

## Critical Water Issues Prize Competition RFI

DATE: March 13, 2018  
SUBJECT: Request for Information (RFI), DE-FOA-0001899

### Description

The U.S. Department of Energy seeks to understand the key technical and other barriers that may prevent long-term access to low-cost water supplies that could be best addressed through challenges and prize competitions. For the purposes of this Request for Information (RFI), challenges and prize competitions are tools and approaches the Federal government and others can use to engage a broad range of stakeholders, including the general public, in developing solutions to difficult problems. Challenges and prize competitions rely on competitive structures to drive innovation among participants and usually offer rewards (financial and/or other) to winners and/or finalists. DOE may use the information provided through this RFI to develop challenges and prize competitions to address key water issues. This RFI is not designed to solicit input on DOE's broader R&D efforts on affordable water.

### Background

Water is a critical resource for human health, economic growth, and agricultural productivity. The United States has benefitted from access to generally low-cost water supplies, but new challenges are emerging that, if left unaddressed, could threaten this paradigm. For example, traditional freshwater sources are coming under stress from competing uses in a growing number of U.S. regions. A range of water quality problems are impacting human health and the environment, while municipal water and wastewater treatment systems face billions of dollars in unmet infrastructure investment needs, which will likely increase as population grows, and water and wastewater treatment requirements become more stringent.<sup>1</sup> This will put upward pressure on water and sewer rates, which have already experienced steady increases, on a national average, over the last several years.<sup>2</sup>

Energy is a key resource that modern water systems need to function properly. DOE has conducted substantial work to explore issues and advance solutions related to the energy-

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<sup>1</sup> Arzbaeher, C., K. Parmenter, R. Ehrhard, and J. Murphy. 2013. *Electricity Use and Management in the Municipal Water Supply and Wastewater Industries*. Palo Alto, CA: Electric Power Research Institute and Water Research Foundation. <http://www.waterrf.org/PublicReportLibrary/4454.pdf>.

<sup>2</sup> DOE (Department of Energy). 2017. *Water and Wastewater Annual Price Escalation Rates for Selected Cities across the United States*. Washington, DC: DOE.

[https://www.energy.gov/sites/prod/files/2017/10/f38/water\\_wastewater\\_escalation\\_rate\\_study.pdf](https://www.energy.gov/sites/prod/files/2017/10/f38/water_wastewater_escalation_rate_study.pdf).

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water nexus,<sup>3</sup> a term used to describe the interconnected nature of energy and water systems. This RFI contains a category of questions that specifically target the energy-water nexus, and energy is a theme that runs through several, if not all, of the other categories. With the exception of the energy-water nexus category, however, respondents should not limit themselves to energy issues in their responses. DOE is interested in collecting broad information that helps define the key water issues that could be addressed through challenges and prize competitions whether they concern energy explicitly, implicitly, or not at all. Responses collected through this RFI may be shared with other agencies to help them craft related prize competitions and challenges.

DOE recognizes that local, state, Federal, private, and non-profit actors are working to address water challenges using a range of mechanisms, including policy changes, early stage R&D, and grant funding. For example, DOE's Advanced Manufacturing Office (AMO) is developing an early stage R&D program to develop technologies that advance the cost-effective and energy efficient production of treated water from a range of conventional and non-conventional sources. AMO has conducted substantial stakeholder engagement to support this early stage R&D effort, including three workshops and a separate RFI issued in June of 2017. This RFI differs from the June request in that it seeks input from the public specifically on the water problems that could be best addressed through challenges and prize competitions. Additionally, it asks how those challenges and prize competitions could be structured to achieve maximum results.

