U.S. Department of Energy
Office of Critical Minerals and Energy Innovation
Office of Energy Technology
Hydropower Program
NATIONAL LABORATORY CALL FOR PROPOSALS

Streamlining Hydropower Permitting

This Lab Call is being issued by the U.S. Department of Energy's (DOE) Office of Critical Minerals and Energy Innovation (CMEI) Hydropower Program.

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I. Lab Call Description

A. Background and Context

i. Overview

The Hydropower Program is issuing this Streamlining Hydropower Permitting Lab Call for Fiscal Year 2026 (FY26). The program administers a broad portfolio of activities to strengthen the body of technical knowledge and support industry efforts to develop, demonstrate, and deploy hydropower technologies. The research and development activities to be funded under this lab call will support the Hydropower Program in improving hydropower and pumped storage environmental performance and streamlining hydropower permitting and relicensing through innovation in applied sciences including fish passage, environmental monitoring, and effective mitigation technologies.

The Hydropower Program anticipates projects selected for funding from this call for proposals to be forward funded for the full project length.

ii. Timeline and Process Logistics

Timeline:

KEY DATES	
Open Lab Call Date:	March 9, 2026 5:00 PM EST
PROPOSAL DEADLINE AND DECISION DATES[1]	
Concept Slide Due Date:	April 2, 2026 5:00 PM EST • Submit to lab specific **"Streamlining Hydropower Permitting Lab Call/Concept Slides"** folder in H2O & National Labs Sharepoint by 5:00 PM Eastern Standard Time
Confirm Submissions Received with LRMs Date:	April 6 & 7, 2026
Pitch Session Dates:	April 13, 14, & 15, 2026

	• Hydropower Program sign-up sheet, by appointment. • Signup for Concept Pitches
Encourage/Discourage Response to Lab Date:	April 20, 2026 5:00 PM EST
Full Application Open Date:	April 20, 2026 5:00 PM EST
Full Application Close Date:	May 22, 2026 5:00 PM EST • Submit to lab specific **“Streamlining Hydropower Permitting Lab Call/Final Applications”** folder in H2O & National Labs Sharepoint by 5:00 PM Eastern Standard Time
Hydropower Program Sends Reviewer Comments to Labs Date:	June 30, 2026 5:00 PM EST
Labs Response to Reviewer Comments Due Date:	July 6, 2026 5:00 PM EST
Announce Selections:	July 10, 2026 5:00 PM EST

[1]Dates subject to change

Process Logistics:

All topics in this Streamlining Hydropower Permitting Lab Call will be competitively allocated. Topics will build on both existing efforts as well as solicit new projects that address the scientific and technical challenges relevant to the expansion of next-generation hydropower and modernization of the existing fleet to ensure a viable pathway for licensing.

- Proposals may overlap with other projects and activities in the Hydropower Program only if they provide pathways to improve environmental performance or reduce costs and timelines for permitting.
- Previous performance on projects and the suitability of the PI and project team will be considered in the selection process.
- Lab call guidance and templates will be accessible in eXCHANGE as well as on the H2O & National Labs SharePoint system. These documents can be found in each lab-specific team’s folders under ‘Streamlining Hydropower Permitting Lab Call’.
- All Lab Call Concept Slides and Full Applications will be submitted through the H2O & National Labs Sharepoint system, as outlined below.
- For partnerships and project teams,

- Partnerships between labs are encouraged where they support the technical merit, project approach, and team suitability of the project. Refer to individual topics and subtopics within this document to determine specific multi-lab partnership requirements.
    - Proposals that include partnerships outside of the national labs, such as industry and agency partnerships, are strongly encouraged or are required for some topics. These collaborations must include a letter of commitment from each external party which indicates the amount of time and budget they will allocate to the project, and where appropriate identify project participants.
    - Roles, responsibilities, effort and budget of all lab team members must be clearly defined in proposals by tasks.
    - For selected proposals, if the project PI or team members or scope substantially changes from what was reviewed in the proposal post-selections, the Hydropower Program reserves the right to terminate the selection.
- As appropriate by subtopic, labs are expected to identify whether any data resources involved in the proposal exist and/or will be collected during the project and to identify minimum data quality and accessibility metrics.
- **For concept slide decks and pitch sessions:**
    - **A concept slide deck *is required* to be eligible to submit a full proposal.**
    - Labs may submit three concept slide decks per subtopic, excluding Topics 6 (Partnering with MOU fed agencies and Norway Subtopics) and Topic 8 (Open Topic), this includes multi lab projects. Labs may submit five concept slide decks per subtopic 6.1, 6.2 and for Open Topic 8.
    - All labs are eligible for being partners on multi lab work. ANL, INL, ORNL, PNNL, LBNL, LANL, NLR, SNL and SLAC
    - A concept slide template will be provided through eXCHANGE and in lab specific **"Streamlining Hydropower Permitting Lab Call/Concept Slides"** folder in H2O & National Labs Sharepoint. Pitch length should be no more than 15 minutes.
    - Slide submissions can include a maximum of 5 slides and must include the information reflected in the template.
    - Feedback on concept slide decks will be provided verbally in informal feedback sessions, where labs pitch their concept slide decks but final decision and overall comments on the concepts will be communicated in writing after the pitch sessions.
    - Concept slides should be submitted to the lab specific **"Streamlining Hydropower Permitting Lab Call/Concept Slides"** folder in H2O & National Labs Sharepoint by 5:00 PM Eastern Standard Time on April 2, 2026. Please use .pptx format and title files according to "Lead laboratory – Subtopic - Short title". For example, "LAB – 2.1 – Basin-scale Example Project.pptx".
    - **Use the following link to schedule an informal feedback session for concept pitches:** Signup for Concept Pitches
    - The Hydropower Program will provide scores 1, 0, and –1 to all concepts to the LRMs for all concepts by 5:00 PM Eastern Standard Time on April 20, 2026.

