management resources to be used in the course of the proposed work. In particular, a DMP that explicitly or implicitly commits data management resources at a facility beyond what is conventionally made available to approved users should be accompanied by written approval from that facility. In determining the resources available for data management at DOE User Facilities, researchers should consult the published description of data management resources and practices at that facility and reference it in the DMP. Information about other DOE facilities can be found in the additional guidance from the sponsoring program.

The DMP must protect confidentiality, personal privacy, Personally Identifiable Information, and U.S. national, homeland, and economic security; recognize proprietary interests, business confidential information, and intellectual property rights; avoid significant negative impact on innovation, and U.S. competitiveness; and otherwise be consistent with all laws (i.e., export control laws), and DOE regulations, orders, and policies.

Data Determination for a DMP

The Principal Investigator should determine which data should be the subject of the DMP and, in the DMP, propose which data should be shared and/or preserved in accordance with the DMP Requirements noted above.

For data that will be generated through the course of the proposed work, the Principal Investigator should indicate what types of data should be protected from immediate public disclosure by DOE (referred to as "protected data") and what types of data that DOE should be able to release immediately. Similarly, for data developed outside of the proposed work at private expense that will be used in the course of the proposed work, the Principal Investigator should indicate whether that type of data will be subject to public release or kept confidential (referred to as "limited rights data"). Any use of limited rights data or labeling of data as "protected data" must be consistent with the DMP Requirements noted above.

Suggested Elements for a DMP

The following list of elements for a DMP provides suggestions regarding the data management planning process and the structure of the DMP:

Data Types and Sources: A brief, high-level description of the data to be generated or used through the course of the proposed work and which of these are considered digital research data necessary to validate the research findings or results.

Content and Format: A statement of plans for data and metadata content and format including, where applicable, a description of documentation plans, annotation of relevant software, and the rationale for the selection of appropriate standards. Existing, accepted community standards should be used where possible. Where community standards are missing or inadequate, the DMP could propose alternate strategies for facilitating sharing, and should advise the sponsoring program of any need to develop or generalize standards.

Sharing and Preservation: A description of the plans for data sharing and preservation. This should include, when appropriate: the anticipated means for sharing and the rationale for any restrictions on who may access the data and under what conditions; a timeline for sharing and preservation that addresses both the minimum length of time the data will be available and any anticipated delay to data access after research findings are published; any special requirements for data sharing, for example, proprietary software needed to access or interpret data, applicable policies, provisions, and licenses for re-use and re-distribution, and for the production of derivatives, including guidance for how data and data products should be cited; any resources and capabilities (equipment, connections,

systems, software, expertise, etc.) requested in the research proposal that are needed to meet the stated goals for sharing and preservation (this could reference the relevant section of the associated research proposal and budget request); and whether/where the data will be preserved after direct project funding ends and any plans for the transfer of responsibilities for sharing and preservation.

Protection: A statement of plans, where appropriate and necessary, to protect confidentiality, personal privacy, Personally Identifiable Information, and U.S. national, homeland, and economic security; recognize proprietary interests, business confidential information, and intellectual property rights; and avoid significant negative impact on innovation, and U.S. competitiveness.

Rationale: A discussion of the rationale or justification for the proposed data management plan including, for example, the potential impact of the data within the immediate field and in other fields, and any broader societal impact.

Additional Guidance

In determining which data should be shared and preserved, researchers must consider the data needed to validate research findings as described in the Requirements, and are encouraged to consider the potential benefits of their data to their own fields of research, fields other than their own, and society at large.

DMPs should reflect relevant standards and community best practices and make use of community accepted repositories whenever practicable.

Costs associated with the scope of work and resources articulated in a DMP may be included in the proposed research budget as permitted by the applicable cost principles.

To improve the discoverability of and attribution for datasets created and used in the course of research, EERE encourages the citation of publicly available datasets within the reference section of publications, and the identification of datasets with persistent identifiers such as Digital Object Identifiers (DOIs). In most cases, EERE can provide DOIs free of charge for data resulting from DOE-funded research through its Office of Scientific and Technical Information (OSTI) DataID Service.

EERE's Digital Data Management principles can be found at: EERE Digital Data Management | Department of Energy

Definitions

Data Preservation: Data preservation means providing for the usability of data beyond the lifetime of the research activity that generated them.

Data Sharing: Data sharing means making data available to people other than those who have generated them. Examples of data sharing range from bilateral communications with colleagues, to providing free, unrestricted access to anyone through, for example, a web-based platform.

