



U.S. DEPARTMENT OF
ENERGY

REQUEST FOR INFORMATION / NOTICE OF INTENT

DE-FOA RFI-0002271

Information Request on the Advanced Reactor Demonstration Program

February 5, 2020

Office of Nuclear Energy

Office of Reactor Fleet and Advanced Reactor Deployment

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1. Introduction/Description

Congress has directed the Secretary of the United States (U.S.) Department of Energy (DOE) to establish an Advanced Reactor Demonstration (ARD) Program to demonstrate multiple advanced reactor designs. The primary objective of this new program is to focus DOE and non-federal resources on actual construction of real demonstration reactors with the following goals:

- Implement congressional direction with an investment to stimulate commercial enterprises in advanced reactor deployment,
- Facilitate U.S. private industry demonstration of several advanced reactors with the capabilities of achieving reliable, cost effective, licensable designs; and
- Enable a market environment in which commercial reactor services are available to Government and private sector customers that are safe and affordable to both construct and operate in the near- and mid-term.

DOE is issuing this Request for Information (RFI)/Notice of Intent (NOI) to notify interested parties of DOE's intent to solicit applications for two advanced reactor demonstration awards using financial assistance procedures described in 2 CFR Part 200 and 2 CFR Part 910. The RFI/NOI is also issued to solicit information from advanced reactor developers and other interested parties that DOE requires to inform its aggressive strategy to demonstrate two advanced reactor designs within five to seven years of award, and two to five smaller awards to address technical risks in other advanced designs. In addition, as appropriate, DOE may use the input received in response to this RFI/NOI to help provide required reports and program status to stakeholders within the Administration and Congress.

DOE currently supports research and development activities for a variety of advanced reactors that are expected to improve on the safety, security, economics, and/or environmental impacts of current nuclear power plant designs. DOE undertakes these activities in support of the Administration's objectives to regain the U.S.'s technological leadership position in the global nuclear industry and to achieve U.S. energy dominance. DOE recognizes that continued efforts will be necessary to assure U.S. leadership in the research, design, and development of advanced reactors, and to ensure the successful deployment of these reactors in U.S. and international marketplaces. However, as stated above, the primary goal of the new ARD Program is on actual construction and operational readiness of the selected demonstrations.

A demonstration project can be an advanced reactor operated as part of the power generation facilities of an electric utility system or in any other manner for the purpose of demonstrating the suitability for commercial application of the advanced nuclear reactor. Advanced reactors are defined as any light water or non-light water fission reactor with significant improvements compared to the current generation of operational reactors. Examples of significant improvements may include inherent safety features, lower waste yields, greater fuel utilization, superior reliability, resistant to proliferation, increased thermal efficiency, and the ability to integrate into electric and nonelectric applications.

The primary purpose of this RFI/NOI is to alert interested parties of DOE's intent to solicit competitive applications for two advanced reactor demonstration awards (Demonstration Awards), such that they can begin to assemble teams and responsive applications, establish or verify supply chains, and identify long-lead items that will require immediate action. Through this RFI/NOI, DOE is seeking information associated with the scope and implementation considerations of Demonstration and Risk Reduction projects. This information will be used to develop DOE's solicitation for executing these projects. Specifically, DOE plans to issue a financial assistance Funding Opportunity Announcement (FOA) for this solicitation, and award cooperative agreements for the demonstrations. The FOA will also include Risk Reduction for Future Demonstrations (Risk Reduction Awards). Accordingly, DOE plans to issue one FOA for two types of awards:

1. **Demonstration Awards.** Demonstration Projects will be awarded to two teams seeking to develop advanced reactors (as defined below). The total first year DOE funding for each award will be approximately \$80 million, with future year funding dependent on the selected project requirements and future congressional appropriations. These awards will require a cost share of not less than 50 percent from non-federal sources. Proposed Demonstration Projects are intended to be operational within five to seven years of the award.
2. **Risk Reduction Awards.** Between two and five applicants not selected for one of the two Demonstration Awards and that represent diversity of advanced nuclear reactor designs may be considered for separate Risk Reduction Awards under the FOA. These awards will address technical risks in each applicant's reactor design. The total value for these awards from DOE will be \$30 million for year one. These awards will require a cost share of not less than 20 percent from non-federal sources. These awards should advance technological maturity of the designs to better prepare them for future commercialization.