- **For full applications:**
    - Labs may submit one full application per subtopic, excluding Topics 6 (Partnering with MOU fed agencies and Norway Subtopics) and Topic 8 (Open Topic), this includes multi lab projects.
    - Labs may submit three full applications per subtopic 6.1, 6.2 and for Open Topic 8.
    - All labs are eligible for being partners on multi lab work. ANL, INL, ORNL, PNNL, LBNL, LANL, NLR, SNL and SLAC
    - All full applications are limited to 8 pages excluding the cover page, references, letters of commitment, resumes, and project planning tables and Gantt charts. Applicants are required to follow template provided through eXCHANGE and in the lab specific **"Streamlining Hydropower Permitting Lab Call/Final Applications"** folder in H2O & National Labs Sharepoint.
    - Full applications should be submitted through lab specific **"Streamlining Hydropower Permitting Lab Call/Final Applications"** folder in H2O & National Labs Sharepoint by 5:00 PM Eastern Standard Time on May 22, 2026. Please use .docx format and title files according to "Lead laboratory - Subtopic - Short title". For example, "LAB – 2.1 – Basin-scale Example Project.docx".

Applicants are responsible for meeting the submission deadlines. DOE strongly encourages all applicants to submit the required information at least 24 hours in advance of the submission deadline.

- Questions During Open Lab Call Period:
    - Specific questions about this Lab Call should be submitted through Streamlining Hydropower Permitting Lab Call Q&A Form
- Response to Merit Reviewer Comments:
    - Reviewer comments will be emailed to LRMs to distribute to applicants for response on June 30, 2026 by 5:00 PM Eastern Standard Time.
    - Labs response to reviewer comments should be emailed back by LRMs by 5:00 PM Eastern Standard Time on July 6, 2026.
- Notification of Selection:
    - Lab LRMs will receive an email from the Hydropower Program with final selections by 5:00 PM Eastern Standard Time on July 10, 2026.

B. Key Considerations, Full Application Review Criteria, and Topic Areas

i. Key Considerations

- **AVAILABLE FUNDING:** There is approximately **$5.45M in total funding** available to fund projects solicited in this Lab Call pending appropriations, program direction, and go/no-go decision points. Meritorious proposals over this amount may be selected for funding with additional funds pending enacted budget and the Hydropower Program's discretion.

- **ELIGIBILITY:** All DOE/National Nuclear Security Agency (NNSA) Federally Funded Research and Development Centers (FFRDCs), and all National Laboratories, are eligible to submit proposals as prime awardees. Please refer to specific eligibility under subtopic guidance. Proposals that involve more than one laboratory are also allowed.

- **DOE NATIONAL LABORATORY GUIDING PRINCIPLES:** To ensure continued alignment with lab engagement principles, applicants should consider the following when developing their proposals:
    - The Hydropower Program encourages projects that involve two or more labs.
    - To the extent possible and appropriate, the Hydropower Program seeks lab projects that involve industry engagement or industry partners.

ii. Full Application Review Criria

Application Evaluation Criteria:

- Technical merit (50%): The proposed work is clearly innovative and important, the proposal explains how it builds on past work and/or scientific principles, it is clear how the proposed work will benefit the broader community. This criterion will be evaluated primarily based on sections 1: Problem Statement, and 2: Objectives and Project Description in the Application Template.
- Project approach (40%): The applicant clearly describes the project structure/approach, and the project approach is appropriate to meet the identified objectives. This criterion will be evaluated primarily based on section 3: Project Structure/Approach in the Application Template.
- Research Team suitability (10%): The applicant has the qualifications, experience, capabilities, and other resources (e.g., equipment, personnel, partnerships, etc.) necessary to complete the proposed project. For projects with external partners, the applicant has submitted strong letters of commitment. This criterion will be evaluated primarily based on section 4 of the full application template.