In challenges and prize competitions, a given prize sponsor will define a problem and offer a reward for a solution.<sup>4</sup> Rewards can be monetary as well as non-monetary, such as national recognition, testing and validation of technologies, access to experts and specialists, and other organizational support. A key characteristic of challenges and prize competitions is they clearly define a problem without prescribing a particular solution path. Participation in prize competitions is generally open to a wide range of participants, with financial or other rewards provided at the end of the competition after a designated target or goal has been reached. This contrasts with traditional R&D funding in which participants are selected up front with funding provided at the beginning in order to pursue a target or goal. Prizes and competitions tend to work best when targeting solutions that are measurable and achievable within a relatively short time period—typically between two and ten years.<sup>5</sup> Challenges and prize competitions are not limited to technology and technical solutions; they can also promote business models, financing

<sup>3</sup> See, DOE. 2014. The Water-Energy Nexus: Challenges and Opportunities. Washington, DC: DOE. <https://energy.gov/sites/prod/files/2014/07/f17/Water%20Energy%20Nexus%20Full%20Report%20July%202014.pdf>.

<sup>4</sup> For an overview of challenges and prize competitions, see Hendrix, M. 2014. *The Power of Prizes: Incentivizing Radical Innovation*. Washington, DC: U.S. Chamber of Commerce Foundation.

<sup>5</sup> National Research Council. 2007. *Innovation Inducement Prizes at the National Science Foundation*. Washington, DC: National Academy Press, 2007.

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approaches, market design, information systems, policy design, and other innovative solutions. Challenges and prizes are powerful tools because they:

- Reach beyond the “usual suspects” to increase the number of solvers tackling a problem
- Identify novel approaches
- Bring out-of-discipline perspectives to bear
- Establish an ambitious goal without having to predict which team or approach is most likely to succeed
- Maximize return on investment by paying only for success.<sup>6</sup>

Since 2010, the Federal government has launched more than 740 challenges and prize competitions with millions of dollars in prize money and other incentives<sup>7</sup> (foundations, non-profit organizations, and private companies have launched many more). Examples of Federal prizes can be viewed on Challenge.gov. In recent years, DOE has run several prize competitions, including: the Catalyst Energy Innovation Prize (<https://energy.gov/eere/solar/sunshot-catalyst-energy-innovation-prize>), which offered cash prizes to teams and individuals that developed data, analysis, and software solutions that serve the energy efficiency and renewable energy market; and the Clean Tech University Prize (<https://energy.gov/eere/technology-to-market/cleantech-university-prize-cleantech>), which offered entrepreneurial support and financial rewards to teams of university students to support the commercialization of clean energy technologies; and the Wave Energy Prize (<https://waveenergyprize.org/>), which was a multi-stage prototype competition incentivizing innovation in wave energy conversion technologies.

## Purpose

The purpose of this RFI is to solicit feedback from industry, academia, research laboratories, government agencies, and other stakeholders on the key water problems that can be best addressed through challenges and prize competitions. DOE is specifically interested in information on how challenges and prize competitions can be used to engage a broad collection of stakeholders in removing barriers and enabling access to long-term, abundant supplies of low-cost, water. This is solely a request for information and not an announcement of a prize, challenge or competition, nor a Funding Opportunity Announcement (FOA). DOE is not accepting applications.

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<sup>6</sup> OSTP (Office of Science and Technology Policy). 2016. *Implementation of Federal Prize Authority: Fiscal Year 2015 Progress Report, A Report from the Office of Science and Technology Policy In Response to the Requirements of the America COMPETES Reauthorization Act of 2010*. Washington, DC: OSTP.

<sup>7</sup> “About,” <https://www.challenge.gov/about/>, retrieved February 22, 2018.

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## Disclaimer and Important Notes

This RFI is not an announcement of the availability of any type of funding; therefore, DOE is not accepting applications at this time. DOE may announce a prize in the future based on or related to the content and responses to this RFI; however, DOE may also elect not to offer any funding related to this topic. There is no guarantee that any funding will be issued as a result of this RFI. Responding to this RFI does not provide any advantage or disadvantage to potential applicants if DOE chooses to make any funding available related to the subject matter. Final details, including the anticipated funding amount and timing of DOE funded awards, will be subject to Congressional appropriations and direction.

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. DOE 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. DOE will not provide reimbursement for costs incurred in responding to this RFI. Respondents are advised that DOE 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 DOE 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/or otherwise be made available to the public, **respondents are strongly advised to NOT 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:

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**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-0001899. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source.