Digital Research Data: The term digital data encompasses a wide variety of information stored in digital form including: experimental, observational, and simulation data; codes, software and algorithms; text; numeric information; images; video; audio; and associated metadata. It also encompasses information in a variety of different forms including raw, processed, and analyzed data, published and archived data.

Research Data: The recorded factual material commonly accepted in the scientific community as necessary to validate research findings, but not any of the following: preliminary analyses, drafts of scientific papers, plans for future research, peer reviews, or communications with colleagues. This 'recorded' material excludes physical objects (e.g., laboratory samples). Research data also do not include:

> (A) Trade secrets, commercial information, materials necessary to be held confidential by a researcher until they are published, or similar information which is protected under law; and
>
> (B) Personnel and medical information and similar information the disclosure of which would constitute a clearly unwarranted invasion of personal privacy, such as information that could be used to identify a particular person in a research study."

Validate: In the context of DMPs, validate means to support, corroborate, verify, or otherwise determine the legitimacy of the research findings. Validation of research findings could be accomplished by reproducing the original experiment or analyses; comparing and contrasting the results against those of a new experiment or analyses; or by some other means.

XIII. Appendix E – Modeling Gaps

1. High-Value Gaps

High-Value Gaps are those areas for which the value of a given modeling enhancement is generally accepted by most hydro industry stakeholders (e.g., few would argue against doing a better job of using hydrologic models to improve hydro generation dispatch, and preliminary research has shown that this is an area that could benefit from additional investment).

- Electricity system modeling tools with detailed representations of PSH facility operational characteristics, performance, and cost. Of particular interest is flexibility characterization for alternate PSH configurations and site characteristics. Model types could include production-cost, capacity-expansion, stability, and power flow models.
- Modeling tools that use tight couplings between hydrology/hydropower models and power system models to enable analysis that includes a high level of detail in PSH systems, hydrological systems, and the broader electric grid.
- Sub-hourly operations modeling capabilities that capture dynamics of variable renewables, load, and PSH systems.
- Improved ability to co-plan generation and transmission assets to better characterize the value and relationship between PSH and transmission expansions.
- Stochastic capabilities in operations and planning models to incorporate variability of system needs and PSH opportunities on daily, monthly, or longer time scales. Variable and uncertain system needs could result from factors such as uncertain renewable energy production, load, demand response, and hydrology conditions.
- Tools for improved quantification of non-power value streams for PSH, and implementation of these value streams in planning techniques.
- Planning models that can utilize long (multidecade) planning horizons that better incorporate long-term value of PSH.
- Models that incorporate more detailed and accurate representations of electricity market rules and structures that do or could provide value streams and market opportunities for PSH, such as an improved representation of the value of regulation, inertia, or voltage support.

2. Uncertain-Value Gaps

Uncertain-Value Gaps are topic areas that where a given model enhancement is believed to add value; however, the value has not yet been demonstrated or is not widely accepted. As an example, many believe that hydro is helpful in regard to system resilience; however, there is limited research substantiating this point. For proposals related to "uncertain-value" gaps (a few examples are listed below), the proposal should clearly demonstrate why the research team thinks a given gap is important as well as how they plan to investigate their claim.

- Power system models that directly incorporate improved representation of PSH non-power constraints, including environmental and other regulatory requirements.
- Improved solution algorithms to optimize PSH operation within an electricity system optimization framework. Algorithms would enable detailed characterization of PSH operating characteristics within a scalable modeling framework appropriate for representing realistic systems, all while maintaining acceptable computation time.
- Lifecycle approaches to assessing PSH value, both for power and non-power uses.
- Analysis methods and tools that will provide market operators the full storage context rather than just energy and ancillary service bids.
- Methods for assessing the value of PSH for system reliability.
- Tools to directly assess the value of PSH to provide secondary frequency response (i.e., automatic generation control). Most tools capture AGC provisioning but do not estimate how much secondary frequency response will be deployed.
- Methods for assessing the value of PSH for system resilience.
- Tools to assess the effect of electricity market structure on PSH value and performance. Capabilities would allow study of both vertically integrated and restructured markets with alternative rule sets.
- Representations for modeling ternary and variable-speed pumped storage hydro in dynamic studies (e.g., PSLF- or PSSE-based studies).
- Tools that provide an estimate of the amount of flexibility needed for a given amount of net load variability (i.e., given a known amount of variable generation).
- Methodologies for accurately representing the transition from generating to pumping modes (and vice versa) pumped storage hydro. Mode switching may take several minutes, it is appropriate to model generating and pumping modes separately for dynamic studies.
- Tools that provide forward-looking capacity prices (e.g., expected capacity prices for 2020, 2030, etc.).