Program Policy Factors:

In addition to the results of the merit review, which will follow the criteria listed above, the Hydropower Program may also consider program policy factors in making selection decisions. These factors may include, but are not limited to:

- Previous project performance by the principal investigator, team, or national laboratory.
- Avoiding duplication of existing or previous work.
- Coordination with other Hydropower Program, DOE, or government efforts and leveraging of external resources for greater impacts.
- Geographic distribution of projects.

iii. Lab Call: Topic Areas At-a-Glance

Subtopic #	Title	Anticipated # of awards	Total Estimated Funding per Project per Year
1.1	Pumped Storage Research to Support Siting and Impacts Assessments	0-3	250k
2.1	Cumulative Impacts Tools and Technologies for Relicensing	1	500k
3.1	Technology Catalog for Industry	1	350k
4.1	Hydropower Recreational Benefits Dataset	1	300k
5.1	Mitigation and Compliance Solutions	2-4	250k
5.2	Bioindexes to Support Hydropower Permitting and Compliance	1	250k
5.3	Fish Passage Mitigation	1	750k
6.1	Technical Support to Hydropower Owner/Operators and Tribes	0-4	250k
6.2	Norway MOU collaborations	0-3	125k
7	Understanding Hydropower Social Dimensions Challenges Through Novel Research	0-2	500k
8	Open Topic	0-3	450k

iv. Topic Area Descriptions

Topic 1: Hydropower Permitting Toolkits: Development of information and tools for hydropower and pumped storage hydropower assessments and siting

SUBTOPIC 1.1. PUMPED STORAGE RESEARCH TO SUPPORT SITING AND IMPACTS ASSESSMENTS

Background: Streamlining permitting and licensing is necessary for accelerating the development of pumped storage hydropower (PSH) in the United States, particularly given the rapid growth in project proposals. Despite the U.S. having 43 PSH plants accounting for 96% of utility-scale energy storage capacity in 2022, and a development pipeline that surged to 96 projects in 2022 from 67 in 2019, none are currently under construction (Market Report 2023, ORNL). This stagnation points to significant permitting and licensing hurdles, intertwined with challenges such as high costs, complex siting, water resource and rights issues, and cultural and environmental impacts. To combat environmental and cost barriers to PSH expansion, there is a need for the development of tools and information. These tools are used to screen project sites, to identify environmental impacts and mitigation methods early to inform costs and risk evaluations, and to identify and remove topics that are not relevant from discussions to focus conversations. The ultimate use case supports identification of solutions to avoid, reduce or mitigate impacts and clarifies stakeholder concerns, data needs, and studies to ensure a streamlined process for permitting. Identifying of risks and stakeholder perceptions of environmental impacts and project nexus early reduces time and takes studies requests that are not relevant off the table.

The Hydropower Program has actively addressed environmental knowledge gaps and supported PSH development by sponsoring comparative analyses of environmental impacts for both open-loop (connected continually to a flowing water body) and closed-loop (not connected continually to a flowing water body) PSH designs (Saulsbury 2020), and assessing known environmental impacts and mitigation strategies for closed-loop PSH across U.S. and global studies (Pracheil et al. 2025). These efforts align with the Federal Energy Regulatory Commission's 2019 guidance, which noted the potential for more rapid development of closed-loop PSH (FERC 2019 guidance). Further, the Hydropower Program HydroWIRES portfolio has investigated the technical potential and provided information to support PSH development in the U.S., evidenced by tools such as the NLR Pumped Storage Hydropower Supply Curves Tool, ANL PSH Valuation Tool, NLR Technical Resource Mapping: Pumped Storage Hydropower, and ANL Geospatial Energy Mapper: Geospatial Energy Mapper (GEM). Industry interest spans a range of designs, including open- and closed-loop, and "add-on" (involves use of an existing hydropower facility and the construction of upper reservoir) PSH, all of which face complex regulatory navigation. To address these PSH interest areas, additional resources are needed to reduce barriers to deployment and streamline environmental assessments within the permitting and licensing framework to maximize benefits for interested communities and avoid impacts.

Subtopic Goals: Development of tools and information to inform and streamline environmental assessments and the siting of PSH that leverages and builds upon Hydropower Program investments and tools. Develop interdisciplinary teams to collaborate on pumped storage environmental assessments and siting work.

- Eligibility: ANL, INL, NLR, ORNL, PNNL
- Proposed annual budget not to exceed: $250K
- Estimated Number of Projects: 0-3
- Estimated Project Duration: 1-2 years

Subtopic Guidance: The Hydropower Program will consider proposals for datasets, tools, or regional analyses that clearly communicate unique added value for pumped storage siting and other environmental impacts assessments (e.g., social science, geospatial planning tools, address tribal concerns, guide developers towards use of brownfield or lower environmental/ social impacts sites, etc.). Proposals must build on previous Hydropower Program efforts, communicate unique value of a specific research gap and explore topics beyond technical potential that are barriers to deployment of PSH including those related to permitting and licensing.

Topic 2: Improving estimates of downstream fish passage performance to increase permitting efficiency

SUBTOPIC 2.1 CUMULATIVE IMPACTS TOOLS AND TECHNOLOGIES FOR RELICENSING

Background: During hydropower permitting, information on the risks and impacts to fish from different routes of passage are rigorously reviewed and agencies with mandatory conditioning authority may make recommendations for project protection, mitigation and enhancement measures. The role of different types of fishways, deployed or potential hydropower mitigation technologies, and fish traits are central to providing context to impacts assessments and the resulting requirements built into permits. Impacts assessments and requirements for hydropower are site specific but consider context of management and restoration goals for fish populations and larger systems including systems with multiple dams or sites with multiple stressors. Improved tools for fish population risk assessments and impacts evaluations are needed to better detect and understand the role of cumulative impacts and advance fish management and restoration.

