



Waves to Water Prize Official Rules

SEPTEMBER 2019



The U.S. Department of Energy (DOE) Waves to Water Prize will be governed by this Official Rules Document, which establishes the rules and requirements for the Waves to Water Prize. The Prize Administrator and DOE reserve the right to modify this Official Rules document if necessary and will publicly post any such notifications as well as notify prize participants.

MODIFICATIONS	Date
1. Revised Section 3.5 How We Determine Winners to classify advisory judges as reviewers, and specified conflict of interest requirements for the final judge.	September 3, 2019

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1. EXECUTIVE SUMMARY

The U.S. Department of Energy (DOE) Water Power Technologies Office (WPTO) is launching a prize to develop wave energy powered desalination systems. The Waves to Water Prize is a 4-Stage, \$2.5M contest to accelerate the development of small, modular, wave-powered desalination systems capable of providing potable drinking water in disaster relief scenarios and remote coastal locations. The prize supports the integration of existing and novel wave energy generation technologies with water technologies that can deliver effective, consistent, durable and low-maintenance water delivery systems. The prize seeks to identify the ideal scale of wave energy innovation paired with water technologies that can serve niche markets such as disaster response, and advance the state of both wave energy devices and desalination technologies that could provide value in other markets as the technologies mature.

The prize aims to attract dedicated teams of highly capable individuals and provide them with sufficient incentives so that they will advance their technologies through completion of the prize. While the technology development goals of the prize are specifically tailored to address the unique circumstances around disaster response or remote coastal community water needs, the purpose is also to advance technologies that could have broader applications for wave energy and desalination technologies. Through the competition, participants will develop skills and knowledge that will contribute to a general improvement and proliferation of wave power and desalination technologies.

1.1 TECHNOLOGY DEVELOPMENT GOALS

The purpose of this program is to incentivize the creation of wave powered desalination systems that meet the following goals:

- **Flexibility in Varied Wave Conditions:** Competitors must develop systems that can survive harsh wave conditions and operate under different wave conditions and different sites without major tuning to ensure operation at a wide variety of locations. All solutions that make it to the DRINK Stage will be evaluated at an open-water test site with an anticipated average- to low-energetic wave resource.
- **Easily Deployed:** Systems must be able to be deployed in less than 48 hours, addressing the ability to deploy quickly and easily in a disaster response scenario where there is large uncertainty around site conditions.
- **Ship in a Standard Container:** Technologies must fit into a predefined container – approximately 45 x 48 x 42 inches – to standardize the shipping constraints that face many disaster response and recovery scenarios.
- **Deliver Minimum Water Quality:** The maximum total dissolved solids (TDS) quantity for this competition is 1,000 mg/L. At the DRINK Stage, competitors will be scored higher if this threshold is exceeded and the water quality is closer to a target goal range of 300 - 600 TDS mg/L.
- **Operate without Environmental Degradation:** Brine discharge, or other salt concentration issues from the process of desalinating water will need to be managed without creating environmental issues.

More information on the goals of the program can be found in Appendix 2 of this document.

1.2 PRIZE STAGES



STAGE I: CONCEPT

90 DAYS: June 13, 2019 to September 11, 2019



Competitors should describe how their proposed solution meets the goals of the program— as laid out in Section 1.1 of this document. Submissions should detail the functionality of the wave energy generation technology, desalination technology, and the proposed integration methods. This includes describing the risks and difficulties of the system, and proposed solutions to these issues. And competitors should detail how their solution has any other benefits,

including potential to scale or other value streams. Competitors will be evaluated based on the level of innovation of their proposed idea, the feasibility of their system, scale-up and other benefits, and their team. Up to 20 winners will receive a \$10,000 prize.

More information on what to submit and the criteria for this stage can be found in Section 3 - CONCEPT Stage Rules and Requirements.

STAGE II: DESIGN

90 DAYS: October 2019 to January 2020 (anticipated)



Competitors in the DESIGN Stage will develop a technical plan and supporting analysis of their wave-powered desalination system. Submissions should focus on two major components: (1) A detailed design of their wave-powered desalination system, including modeling to support their claims of performance if a prototype of the system is built; and (2) a plan to build a prototype of their system, including how major risks will be addressed if the submission wins and the team advances to the CREATE Stage. Teams that demonstrate they have the technical capability and sufficient plans to build a functional or proof-of-concept prototype will be awarded a cash prize. There will be up to 20 winners, who will share equally a total funding amount of \$800,000, but not to exceed \$100,000 per team even if less than 8 winners are selected. Any eligible entity may compete in the DESIGN Stage regardless of whether they were a competitor in the CONCEPT Stage.