Financial assistance cooperative agreements are required to include indirect cost rate(s) for recipients and subrecipients. Applicant teams are advised to immediately begin steps to get federally approved rate agreements in place for this FOA so as not to delay award negotiations. The anticipated Assistance Listing for the ARD FOA is 81.121. Information for this listing is at <https://beta.sam.gov/help/assistance-listing>. The System for Award Management (SAM) provides detailed, public descriptions of federal assistance listings.

DOE asks any interested party to respond to this RFI/NOI. DOE is seeking input from nuclear industry entities (reactor vendors, fuel manufacturers, utilities and power producers, supply chain vendors, engineering, procurement, construction contractors, etc.) as well as from government organizations, federal contractors, universities, manufacturers, or consortia capable of designing, building, and operating advanced nuclear reactors on how advanced reactor demonstrations executed within a cost-shared partnership with DOE and licensed by the U.S. Nuclear Regulatory Commission (NRC) can be structured to ensure the greatest chance of success. Industry sources should have demonstrated capabilities for producing reactors, and/or materials and manufacturing of reactor components and systems to the American Society of Mechanical Engineers (ASME) Nuclear Quality Assurance (NQA-1) quality standards.

Please note that pursuant to congressional direction entities receiving greater than \$200,000 of fiscal year (FY) 2020 funds through the Advanced Small Modular Reactor Research and Development program will not be eligible to receive FY 2020 funds associated with Demonstration or Risk Reduction Awards to be solicited under the ARD Program.

2. Requested Information

DOE is seeking information, comments, feedback, and recommendations from parties interested in supporting specified ARD Program activities. Information requested in this RFI/NOI focuses on the solicitation for and the execution of Demonstration and Risk Reduction projects. All nuclear industry stakeholders as described in the previous section are encouraged to reply to this RFI/NOI with feedback on potential project activities. Respondents are encouraged to provide feedback regarding all applicable parts of this RFI/NOI that should be considered by DOE in a solicitation of this nature. Replies should provide information requested in the Questionnaire (Appendix) to help DOE gain understanding about industry perspectives on potential industry partnership opportunities, integration strategies, cost or time saving measures, and technology development risks

3. Directions for Responding to the RFI/NOI

RFI/NOI responses shall include:

- RFI/NOI title and reference number
- Name(s), phone number(s), and e-mail address(es) for the principal point(s) of contact
- Institution or organization affiliation, postal address, e-mail address, and phone number
- Specify your organization's role and/or interest is in Demonstration and Risk Reduction projects
- Responses to the Questionnaire (Appendix) of this RFI/NOI.

RFI/NOI Response Requirements:

Responses are requested no later than **February 26, 2020** at 11: 59 PM Mountain Time on the deadline date.

Respondents to this RFI/NOI are asked to submit their response in electronic format (Adobe PDF) to: advancedreactordemonstration@id.doe.gov

Questions concerning this RFI/NOI may be directed to: Eliot Dye, DOE Contracting Officer, email: dyeej@id.doe.gov

4. Disclaimers

- a. This is a request for information and notice of intent only. This RFI/NOI is used solely for information capture and planning purposes and does not constitute a solicitation. It has no

relationship to any DOE FOAs or solicitations. This RFI/NOI is issued only with the intent of obtaining information.