- Eligibility: ANL, INL, NLR, ORNL, PNNL
- Proposed annual budget not to exceed: $500K
- Estimated Number of Projects Expected: 1
- Estimated Project Duration: 2-3 years

Subtopic Goal: Advance science to support fish passage cumulative impacts assessments and to provide context relevant to hydropower permitting and decision making.

Subtopic Guidance: Proposals in this area should identify and advance monitoring tools, technologies, and/ or models which will aid in evaluation of cumulative impacts at sites and enable transparent and scientifically defensible methods to relate information from sites undergoing environmental reviews to include multiple stressors or larger scale assessments. Proposals must show how work will support decision making and inform established hydropower permitting processes or studies to reduce costs or time of assessments.

Topic 3: Information and standards development to support industry in the adoption of hydropower turbines designed for fish passage and innovative technologies

SUBTOPIC 3.1. TECHNOLOGY CATALOG FOR INDUSTRY

Background: Fish passage requirements are an integral component of the regulatory framework for hydropower projects. There is a need to simultaneously acknowledge environmental concerns while prioritizing the identification and implementation of efficient, cost-effective fish passage solutions that minimize regulatory burdens and facilitate the timely deployment of hydropower resources. Although a variety of novel monitoring tools and fish passage and protection technologies have been successfully tested and applied (e.g., advanced turbines and experimental fishways to eDNA and artificial intelligence for species detection), industry remains challenged by the inherent risks, outcome uncertainties, and costs associated with these experimental technologies, as well as the demands for site-specific information and assessment needs.

- Eligibility: NLR, ORNL, PNNL
- Proposed annual budget not to exceed: $350K
- Estimated Number of Projects Expected: 1
- Estimated Project Duration: 2 years

Subtopic Goals: Develop a set of plain language information resources to support industry and decision-makers in understanding the state of the science and technology for fish passage. Catalog the status of available hydropower monitoring and fish passage technologies to communicate the state-of-the-art, technology readiness and applications, and considerations for targeted uses that support efficient and cost-effective compliance. Additionally, conduct horizon scanning reviews for high-interest development technologies to identify R&D gaps, clarify the current state of science and technology, and inform future R&D pathways that can reduce industry risk, uncertainty, and address site-specific assessment needs for improved regulatory outcomes.

Subtopic Guidance: The Hydropower Program seeks a proposal to develop plain language information that supports industry for the selection of advanced technologies including 1) turbines that reduce harm to fish (e.g., fish-friendly turbines, fish safe turbines, environmentally enhanced turbines, etc.) for hydropower sites where risk to entrained fish has been identified, 2) multispecies passage technologies for systems where selective passage (native vs invasive community guidance) is a goal, 3) eel passage methods, and 4) other topics of interest to industry that will be defined in collaboration with the Hydropower Program and industry. Example proposals of interest may seek to bundle information from science into fact sheets, process charts, or guidance or may include reporting. Proposals should describe processes and procedures and must build on previous DOE-funded work and scientific literature. Resources should serve as quick guides to point parties towards what is available now or to clarify potential requirements to apply technologies post testing and where adaptive management may be beneficial.

Topic 4: Mapping information from the permitting record to support hydropower relicensing

SUBTOPIC 4.1. HYDROPOWER RECREATIONAL BENEFITS DATASET

Background: Recreation is a significant and actively considered aspect of the hydropower permitting and licensing process, particularly under the Federal Energy Regulatory Commission (FERC), which mandates that recreation be considered alongside energy production, fish and wildlife protection, and environmental quality. Therefore, to secure and maintain operational licenses, hydropower project developers often plan for, integrate, and manage recreational facilities and public access, involving both stakeholder consultation and environmental assessments.

Hydropower rivers and reservoir impoundments serve multiple recreational (e.g., boating, rafting, fishing, swimming, etc.) and other uses. Depending on their operation, hydropower facilities can either positively or negatively impact the diverse recreational interests in these areas. While information on the location, types, and user groups of recreational interests is limited in some areas, national NGOs and local community groups are strong advocates of operational outcomes that support their recreational interests. Conflicts can arise over conditions that affect both recreation and environmental quality, particularly those pertaining to instream flows, peaking operations, and reservoir or stream levels.

- Eligibility: ANL, INL, NLR, ORNL, PNNL
- Proposed annual budget not to exceed: $300K
- Estimated Number of Projects Expected: 1
- Estimated Project Duration: 1-2 years

Subtopic Goal: Develop information and tools on recreational interests on hydropower rivers and reservoirs that support benefits and impacts assessments.

Subtopic Guidance: The Hydropower Program seeks a proposal to develop information and data on recreational uses of rivers to lay the foundation for recreational benefits and impacts assessments for permitting. The proposal may present a standalone resource or propose building a module that integrates into the existing Hydropower Program-sponsored toolkits such as Environmental Decision Support Toolkit. Associated information about environmental conditions such as instream flows and reservoir peaking is of high interest to relate to recreational uses of rivers.

Topic 5: Development of technologies for environmental monitoring and mitigation to reduce permitting, and operational and compliance study costs.

