U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

HydroNEXT Request for Information:

Challenges and Opportunities for Sustainable Development of Hydropower in Undeveloped Stream Reaches of the United States

RFI#: DE-FOA-0001685

DATE: 10/31/2016
SUBJECT: Request for Information (RFI)
RESPONSES DUE: 2/10/2017

Description

The Water Power Technologies Office (WPTO), within the U.S. Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE), invites input from the public regarding challenges and opportunities associated with hydropower development in undeveloped stream-reaches. Additionally, WPTO is seeking input on the focus and structure of a potential funding opportunity to support research and development of advanced and/or non-traditional transformative hydropower technologies and project designs capable of avoiding or minimizing environmental and social effects for new cost-competitive hydropower development in undeveloped stream-reaches of the United States.

Background

Through its HydroNEXT initiative, WPTO's Hydropower Program (the Program) invests in the development of innovative technologies that lower cost, improve performance, and promote environmental stewardship of hydropower development across three resource classes:

- Existing non-powered dams (NPD)
- Pumped storage hydropower (PSH)
- New stream-reach development (NSD)

Under a Fiscal Year (FY) 2016 Funding Opportunity Announcement (FOA) DE-FOA-0001455 titled, "Innovative Technologies to Advance Non-Powered Dam and Pumped Storage Hydropower Development," the Program made Federal funding available to research and develop innovative solutions for NPD and PSH development. In FY 2017, the Program seeks to overcome challenges associated with furthering the development of hydropower in new stream-reaches.

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Development of hydropower in new stream-reaches refers to new projects in stream segments and waterways that do not currently have hydroelectric facilities. New stream-reach development projects are subjected to more scrutiny than development of other hydropower resources (i.e. NPDs, refurbishments) because such development can have more extensive environmental and social effects, particularly if construction of a dam or diversion is required. Construction of barriers in a natural waterway can affect fish migration, channel geomorphology, sediment transport, habitat connectivity, water quality, and flow regimes. The unique nature of new stream-reach development can also add cost, time, and uncertainty to the development process. These factors have hindered the development of this resource in recent decades. According to the *Hydropower Market Report*,[1] new stream-reach development accounted for only 10% of all hydropower projects in the development pipeline at the end of 2015.

To realize sustainable and responsible hydropower development and protect the integrity of existing streams, EERE is seeking information regarding transformative and/or innovative hydropower technologies that reduce or eliminate environmental concerns and are financially viable.

Purpose

The purpose of this RFI is to solicit feedback from industry, academia, research laboratories, government agencies, and other stakeholders on issues related to development of hydropower in new stream-reaches. EERE is specifically interested in information on the costs/benefits and environmental effects associated with such development, and possible solutions to address the related challenges. EERE is seeking input on the focus and structure of a potential funding opportunity to support research and development of advanced and/or non-traditional transformative hydropower technologies and project designs capable of avoiding or minimizing environmental and social effects for new cost-competitive hydropower development in undeveloped stream-reaches of the United States.

Disclaimer and Important Notes

This RFI is not a Funding Opportunity Announcement (FOA); therefore, EERE is not accepting applications at this time. EERE may issue a FOA in the future based on or related to the content and responses to this RFI; however, EERE may also elect not to issue a FOA. There is no guarantee that a FOA will be issued as a result of this RFI. Responding to this RFI does not provide any advantage or disadvantage to potential applicants if EERE chooses to issue a FOA

[1] http://www.energy.gov/eere/water/downloads/2014-hydropower-market-report

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regarding the subject matter. Final details, including the anticipated award size, quantity, and timing of EERE funded awards, will be subject to Congressional appropriations.

Any information obtained as a result of this RFI is intended to be used by the Government on a non-attribution basis for planning and strategy development; this RFI does not constitute a formal solicitation for proposals or abstracts. Your response to this notice will be treated as information only. EERE will review and consider all responses in its formulation of program strategies for the identified materials of interest that are the subject of this request. EERE will not provide reimbursement for costs incurred in responding to this RFI. Respondents are advised that EERE is under no obligation to acknowledge receipt of the information received or provide feedback to respondents with respect to any information submitted under this RFI. Responses to this RFI do not bind EERE to any further actions related to this topic.

Proprietary Information

Because information received in response to this RFI may be used to structure future programs and FOAs and/or otherwise be made available to the public, **respondents are strongly advised NOT to include any information in their responses that might be considered business sensitive, proprietary, or otherwise confidential.** If, however, a respondent chooses to submit business sensitive, proprietary, or otherwise confidential information, it must be clearly and conspicuously marked as such in the response.