The details of Stage II: DESIGN are still under development. Detailed rules for this stage will be released before the start of this stage.

STAGE III: CREATE

180 DAYS: February 2020 to August 2020 (anticipated)



Competitors in this stage will have 180 days to build a functional prototype or proof-of-concept of their system, and develop a plan to build and deliver their technology for the DRINK Stage. Up to 5 - 10 winners will be awarded equally from a total prize pool of up to \$500,000, but not to exceed \$150,000 each, even if less than 4 winners are selected. Any eligible entity may compete in the CREATE Stage regardless of whether they were a competitor in the DESIGN or CONCEPT Stage.

The details of Stage III: CREATE are still under development. Detailed rules for this stage will be released before the start of this stage.

STAGE IV: DRINK

180 DAYS: October 2020 to April 2021 (anticipated)



Winners of the CREATE Stage will have up to 180 days to build and ship their systems to a designated test site to conduct a test for up to 5 days. The site will be a testing environment in the ocean. Competitors will compete on efficiency, logistics, and system integration metrics, and will be scored on ability to meet minimal thresholds, and how they performed against the defined metrics. Only winners of the CREATE Stage can participate in the DRINK Stage.

Multiple winners will be selected, including:

- **Grand Prize:** A grand prize in the amount of \$500,000 will be awarded to the competitor with the best overall score.
- **Individual Metrics Prizes:** There will be other prizes awarded to the competitors for a total prize pool of \$500,000.

The details of the Stage IV: DRINK are still under development. Detailed rules for this stage will be released before the start of this stage.

1.3 APPLICATIONS NOT OF INTEREST

The prize specifically does not target larger desalination systems (e.g. small municipal or community scale).

1.4 PARTICIPANT ELIGIBILITY

The competition is open only to: (a) citizens or permanent residents of the United States; and (b) private or non-federal public entities, such as townships, tribes, corporations, or other organizations that are incorporated in and maintain a primary place of business in the United States. Individuals can compete alone or as a member of a group.

A representative of a private entity can register the entity to compete. So long as an entity is legally formed under the laws of a state or the laws of the United States, individuals working under that entity may participate regardless of immigration status.

DOE employees, employees of sponsoring organizations, members of their immediate families (i.e. spouses, children, siblings, or parents), and persons living in the same household as such persons, whether or not related, are not eligible to participate in this prize. Federal entities and federal employees, acting within the scope of their employment, are also not eligible to participate in any portion of this prize. DOE national laboratory employees cannot participate in any stage of the prize.

2. BACKGROUND

In 2017 through early 2019, WPTO conducted analysis and stakeholder engagement to identify and study the range of potential applications and markets for marine energy technologies, beyond a focus on grid-scale power applications. This work resulted in the release of a report in April 2019, entitled [*Powering the Blue Economy: Exploring Opportunities for Marine Renewable Energy in Maritime Markets*](#). The report identifies potential opportunities and challenges for marine energy in eight different ocean markets, including those far out at sea, like ocean observation and mining - and those nearshore, like desalination and coastal resiliency.

The *Powering the Blue Economy* report identifies wave-powered desalination as a potential growth market for marine energy technologies, particularly targeting isolated coastal/island communities with high energy costs. Wave energy-powered desalination systems could help to address coastal challenges such as resilience, disaster recovery, and water scarcity, especially if systems are competitive on price, water production, and reliability when compared to conventional alternatives. However, even given its theoretical advantages, wave-powered desalination is still an early-stage technology with significant market and technical challenges.

Through this prize, WPTO seeks to accelerate innovation in both wave energy devices and desalination systems, and create the incentive for teams to build interdisciplinary approaches to integrate wave power and desalination. WPTO aims to leverage the expertise and creativity of academia, industry, government, and other partners engaged in marine energy and desalination technologies through this prize. Due to its interdisciplinary challenges, the prize seeks to unite the water technology community, the marine renewable energy industry, and the set of experts and stakeholders working to address water security challenges in remote or island communities. And it is WPTO's hope that by supporting competitors to demonstrate initial viability through this contest, it will provide a spark for additional private sector investment.