SUBTOPIC 5.1. MITIGATION AND COMPLIANCE SOLUTIONS

Background: Hydropower projects are subject to extensive water quality monitoring during both the initial permitting process and ongoing licensing requirements due to regulation under the Clean Water Act (CWA). A component of this process is often obtaining a Section 401 Water Quality Certification from state or tribal authorities, confirming the project's compliance with state water quality standards and serving as an essential prerequisite for federal licenses, such as those issued by FERC. FERC licenses, often spanning 30-50 years, mandate ongoing water quality data submission through monitoring programs that assess a range of parameters affected by hydropower operations such as pH levels, turbidity, dissolved oxygen (DO), temperature, conductivity, salinity and nutrients. These parameters are vital not only for the efficiency of hydropower generation but for maintaining aquatic ecosystem health and fish survivability. While a large body of research and technological innovation focuses on the maintenance and restoration of fish species and habitats by addressing factors like DO, water temperature, and flow regimes in regulated river systems, the role of nutrients is equally critical. Fish and other aquatic species depend on essential nutrients, including nitrogen, phosphorus, silicon, and carbon, to sustain their food sources like algae, microorganisms, and macroinvertebrates. Therefore, achieving a proper balance of these nutrients is crucial as imbalances can lead to problematic outcomes, such as overabundance resulting in algal blooms and eutrophication, or limitations causing aquatic biota reproductive and growth deficiencies.

Studies consistently demonstrate distinct differences in nitrogen and phosphorus concentrations between reservoirs and their downstream waters. For instance, while ammonium, an essential nutrient for aquatic biota, is often limited in downstream reservoir waters, nitrate levels are frequently elevated both within the reservoirs themselves and in connected downstream and riparian areas. Elevated nitrate concentrations and associated denitrification rates can be exacerbated by fluctuating water levels in reservoirs leading to detrimental problems such as eutrophication, human health risks (e.g., methemoglobinemia), and the release of nitrous oxide gas into the atmosphere. Phosphorus dynamics within reservoirs are similarly complex: while it can become a limiting nutrient due to its strong binding affinity with sediments, metals, and organic compounds, it can also be present in excess when periodic dam releases create anaerobic conditions at the reservoir bottom, triggering its release from sediments. Similar to nitrogen, phosphorus limitation can disrupt the aquatic food web by hindering primary productivity whereas excess contributes to eutrophication, harmful algal blooms, oxygen depletion, and the production of costly-to-remove toxins.

As hydropower continues to provide essential grid services, there is an opportunity for hydropower operations to better support and act in concert with the surrounding natural environment. Therefore, there is a need to better understand the biogeochemical cycling of nitrogen and phosphorus within and below reservoirs, specifically how their excess or limitation impacts microbial, algal, macroinvertebrate, and fish communities, as well as human populations dependent on these waters for food and drinking. This understanding is paramount for hydropower permitting and licensing processes because regulatory bodies require projects to demonstrate compliance with water quality standards and minimize adverse environmental impacts over their operational lifespans. Characterizing nutrient cycling allows for the development of effective mitigation strategies that maintain aquatic biodiversity, manage denitrification-related concerns, and prevent issues like eutrophication. Building on this foundational knowledge, an opportunity arises for dedicated research into designing and implementing nature-based solutions to attenuate nutrient fluxes (e.g., through novel riparian designs and increased tributary connectivity) for potential integration into future license applications.

- Eligibility: ANL, INL, ORNL, PNNL, LBNL, LANL, and SLAC
- Proposed annual budget not to exceed: $250K
- Estimated Number of Projects Expected: 2-4
- Estimated Project Duration: 1-2 years

Subtopic Goal: Understand the effects of hydropower operations on nitrogen and phosphorus biogeochemical cycling in and around reservoirs, specifically addressing nutrient excess and/or limitation. This understanding will inform effective mitigation and management strategies, including the development of nature-based solutions, ultimately improving water quality monitoring, enhancing aquatic ecosystem health, and protecting human populations reliant on these waters while ensuring compliance with environmental regulations during permitting and licensing.

Subtopic Guidance: Proposals in this topic area must present plans to investigate biogeochemical cycling in hydropower reservoirs and/or adjacent downstream waters and use cases to relate information to hydropower operations, management, and/or permitting challenges. Example areas of interest include but are not limited to:

- Provide information and guidance on the influence of hydropower reservoir operations (e.g., draw-down, over-topping) on nitrogen and phosphorus biogeochemical processes to inform mitigation and management of water quality; and
- Nature-based solutions that support mitigation to aid in attenuating nutrient fluxes from hydropower operations.

SUBTOPIC 5.2. BIOINDEXES TO SUPPORT HYDROPOWER PERMITTING AND COMPLIANCE

Background: Efficient, accurate, low-cost, and comprehensive hydropower biological assessment and monitoring methods are critical for obtaining state and federal permits to operate, maintaining regulatory compliance and protecting biodiversity and ecosystems. Current hydropower biological monitoring and environmental assessment methods are well documented but not standardized across sites due to variable site-specific conditions and needs. Biological and/or environmental studies are often required during hydropower permitting to address data and information needs to enable National Environmental Policy Act proceedings and, in some cases, for continued monitoring of environmental outcomes as a required license condition. Due to limited data and knowledge about many aquatic systems, and the cost and time investments to conduct studies, the hydropower industry is challenged by a variety of aspects of study requests.