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 DOE 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: Increasing Alternative Water Supplies**

Traditional freshwater supplies are under stress in several parts of the country with withdrawals either already outpacing supplies or approaching that point. This will become a bigger problem over time as population grows and growth patterns shift. As a result, demand is expected to increase for non-traditional sources of water, which include sea water along coastal regions, brackish water available in much of the heartland, produced waters associated with oil and gas recovery, and beneficial reuse of wastewater treatment effluents. Technologies exist to treat these non-traditional sources of water, though often at high expense.

1. What are the key technical and non-technical challenges that, if overcome, would allow for a significant increase in the volume of available water produced from non-traditional sources? (This can be for a range of beneficial uses, including agricultural, industrial, or

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drinking purposes.) Please limit responses to those technical and non-technical challenges that could be best addressed through prize competitions.

2. Please elaborate on these challenges by providing: (1) a brief description of the challenge; (2) solutions that could be used to overcome the challenge; and (3) near-term goals that, if met, would signal success in, or significant progress toward, overcoming the challenge.
3. What types of prize incentives or other competitive structures could be employed to drive solutions to these challenges?
4. To what extent do insufficient information, data availability, and monitoring capabilities impede the utilization of non-traditional water sources? Please explain how.

**Category 2: Reducing Costs to Treat Drinking Water and Wastewater**

DOE's Pacific Northwest National Laboratory estimates that water prices increased each year, on average, by about 4.1% for drinking water and 3.3% for wastewater covering the time period 2008 through 2016. Price increases generally come about as water utilities pay back capital investments to modernize their infrastructure, add capacity, meet new water quality regulatory limits, or some combination of all three. Additional, significant capital expenses for these purposes are expected to persist into the future, leading to continued upward pressure on water prices.

1. What are the key technical and non-technical challenges that, if overcome, could reduce the cost to treat and deliver drinking water and wastewater to consumers, without negative impact on water quality? Please limit responses to those technical and non-technical challenges that could be best addressed through prize competitions.
2. Please elaborate on these challenges by: (1) providing a brief description of the challenge; (2) solutions that could be used to overcome the challenge; and (3) near-term goals that, if met, would signal success in, or significant progress toward, overcoming the challenge.
3. What novel opportunities exist for wastewater treatment plant operators to create revenue streams from resources recovered from their influent? What barriers prevent operators from capturing these opportunities?
4. Are there water quality solutions that, if deployed, could protect water quality more cost-effectively than central treatment systems alone? What are the barriers to deploying these solutions?
5. What types of prize incentives or other competitive structures could be employed to drive solutions to these challenges?
6. To what extent do insufficient information, data availability, and monitoring capabilities impede addressing challenges in the water and wastewater treatment sectors? Please explain how.

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**Category 3: Opportunities to Use Water More Efficiently**

Using water more efficiently can relieve pressure on freshwater sources, save energy, cut costs, and improve water quality. There are opportunities for the commercial and industrial sectors to use water more efficiently, though DOE recognizes that approaches to do so will vary by sector—commercial, residential, industrial, oil and gas, electric power, or agricultural. Respondents should note which sector(s) they are referring to in any sector specific responses.

1. What are the key technical and non-technical challenges that, if overcome, could lead to significant improvements in water efficiency? Please limit responses to those technical and non-technical challenges that could be best addressed through prize competitions.
2. Please elaborate on these challenges by: (1) providing a brief description of the challenge; (2) solutions that could be used to overcome the challenge; and (3) near-term goals that, if met, would signal success in, or significant progress toward, overcoming the challenge.
3. To what extent do insufficient information, data availability, and monitoring capabilities impede water conservation efforts? Please explain how.
4. Do emerging water utility business models with revenue structures that encourage conservation hold promise for reducing water consumption? What are some of these business models?
5. Given a ten-year timeframe, what are ambitious but achievable water efficiency targets for certain industrial and/or power sector applications? What are those applications? What are the technical and economic barriers to improving water efficiency within those applications?
6. For any of the questions raised above, what types of prize incentives or other competitive structures could be deployed to drive the development of solutions to these issues?