Responses containing confidential, proprietary, or privileged information must be conspicuously marked as described below. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under the Freedom of Information Act or otherwise. The U.S. Federal Government is not liable for the disclosure or use of unmarked information, and may use or disclose such information for any purpose.

If your response contains confidential, proprietary, or privileged information, you must include a cover sheet marked as follows identifying the specific pages containing confidential, proprietary, or privileged information:

> **Notice of Restriction on Disclosure and Use of Data:**
> Pages [List Applicable Pages] of this response may contain confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for the purposes described in this RFI DE-FOA-0001685. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source.

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In addition, (1) the header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: "Contains Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure" and (2) every line and paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets or highlighting.

Evaluation and Administration by Federal and Non-Federal Personnel

Federal employees are subject to the non-disclosure requirements of a criminal statute, the Trade Secrets Act, 18 USC 1905. The Government may seek the advice of qualified non-Federal personnel. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The respondents, by submitting their response, consent to EERE providing their response to non-Federal parties. Non-Federal parties given access to responses must be subject to an appropriate obligation of confidentiality prior to being given the access. Submissions may be reviewed by support contractors and private consultants.

Request for Information Categories and Questions

Category 1: New Stream-Reach Development (NSD) Challenges and Opportunities

To accelerate the deployment of sustainable and responsible hydropower on new stream-reaches while protecting their social and environmental value, EERE is seeking input on the main challenges and potential opportunities for developing this resource.

Specifically, we welcome feedback on the following questions:

1) How can advances in technology more readily address environmental challenges associated with hydropower development in undeveloped streams?

2) What are the technical challenges associated with new stream-reach development? How can DOE help address these challenges?

3) How can modularization of power train and civil works components affect project costs? How can standardized equipment build familiarity and assist with regulatory review of proposed new stream-reach development projects?

4) With recent advancements in additive manufacturing, it has become increasingly easy to embed sensors and other smart technology into equipment. How can this advancement be

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used to build smarter machines and change the way stakeholders address environmental concerns?

5) What other challenges is the hydropower community facing with regards to new stream-reach development? How can DOE help to address those challenges?

Category 2: Transformative Hydropower Innovations

The DOE's 2016 *Hydropower Vision* analysis[2] found that deployment of 1.7 gigawatts (GW) of new stream-reach development is possible by 2050 based on a scenario in which technology advancements lower capital and operating costs, innovative market mechanisms increase revenue and lower financing costs, and environmental considerations are taken into account. Further, alternative scenarios explored in the *Hydropower Vision* analysis also showed that new stream-reach development could increase by an additional 15.5 GW by 2050 if a substantial level of transformative technological innovation were developed to successfully address the cost and environmental considerations associated with new stream-reach development.

EERE is seeking input on the following questions related to this issue:

1) What type of transformative innovations (either in power train components or plant system designs) could hold the key to reducing or avoiding environmental effects typically associated with development of new stream-reaches?

2) How can Federal investments in research and development help increase benefits and reduce costs for new stream-reach development? What areas of investment would be most impactful?

3) Are other industries using technologies, equipment, or techniques that could be applied to hydropower to increase benefits and/or reduce new stream-reach development project costs, timelines, and environmental effects? Please provide examples.

[2] The 2016 *Hydropower Vision* analysis involved more than 50 modeled scenarios, each examining the effects of key variables or combination of variables that influence the deployment of hydropower facilities in electricity market competition with other generation sources. http://energy.gov/eere/water/articles/hydropower-vision-new-chapter-america-s-1st-renewable-electricity-source

Category 3: Potential Funding Opportunity

EERE seeks input on the focus and structure of a potential funding opportunity topic area to support the development of environmentally-sustainable hydropower development in new stream-reaches. EERE welcomes feedback on the approach outlined below.