Environmental DNA (eDNA) and environmental RNA (eRNA) offer promising, low-cost tools for monitoring biodiversity with potential to be applied within multiple frameworks for hydropower environmental assessment processes (e.g., Federal Energy Regulatory Commission study requests for National Environmental Policy Act Environmental Assessments or Environmental Impact Statements, mandatory conditions for operations and compliance, Project Mitigation and Enhancement Measures). In the last 5 years, the use of eDNA by the hydropower industry for permitting has increased. In addition, the Hydropower Program also has supported research to work with industry to validate eDNA/eRNA applications for fish passage applications and to compare molecular tools to traditional methods. Thus, eDNA/eRNA are ready for some types of hydropower studies (e.g., species presence/absence, biodiversity censuses, etc.) and considerations for site-specific applications of eDNA/eRNA have been highlighted in the literature. However, additional work is required to move recommendations to practice, to evaluate and clarify which types of site-specific hydropower contexts eDNA and eRNA are, and are not appropriate, and further to identify if these molecular tools may be utilized in accepted bioindex or ecosystem health frameworks and related to hydropower operations.

A bioindex is a comprehensive and searchable catalog of biological data and metadata, providing a centralized access point for discovering, locating, and utilizing diverse types of biological information. Bioindexes compile and organize information on bioindicators which are species or groups of species whose function, population or status can inform the qualitative status of the environment. This field is well developed for some ecological systems that use the presence of indicator taxa, such as microbenthic invertebrates for qualitative water quality assessments, or lichen for qualitative air quality assessments.

There is interest in the Hydropower Program to explore feasibility of eDNA and/or eRNA for bioindexing in hydropower environmental regulatory contexts.

- Eligibility: ANL, NLR, ORNL, PNNL, LBNL
- Proposed annual budget not to exceed: $250K
- Estimated Number of Projects Expected: 1
- Estimated Project Duration: 1-2 years

Subtopic Goal: Assess foundational science and hydropower industry needs to explore and establish what is known about the application, existing uses and potential for low-cost molecular eDNA/ eRNA technologies to be applied to bioindexing and bioindication frameworks to address hydropower regulatory needs.

Subtopic Guidance: The Hydropower Program seeks proposals for developing foundational information to assess the feasibility of eDNA and/or eRNA for bioindexing in hydropower environmental regulatory contexts.

Key scientific areas to explore may include:

- Evaluate if eDNA/eRNA and bioindication frameworks can be effectively used within the existing hydropower regulatory system, and whether the data they produce is relevant and usable for regulators and environmental assessments;
- Explore strategies to assess the hydropower industry's readiness and willingness to adopt eDNA/eRNA tools; and
- Develop recommendations for the optimal application of eDNA/eRNA tools, identifying critical information gaps, evaluating the economic and practical value of investment, and proposing methods for leveraging open-source and public datasets and fostering strategic partnerships.

SUBTOPIC 5.3 FISH PASSAGE MITIGATION

Background: Hydropower dams are often required to implement fish passage solutions that are integrated into the permitting and relicensing processes for non-federal projects overseen by FERC with mandates from agencies like NOAA Fisheries. During these regulatory procedures, Environmental Impact Assessments (EIAs) evaluate potential impacts on fisheries and aquatic ecosystems. If adverse impacts are identified, permitting authorities impose stringent requirements for fish passage and other mitigation measures, dictating their design, operation, and ongoing monitoring.

The goal of fish passage technologies and mitigations are to provide safe, timely, and effective movements of species around hydropower dams and to avoid or reduce impacts associated with power generation infrastructure. Despite considerable investigation, research, and significant advancements in areas like artificial intelligence, computing, and data management, numerous grand challenges persist in developing lower-cost and more effective fish passage and mitigation strategies for hydropower. These challenges are particularly pressing given the strict requirements often imposed by permitting and licensing bodies. Addressing areas of high industry interest, complexity, and the continuous need for better information is essential to informing the development of transformative solutions that meet both ecological objectives and regulatory mandates.

- Eligibility: ANL, INL, NLR, ORNL, PNNL
- Proposed annual budget not to exceed: $750K
- Estimated Number of Projects Expected: 1
- Estimated Project Duration: 2-3 years

Subtopic Goal: Provide the foundation and data necessary to overcome existing challenges in fish passage to inform the development of lower-cost, more effective designs and mitigation measures that satisfy both regulatory requirements and achieve ecological objectives during hydropower permitting and relicensing.

Subtopic Guidance: Develop a critical R&D pathway to address one specific grand challenge area for hydropower and fish not already noted in other topics of this Lab Call. This initiative will develop a collaborative R&D program to deliver key datasets, tools, and/or analytical frameworks to advance the state of the science in a manner that addresses permitting and licensing hurdles, enabling more efficient and effective compliance with environmental regulations regarding fish passage and other mitigation measures for hydropower projects. Turbine design and evaluation proposals will not be accepted for this topic area.