**Category 4: Market-based Solutions that Incentivize Innovation and Conservation**

Water utilities across the United States employ a variety of different rate structures. While water can be scarce or abundant in different parts of the country, water prices often do not reflect these supply and demand conditions. The manner in which water rights are allocated can also have an impact on how water is used. Additionally, end-use customers may not always be aware of the full cost of their water consumption, including the energy needed to pump and heat the water within their homes, buildings, and plants.

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1. Do water markets and water rates currently relay appropriate price signals based on supply and demand? If the answer is no, please describe the mechanisms that distort the price signal.
2. Are there market failures or government failures in water markets that, if addressed, could result in water market pricing that more closely reflects supply and demand? Please describe those failures. What are the barriers to achieving more efficient water markets?
3. What challenges related to water pricing or other market design could be best addressed through the use of prizes or competitions?
4. What types of prize incentives or competitive structures could be deployed to drive meaningful solutions to these problems on a near-term basis?

**Category 5: The Energy-Water Nexus**

The energy-water nexus is a term used to describe the interconnected nature of energy and water systems. For example, energy is required to extract, convey, and deliver water of appropriate quality for diverse human uses and then again to treat wastewater prior to return to the environment. Conversely, water is used in multiple phases of energy production and electricity generation, from hydraulic fracturing and irrigating crops for biofuels to providing cooling water for thermoelectric power plants. Vulnerabilities in one system can affect the other. DOE recognizes that the energy-water nexus theme cuts across the other categories of questions listed above. This category is intended to solicit input on water challenges solely or predominantly impacted by energy issues and energy challenges solely or predominantly impacted by water issues. For questions 1-4, please limit responses to those technical and non-technical challenges that could be best addressed through prize competitions.

1. What are the most critical energy issues that, if solved, could have a measurable and significant near-term impact on the availability of low-cost water supplies?
2. What are the most critical water issues that, if solved, could have a measurable and significant near term impact on low-cost energy production?
3. What opportunities are there to pursue measurable value through integrated energy and water systems?
4. What opportunities are there to pursue measurable value through innovation in water, electricity, and other market design?
5. Please elaborate on the challenges identified in questions 1 through 4 by: (1) providing a brief description of the challenge; (2) solutions that could be used to overcome the challenge; and (3) near-term goals that, if met, would signal success in, or significant progress toward, overcoming the challenge.

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6. What types of prize incentives or other competitive structures could be employed to drive solutions to these challenges?

**Category 6:** Past, Existing, and Forthcoming Water-Related Challenges and Prize Competitions

DOE would like to be aware of any past, existing, or forthcoming water-related challenges and prize competitions to: learn from others' experiences; potentially partner with synergistic initiatives; and/or avoid duplication of effort.

1. Please list any past, existing, or forthcoming water-related challenges and prize competitions. Include brief descriptions of the initiatives and web links if available.
2. What have been some key characteristics of prior successful water or energy-water nexus prize competitions and challenges? Please include examples of incentives that have been effective in prize competitions and challenges.
3. Are there any considerations that DOE should keep in mind when formulating new challenges or prize competitions focused on key water issues?

**Category 7:** Other Water Challenges not Covered Elsewhere in this RFI

DOE is interested in understanding the broad range of critical water problems that challenges and prize competitions are best suited to tackle. The preceding categories may not be inclusive of all key water challenges facing the country and world. This category of questions is designed to gather input on any other water challenges not covered elsewhere in the RFI.

1. Please include additional challenges not covered previously. What are the technical and non-technical barriers that need to be overcome to solve these problems?
2. How could a challenge or prize competition be structured to address these problems?

**Request for Information Response Guidelines**

Responses to this RFI must be submitted electronically to [WaterPrizeRFI@ee.doe.gov](mailto:WaterPrizeRFI@ee.doe.gov) no later than 5:00pm (ET) on **May 14, 2018**. 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 5 pages in length per category of questions, 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.

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DOE 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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