- b. Not responding to this RFI/NOI does not preclude participation in any future and potential solicitations or procurement activities.
- c. Specific responses to this RFI/NOI will not be made public in an effort to protect any propriety company information. Respondents are advised to clearly and properly mark any propriety or restricted data contained within their submission so it can be identified and protected.
- d. It is the respondent's responsibility to monitor for the release of any solicitation, synopsis or procurement activities.
- e. Responses to this RFI/NOI are not offers and cannot be accepted by the Government to form a binding contract or other agreement. The Government is under no obligation to issue a solicitation or to award any contract or other agreement on the basis of this RFI/NOI. Any response to this RFI/NOI is voluntary and does not commit the Government to any expense or obligation. This request does not impose any obligation on the Government or signify a firm intention to enter into a contract or other agreement. No costs associated with responding to this RFI/NOI or participating in any subsequent meetings will be borne by the Government. Respondents are solely responsible for all expenses associated with responding to this RFI/NOI
- f. Responses to this RFI/NOI will not be returned, and respondents will not be notified of DOE's result of the review of information submitted in response to this RFI/NOI. DOE does not plan to send individual acknowledgements or replies to respondents to the RFI/NOI. However, DOE may conduct one-on-one meetings with entities that respond to this request if clarification or additional information is required to improve the DOE's understanding of the comments provided. If DOE decides to hold one-on-one meetings, applicable interested parties will be contacted. The decision to meet with a company one-on-one has no bearing on the worthiness of its RFI/NOI submittal or on any future offerings.

APPENDIX

QUESTIONNAIRE

1. Preliminary planning calls for DOE to issue an FOA with the intent of making two cooperative agreement awards (Demonstration awards) for the construction and demonstration of two advanced reactors, as well as two to five awards to assist in technology risk reduction for advanced reactor designs (Risk Reduction awards) not selected for a Demonstration award. Please comment on your experience with approaches that could potentially streamline the FOA process.
2. Please provide information on any regulatory hurdles that would limit the ability to successfully carry out an advanced reactor demonstration, and provide feedback on how DOE can help in overcoming those challenges. Please comment on:
 - a. Considerations and rationale to authorize and operate under authority other than NRC.
 - b. Current status and licensing/regulatory efforts to-date.
 - c. Critical issues requiring NRC approval.
3. Please provide information on any market limitations that would limit the ability to successfully carry out an advanced reactor demonstration (e.g., supply chain limitations, availability of fuel), and provide feedback on how DOE can help in overcoming those challenges.
4. Demonstration projects shall require a cost share of not less than 50 percent from non-federal sources. Risk Reduction projects shall require a cost share of not less than 20 percent from non-federal sources. Please provide any feedback regarding:
 - a. Concerns related to this cost sharing, including industry willingness and ability to do so.
 - b. Commitments DOE should obtain from applicants related to cost sharing.
5. Understanding that DOE has a major interest in assuring that taxpayers benefit from this project, please comment on any considerations relating to intellectual property and data rights that the Department should consider.
6. Regarding project work to be done under the cooperative agreements, DOE intends to include requirements substantially as follows:

“All work performed under DOE 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 sub-recipients. DOE 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 if the work is performed by the Prime Recipient, sub-

recipients, contractors or other project partners. 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 DOE.”