The objective of this potential research is to develop advanced and/or non-traditional transformative hydropower technologies and project designs capable of avoiding or minimizing environmental and social effects for new cost-competitive hydropower development in undeveloped stream-reaches of the United States. **Of particular interest are projects that do not require the use of a dam to create the head differential necessary to generate hydropower.**

Following a two-phase process, potential researchers should be able to demonstrate—through research, analysis, and engineering design—that the proposed systems can meet the following metrics:

1. Environmental and Social Impact[3]
2. Technical Feasibility
3. Cost Competitiveness

Phase 1 (12 months):

Research the available hydropower potential and develop innovative and transformative design strategies that include ways to increase head for cost-competitive and environmentally-sustainable hydropower development. Such designs should include the following features:

- Transformative diversionary structures without the use of a solid dam: examples include side intakes or side-channel intakes and headrace canals, and trench weirs with suitable water conveyance systems
- Alternative water conveyance systems using innovative technologies (such as advanced tunneling methods, intakes, alternative pipe materials and manufacturing, and tailrace systems) to increase power density and reduce component and system costs
- Use of low-impact, modular, and scalable hydropower technologies, as applicable, to achieve cost reductions

Researchers should consider multipurpose uses of the hydropower facility that may help to reduce the cost allocation to hydropower development.

[3] Environmental and Social Impact refers to how construction and operation of a project affects geomorphology, water quality, and the function of streams in supporting social objectives (e.g., recreation) and species reproduction.

Researchers should perform desktop studies using available data to identify probable locations on undeveloped stream-reaches for potential application of their innovative/transformational design strategies. These studies will help to identify the most favorable sites and inform reconnaissance and feasibility studies in Phase 2.

Phase 2 (12-18 months):
With respect to the most favorable sites identified in Phase I, researchers should perform: a) reconnaissance studies, and b) feasibility studies.

A. Reconnaissance Studies

Reconnaissance studies are performed with the aim of determining if further feasibility studies are warranted. These studies should:

1. Scope the extent of study necessary for hydropower site development and preliminary economic analysis
2. Develop a preliminary layout (plan and cross-section)
3. Assess the head and flow (site hydrology)
4. Determine the type of turbine-generator for the head and flow for the purpose of obtaining typical equipment costs
5. Estimate preliminary power potential
6. Evaluate the transmission requirements at a high level for power take-off
7. Assess potential environmental and social impacts and related mitigation
8. Develop a high level cost estimate
9. Estimate potential revenue streams
10. Determine economic feasibility including possible financing costs
11. Include a report to document reconnaissance findings

B. Feasibility Studies

Feasibility studies should be performed with the aim of determining if an investment commitment should be made without actual ground disturbance and the requirement of permit(s). These studies should include the following activities:

1. A firm-up of the project layout to include alternate sites based on actual preliminary site investigations
2. Confirmation of the project parameters such as:
    a. head
    b. flow duration and unit flow

c. number and type of units
d. installed capacity
e. water conductor system and ancillary equipment and other physical work
f. transmission routing and associated equipment needs

3. Identification of site development needs
4. Evaluation of power purchase alternatives
5. Potential environmental and social impact studies and related mitigation
6. Detailed preliminary cost studies
7. Evaluation of possible multi-use of the facility
8. Determination of economic feasibility including possible financing costs
9. Preparation of a report to document feasibility findings

Researchers should perform reconnaissance studies for at least six selected locations for project development, with the aim of performing feasibility studies on the three most promising sites. We anticipate that DOE would make a Go/No-Go decision after Phase 1 based on the environmental performance, costs, and applicability of the proposed technology or design strategy.

EERE welcomes input on the approach outlined. Specifically, we welcome feedback on the following questions:

1) Is the focus outlined above the optimal approach for supporting sustainable development of hydropower in undeveloped streams? If not, what improvements would you suggest?

2) Please share comments on other items not considered here that you believe EERE should address as it develops a strategy to advance new stream-reach development.

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Request for Information Response Guidelines

Responses to this RFI must be submitted electronically to HydroNextFOA@ee.doe.gov no later than 5:00pm (ET) on 2/10/17. Responses must be provided as attachments to an email. It is recommended that attachments with file sizes exceeding 25MB be compressed (i.e., zipped) to ensure message delivery. Responses must be provided as a Microsoft Word (.docx) attachment to the email, and no more than 6 pages in length, 12 point font, 1 inch margins. Only electronic responses will be accepted.

Please identify your answers by responding to a specific question or topic if applicable. Respondents may answer as many or as few questions as they wish.

EERE will not respond to individual submissions or publish publicly a compendium of responses. A response to this RFI will not be viewed as a binding commitment to develop or pursue the project or ideas discussed.

Respondents are requested to provide the following information at the start of their response to this RFI:

- Company / institution name;
- Company / institution contact;
- Contact's address, phone number, and e-mail address.

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