Some areas of high industry interest, complexity, and need for information to inform technologies and transformative solutions include:

- Downstream American eel passage;
- Multiple species fish passage to enable selective passage systems;
- Improved efficiency of attraction, guidance, and bypass systems; and
- Operational strategies to improve environmental outcomes.

Topic 6: Hydropower Partnering

SUBTOPIC 6.1. TECHNICAL SUPPORT TO HYDROPOWER OWNER/OPERATORS AND TRIBES

Background: Federally owned hydropower represents approximately half of the U.S. hydropower nameplate capacity, including many of the largest facilities in the fleet. Maintaining and modernizing this federal fleet requires significant investment and coordination. The Hydropower Program has supported this coordination through two Memorandums of Understanding (MOU) and ongoing R&D coordination efforts: 1) **Memorandum of Understanding for Hydropower Technology Development** with the Tennessee Valley Authority (TVA) signed in 2023, and 2) a previous **Memorandum of Understanding for Federal Hydropower** signed in 2020 with the combined interests of the Bureau of Reclamation (USBR), Army Corps of Engineers (USACE), and the Department of Energy (DOE) Power Marketing Administration (PMAs). The PMAs include Bonneville Power Administration (BPA), Southwestern Power Administration (SWPA), Southeastern Power Administration (SEPA), and Western Area Power Administration (WAPA).

The Hydropower Program is aware of a variety of existing laboratory relationships with Tribes in supporting science that informs community goals for fish restoration and recovery, past research collaborations and overlap, and inquiries from tribal representatives for applications of science and tools coming out of the national labs.

- Eligibility: ANL, INL, NLR, ORNL, PNNL, SNL, LANL
- Proposed annual budget not to exceed: $250K
- Estimated Number of Projects Expected: 0-4
- Estimated Project Duration: 1-2 years

Subtopic Goal: Utilize national laboratory expertise to strength relationships and provide science and technical support to tribes, hydropower industry and agency groups. Proposals **must** include a letter of interest from an authorized partner agency or tribal representative and clearly identify how the proposal aligns with agency goals and/or complements ongoing efforts. Letters of support should include the expected staffing, data, equipment, and labor-hour needs from the partner, as well as, how the partner plans to support these needs (e.g., through existing research, maintenance, capital improvement, or other budgets).

Subtopic Guidance: The Hydropower Program is open to ideas to provide a range of technical support including but not limited to applications of models or frameworks of evaluation for decision support, lab or field technical support, support for research study design and/or data analysis. Proposals of interest will be for R&D to address gaps or test experimental solutions and use of under development national lab tools to support industry needs and technology transfer. Proposals that outline work/ ideas to conduct studies that FERC or another agency has ordered for hydropower permitting or regulatory compliance will not be reviewed.

SUBTOPIC 6.2. NORWAY MOU COLLABORATIONS

Background: DOE and Norway collaborate on hydropower R&D as outlined in a 2025 MOU. The MOU outlines mutual interests and cooperation on hydropower flexibility and sustainability, including:

- Flexible Operations and Planning;
- Markets and Value;
- Plant Capabilities and Constraints;
- Monitoring and Control Technologies;
- Pumped storage hydropower;
- Environmental monitoring, impacts, and design solutions;
- Trade-offs and Decision Support Tools;
- Hydrologic seasonal variations;
- Data management and Dissemination;
- Small Hydro contributions to flexible hydropower; and
- Technology Innovation.

Specific research groups that participate include the recently awarded 8-year RenewHydro Research Center and participating NTNU, SINTIF, and NINA (Norwegian Research Institutes) staff.

- Eligibility: ANL, INL, NLR, ORNL, PNNL, SNL
- Proposed annual budget not to exceed: $125K
- Estimated Number of Projects Expected: 0-3
- Estimated Project Duration: 2 years

Subtopic Goal: The Hydropower Program is open to ideas to advance topics of mutual interest as outlined in the DOE-Norway MOU.

Subtopic Guidance: Develop proposals that are aligned with the Hydropower Program and Norway's mutual interests as outlined in the MOU for Hydropower R&D. The Hydropower Program cannot fund foreign partners, and partners in Norway need support from their own organization to collaborate. Past work under a 2020 MOU included workshops to outline R&D gaps and opportunities; conference symposium; white papers, conference papers, and journal publications development; model building and data sharing; and evaluation and testing of tools and technologies by partners to verify performance or explore broader use cases for commercialization. Proposals **must** include a letter of interest from an authorized partner agency in Norway and clearly identify how the proposal aligns with and/or complements ongoing efforts. Letters of support should include the expected staffing, data, equipment, and labor-hour needs from the partner, as well as, how the partner plans to support these needs.

Topic 7: Understanding Hydropower Social Dimensions Challenges Through Novel Research

Background: Assessing non-technical challenges to new hydropower projects is critical to avoiding costs, decreasing the likelihood of permitting delays, and preventing outright project cancelations. Other industries have successfully utilized proven social dimensions research methods to inform and streamline energy development. If applied to near-term opportunities for added hydropower generation, such research has the potential to support gathering local input, identifying differing perceptions, prevention of potential conflicts, and highlighting regions and partners where hydropower may move forward more efficiently and with fewer obstacles and greater benefits.