- a. Please provide comments on related concerns.
 - b. Please comment on your need for foreign partnership or suppliers.
 - c. Please comment on your likelihood of requesting a waiver.
7. The following minimum award evaluation criteria are planned: (1) technical feasibility that the demonstration can be operational in five to seven years; (2) likelihood that the design can be licensed for safe operations by the NRC; (3) use of certified fuel design, or demonstration of a clear path to certification within five to seven years; (4) affordability of the design for full-scale construction and cost of electricity generation; (5) ability of the team to provide its portion of the cost share; and (6) technical abilities and qualifications of teams desiring to demonstrate a proposed advanced nuclear reactor technology. Please comment on information needed to clarify any of the proposed criteria, as well as any additional criteria DOE should consider, along with your rationale.
8. The evaluation may consider diversity in designs for the advanced reactors to be demonstrated as a policy factor impacting the selection. Please comment on this consideration.
9. The evaluation may consider foreign ownership, control, or influence (FOCI) as a policy factor impacting the selection. Please comment on this consideration.
10. DOE cooperative agreements contain a “Statement of Substantial Involvement” detailing the type and nature of the engagement DOE intends to have in the project, e.g., DOE contributions to the technical aspects of the effort necessary for its accomplishment, etc. This involvement may include collaboration, participation in the management of the project, design or readiness reviews, or intervention in the activity, over and above the exercise of normal Federal stewardship responsibilities.
 - a. Please provide information on the types and extent of substantial involvement DOE should have in the review and oversight of selected projects, including any rationale.
 - b. Substantial involvement could also include National Laboratory support or Laboratory partnerships, and government furnished equipment. Please comment on how DOE should structure this support.
11. DOE is exploring alternative implementations of its financial assistance in the solicitation for Demonstration and Risk Reduction awards. An example is a public-private partnership modeled after the National Aeronautics and Space Administration (NASA) Commercial Orbital Transportation System (COTS) experience. Specifically, payments would be made upon the successful completion of performance milestones as proposed

by the participants or as negotiated with DOE. Please provide any concerns you have with this approach or alternate methods that you believe would benefit the project.

12. DOE could require pre-applications in the FOA application process to assist entities unlikely to be a viable competitor from having to prepare full applications. In addition, this would help DOE streamline its application evaluation process. Please provide information on concerns or suggestions regarding this approach, including information DOE should obtain from applicants for this early phase of the submission, and any criteria you suggest DOE should use to evaluate the pre-applications.
13. DOE cooperative agreements have typical standard reporting requirements, including Management Reporting, Research Performance Progress Reporting, Scientific and Technical Reporting, Financial Reporting, etc.
 - a. Please provide information on specific reporting that should be required for selected projects, including purpose, frequency, and content.
 - b. Please comment on a proposed frequency of reporting for cost and schedule information.
14. Government financial assistance rules permit a cooperative agreement to be terminated by the non-Federal entity upon sending to DOE written notification. However, given the importance of the Demonstration projects, DOE intends to include specific award language outlining the termination process to protect the Government's interests. For example, the award may contain a requirement that an awardee can only terminate the award with prior written notice to DOE and with prior written concurrence from DOE at least 120 days prior to the planned termination date.
 - a. Please provide information on any concerns you may have with this approach.
 - b. Please provide information on ideas you may have to help guarantee the recipient's performance of the award.
15. Congressional language directs DOE to fund ARD projects which can be operational no later than five to seven years from the date of award.
 - a. Please comment on the feasibility of this requirement.
 - b. If not feasible, please provide information on a recommended completion date.
 - c. If not feasible, please comment on the significant barriers preventing completion of the Congressional direction.
16. DOE intends to utilize outside subject matter experts to assist with the evaluation of applications submitted in response to the FOA, including: (1) a representative from an electric utility that operates a nuclear power plant; (2) a representative from an entity that uses high-temperature process heat, district heating, hydrogen production, or heat for manufacturing, industrial processing, or other purposes; (3) experts from industry with experience in design, manufacturing, and operation of nuclear reactors; and, (4) a representative from the finance industry with background in the nuclear field.
 - a. Please explain any conflict of interest concerns you may anticipate, as well as your mitigation suggestions.