While the focus of this prize is specific to remote communities and disaster response, WPTO seeks to uncover innovation to advance marine energy technology readiness for cost-competitive applications of both small-scale and municipal-scale water production, or other

technological advancements that could advance the state of wave energy for other market applications.

In addition to the work being explored by WPTO, DOE is deeply invested in a variety of technology solutions to solve many challenges related to freshwater, as its availability is a big, multi-faceted challenge. This includes, among other energy-water nexus challenges, the recently announced [Water Security Grand Challenge](#).

Wave Power: An Energy Opportunity

Desalination is an energy-intensive process, where typically energy is used for a variety of purposes, which could include driving fluid through a membrane, providing heat for a distillation or evaporation process, and/or hybrid configurations. The high energy costs (in many cases electricity costs) of these systems have economic implications for their owner/operators, as fuel costs can be variable and leave operators with little predictability of the operational costs to run these systems. Additionally, unlike capital expenditures (i.e. buying the equipment) operational costs cannot be amortized over the life of the project. The ability to bypass these energy costs – either by producing off-grid, decentralized electricity to directly power the system or eliminate the need for electricity through direct pressurization – could be critical for development, driving significant cost savings and reducing the risk or sensitivity of technologies to dynamic energy prices. Companies and technology developers in the marine energy space believe wave-powered desalination may help address these issues.

The National Renewable Energy Laboratory (NREL) has researched and modeled wave powered concepts that directly pressurize reverse-osmosis (RO) seawater desalination systems. NREL’s simulation results suggest that a wave-pressurized RO application could be more cost competitive when producing water than a wave energy system producing electricity, given current cost estimates.¹ This finding signals a near-term market opportunity for wave energy requiring smaller cost reductions before the technology is commercially competitive with grid-power applications.

The United States has one of the most compelling and varied wave resources across its coastline, where integrating wave energy and seawater desalination could have specific advantages:

- **Wave energy can produce clean water without any electrons.** Many desalination processes, such as RO, traditionally require a reliable grid-connected power supply to provide continuous energy input (e.g. pressure across a membrane). However, with many wave energy converter designs operating as oscillatory pumps, they can be used to directly pressurize an RO system, potentially eliminating the need to purchase electricity.
- **Wave-powered desalination is more than just an economic challenge, it’s a technical challenge.** Both the capture of energy from waves and the application of water treatment technologies are valuable areas of innovation. A marine energy-powered system might have inherent system attributes and capabilities that go beyond

¹ Yu, Yi-Hsiang, and Dale Jenne. 2017. “Analysis of a Wave-Powered, Reverse-Osmosis System and Its Economic Availability in the United States.” 36th Annual International Conference on Ocean, Offshore and Arctic Engineering. Trondheim, Norway. June 25–30. <https://www.nrel.gov/docs/fy17osti/67973.pdf>.

existing requirements or incumbent technologies. Technical innovations are still needed to achieve a level of economic competitiveness.

- **Desalination without electricity consumption is a compelling technological challenge with potential benefits beyond drinking water.** Many of the advances from this competition could find integration in other applications for marine energy technologies. For example, directly pressurizing a system might be an attribute of an aquaculture or marine algae farm; or it could be applied to direct seawater adsorption systems. The efforts undertaken in the prize might have broad application across many new opportunities for marine renewable energy.
- **Wave-powered desalination could shift from costs from variable to fixed.** Either by directly supplying electricity via wave energy, or by eliminating the need for electricity through pressurizing, the variable costs of grid-scale or diesel-based systems could be eliminated, which would allow for operators to better control and predict operational costs.

3. CONCEPT Stage Rules and Requirements

3.1 INTRODUCTION

The Waves to Water Prize is a four-stage contest seeking to accelerate the development of modular, flexible, and easily transportable systems using wave power to desalinate ocean water, providing clean water in areas of the world facing disaster relief and recovery scenarios or providing water to remote, high-cost, and water-scarce coastal and/or island locations with little infrastructure support. This stage invites competitors to submit functional and/or novel system concepts that use wave energy to desalinate water.