As next-generation hydropower technologies are being developed, the social dimensions of hydropower – that may create barriers to deployment and increase costs – are lacking study. Most of the social science research on hydropower is focused internationally and thus there is limited data on the social dimensions for the United States. Moreover, there is a lack of research on this topic as it applies to opportunities for hydropower technologies such as fish passage, non-powered dam conversion, conduit hydropower integration, remote and rural hydropower systems.

Social dimensions refer to the social, cultural, economic, environmental, and technological forces that influence decision-making, and in this context, technology use and hydropower development. These dimensions may include public perceptions, community resistance, and non-technical barriers to adoption of technology. Such factors can affect project planning, decision-making, and regulatory processes. For example, federal and state hydropower regulatory processes require community engagement. Evaluating the possible points of friction and a community's level-of-understanding can inform project planning and may reduce the time and costs of meeting requirements to accelerate project timelines.

Social dimensions are not exclusively barriers to deployment; they can also indicate opportunities for the hydropower industry. Certain regions and social conditions may, due to these dimensions, be better equipped or receptive for new deployments, or may prefer certain aspects or types of hydropower technologies over others. Accounting for these preferences is essential to inform site identification and engagement efforts. In addition, studying social dimensions extends beyond the public. For example, in the context of technology adoption and uptake, understanding the barriers faced by specific stakeholders or decision-makers is valuable for informing the Hydropower Program's activities and supporting the broader hydropower industry in promoting the widespread use of innovative technological solutions.

- Eligibility: ANL, INL, NLR, ORNL, PNNL, LANL
- Proposed annual budget not to exceed: $500,000
- Estimated Number of Projects Expected: 0-2
- Estimated Project Duration: 2-3 years

Topic Goal: The Hydropower Program is interested in real world, in situ, and on-the-ground data that outline the social dimensions of hydropower, potential barriers and opportunities, and possible solutions to reduce costs and/or increase deployments. This topic will support novel social science research in the social dimensions of hydropower, for example, through a set of qualitative and quantitative approaches to understand a targeted region or set of stakeholders.

Large scale or nationally focused projects lack the specificity for on the ground and project specific decision-making and development. The program is interested in an effective scale of research, where the results can be useful for several potential and/or existing hydropower projects and contain enough specificity to capture important local context. Regional or medium-scale focused projects are preferred because they can be technology specific and focus on areas of high hydropower resource potential, while functionally studying several related local areas. A medium-scale-focused project does not have to be geographically restricted. A project could target a set of areas or stakeholders that share resource potential and other social or economic factors that are not adjacent or in the same geographic region.

The Hydropower Program is keen on developing 'local' or 'regional' expertise and insights beyond those captured through impersonal and anonymous methods (e.g. online surveys). Therefore, partnering with local universities and researchers is encouraged to provide insights and expertise to improve the quality and efficacy of the proposed research as they are often well-connected with regional and nuanced stakeholder networks, relationships, and platforms relevant to assessing the social dimensions of hydropower. Overall, the Hydropower Program is concerned with addressing the aforementioned data and information gaps, how these dimensions may be shifting, and how the program and industry can adapt.

Topic Guidance: Proposals are encouraged to partner with regional-specific universities and/or researchers that can provide local and regional knowledge and give insight and direction to the overall projects and research questions and methods. Proposals can include novel research and additional activities like engagement and communication to share the research results with industry and stakeholders, becoming particularly relevant in the latter years of a project after novel data has been collected and analyzed. Engagement and communication activities can include workshops, trainings, or presentations for relevant stakeholders that help disseminate results into industry practices. Teams are encouraged to present plans that incorporate methods to ensure results are useful and actionable for the Hydropower Program, the hydropower industry, regulators, and stakeholders.

Topic 8: Open Topic

Background: Hydropower Program seeks new ideas that align with the environmental and permitting needs of the hydropower sector.

- Eligibility: ANL, INL, NLR, ORNL, PNNL, SNL, LANL
- Proposed annual budget not to exceed: $450,000
- Estimated Number of Projects Expected: 0-3
- Estimated Project Duration:1-3 years

Topic Goal: Initiate new projects that align with the Hydropower Program Environmental R&D activities, have a high likelihood of improving environmental performance of hydropower, and reflect industry feedback on environmental and permitting challenges for hydropower.

Topic Guidance: Proposals of interest will aim to improve existing tools and designs related to Environmental R&D, describe the benefits of the proposed improvements, potential outcomes, user and use cases, and costs associated with implementing improvement(s). Collaborations with industry or other external entities outside the labs to co-design, validate, and implement National Lab results are highly encouraged. While the topic is open to any project aligned with Environmental R&D, possible topics of interest, in no particular order, could include the following:
Foundational science and data to inform management, mitigation, and technology design aimed at improving the environmental performance of hydropower for:

- Regional environmental challenges and industry needs;
- Basin scale coordination for permitting;
- Adaptive management;
- Stressor-response for hydropower environmental impacts assessments; and
- Species ecology, life history, biology to inform innovative design, mitigation or evaluations of hydropower.

These topics are not exhaustive, and DOE may select projects on topics beyond those listed above.