- b. Please comment on other categories of subject matter experts DOE should consider in addition to those listed.
- 17. Please provide information on the skills and capabilities of your organization that support achieving the described demonstration objectives in the following areas:
 - a. Major development requirements including materials, testing, systems, etc.
 - b. Capabilities to resolve development requirements and area of potential government support.
 - c. Major risks to accomplishing commercial operation.
- 18. The following is a list of potential information that will be required for the response to the FOA. Please comment on the relevancy of the potential requested information. Specifically, identify what should be added or removed and the associated rationale.
 - a. Advanced Reactor Design and Technology
 - i. Reactor type
 - ii. Reactor coolant
 - iii. MWt
 - iv. MWe (net of station load)
 - v. Heat transfer mechanism
 - vi. Safety features and systems
 - vii. Safeguards and security considerations
 - viii. Anticipated coping time with station blackout
 - ix. Design life
 - x. Transportability
 - b. Nuclear Power Plant
 - i. Scalability – number of potential reactors per site
 - ii. Switchyard / interconnection requirements
 - iii. Structures / buildings
 - iv. Maximum height / elevation of the tallest structure
 - v. Area, in acres, inside the security fence
 - vi. Total area in acres for all structures
 - vii. Anticipated Operating Basis Earthquake (ground acceleration)
 - viii. Anticipated Safe Shutdown Earthquake (ground acceleration)
 - ix. Anticipated Emergency Planning Zone
 - x. Anticipated on-site construction time
 - xi. Anticipated peak on-site construction personnel requirement

- c. Energy Resiliency
 - i. Features that contribute to energy resiliency
 - ii. Cyber security
 - iii. Resistance to electromagnetic pulse (EMP) and geomagnetic disturbances (GMD)
 - iv. Black start capability
 - v. Ability to manage station black out
 - vi. Suitability for connection to a micro-grid
- d. Fuel
 - i. Fuel description
 - ii. Fuel Acquisition Strategy
 - iii. Enrichment
 - iv. Refueling interval
 - v. Refueling process / duration / on or off site
 - vi. Fuel fabrication process
 - vii. Ability to tolerate impurities in fuel material
- e. Spent Fuel Management
 - i. Please describe the plan for managing spent fuel (on or off site)
 - ii. Please describe any unique aspects of managing spent fuel that might require development, e.g., design and licensing of interim storage casks
- f. Operations / Staffing
 - i. Staffing requirements
 - ii. Total personnel
 - iii. Operators
 - iv. Maintenance
 - v. Security
 - vi. Administration
 - vii. Other
 - viii. Anticipated capacity factor
 - ix. Cooling system options and requirements (wet or dry)
 - x. Water requirement in gallons per day for conventional cooling
- g. Economics
 - i. Estimated overnight capital cost - \$/kw of capacity

- ii. Forecasted Levelized Cost of Energy
 - h. Licensing / Permitting
 - i. Current status and licensing / regulatory efforts to date
 - ii. Critical issues requiring U.S. Nuclear Regulatory Commission (NRC) approval
 - iii. Pathway to Commercial Operation
 - iv. Please provide an assessment of the maturity of the design and the technology readiness level using the DOE Technology Readiness Level (TRL) scale (see [DOE G 413.3-4A, Technology Readiness Assessment Guide](#)).
 - v. Please describe the anticipated pathway to commercial operation including a timeline with major milestones.
 - vi. Please describe any major development requirements including materials, testing, systems, etc.
 - i. End-of-Life
 - i. Please describe a plan, timeline and requirements to decommission and dismantle a nuclear power plant using your technology when it reaches end-of-life
19. Please specify a high level cost estimate by year for a project your organization might propose and identify critical elements that could significantly impact the cost. Include rationale for the estimate.
20. DOE intends to request questions from interested parties to the FOA upon its issuance, as well as hold an Industry Day to provide a program overview and explain solicitation requirements, including the possibility of one-on-one meetings with interested applicants.
- a. Please provide information on what information DOE can present that would be most beneficial to interested applicants at this Industry Day.
 - b. Please provide suggestions for the location and timing of the Industry Day.
21. DOE recognizes that some applicant companies competing for a Demonstration award may not be as mature as others, or are proposing technologies that involve risks that would likely prevent them from meeting the goal of deployment in five to seven years. For these applicants, DOE anticipates making two to five additional awards under the FOA using the \$30 million Risk Reduction award funding identified in the FY 2020 appropriation to address these risks and potentially position these technologies as the next group of domestic reactor designs to be demonstrated. Please provide input regarding how NE should approach this aspect of the solicitation and selection process.
22. Respondents are invited to provide any other suggestions or concerns that may not have been addressed in this RFI/NOI.