CONCEPT STAGE PRIZES

Prize Pool Up to \$200,000
Up to 20 prize winners receive
\$10,000

Competitors are encouraged to provide a range of systems that use wave power for desalination, which could either use wave power to create water pressure or to generate the electricity needed for a desalination system. For this stage, the innovation criteria and the feasibility criteria are almost equally weighted (28% and 36% of the score, respectively) to encourage submissions that include a range of systems. Proven systems and novel solutions both can be successful. WPTO is looking to award prizes to competitors that have a strong likelihood of going on to win Stage IV: DRINK, as well as incentivize innovative and less-proven technologies that are promising concepts.

The following rules are for competitors in the CONCEPT Stage. “You” and “your” reference competitors in this stage. Any eligible team or individual can compete in the CONCEPT Stage. There are no limits on the number of submissions from any one team.

3.2 HOW TO ENTER

Complete a submission package online at <https://www.herox.com/WavestoWater> before the contest closing date.

3.3 IMPORTANT DATES



Submission Open: June 13, 2019
Submission Close: September 11, 2019
Winner Notification: Anticipated to be October 2019

3.4 WHAT TO SUBMIT

The following items constitute the submissions package and must be submitted through the HeroX platform:

- Cover Page Content (to be made public, not scored)
- Submission Summary Slide (to be made public, not scored)
- 2-Minute Video Pitch (to be made public, scored)
- Technical Narrative detailing the solution, team, and plan (scored)²
- Optional: Appendix on Technical Specifications
- Optional: Letters of Commitment or Support

Cover Page Content

Cover Page – List basic information about your submission (will be made public)	
<ul style="list-style-type: none">● Title● Short description● Link to your 2-minute video online	<ul style="list-style-type: none">● Key project members (names, contacts, and links to their other professional online profiles)● Your city and state● Other partners (if any)

Submission Summary Slide

Submission Summary Slide (will be made public)
Make your own public-facing, one-slide submission summary that contains technically specific details but can be understood by most people. There is no template, so feel free to present the information as you see fit. Please make any text readable in a standard printout and conference room projection.

Scored Items: 2-Minute Video and Technical Submission

Submissions will be scored based on the 2-Minute Video and Technical Submission on a 1-6 scale, as shown below.

1	2	3	4	5	6
Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree

² Competitors who do not want the Technical Narrative or other documents (e.g., Appendix on Technical Specifications) to be made public will need to mark them according to the instructions in see Paragraph 10 of Appendix 1.

To calculate the score for each submission, each statement in the criteria listed below for the 2-Minute Video Pitch and Technical Submission are of equal weight. The table below represents the number of statements for each item and its related weighting in the final score:

Item	Score Weighting
2-Minute Video Pitch	3 Statements (12%)
Technical Submission	22 Statements (88%)
Question 1: Innovation	7 Statements (28%)
Question 2: Technical Feasibility	9 Statements (36%)
Question 3: Scalability and Other Benefits	4 Statements (16%)
Question 4: Team	2 Statements (8%)
TOTAL	25 Statements (100%)

2-Minute Video Pitch

Post your publicly accessible video online (e.g. YouTube, Vimeo, etc.). Be creative and produce a video that conveys the suggested content listed below or any other information that will help the judges understand your technology in an exciting and interesting way, but do not focus on time consuming activities that only improve production values (i.e. technical elements such as décor, lighting, and cinematic techniques). The advisory judges will score the video based on the content you have provided and each statement is equally weighted.

Online Public Video – What is your system in 2 minutes	
<p>Suggested Content You Provide</p> <ul style="list-style-type: none"> • Your system and why it will work. • How your solution can address water needs in remote communities or for disaster relief. • Who you are and why you have a competitive edge. 	<p>Judges Score Each Statement on 1-6 Scale</p> <ul style="list-style-type: none"> • The video explains how the system meets the goals of the contest – as laid out in Section 1.1 of this document. • The video describes how the system can be built in the timeframe of the competition. • The video shows a knowledgeable and skillful team.

Technical Narrative

You should answer each of the following four questions. The content bullets are only suggestions to guide your responses. You decide where to focus your answers. The individual answers to the four questions do not have a word limit, however, the aggregate response to these four questions must not exceed 2,500 words. You may also include up to five supporting images, figures, or graphs. The advisory judges will score the questions based on the content you have provided and each statement is equally weighted.

Technical Narrative

Question 1: Innovation - *Does your system represent a novel solution concept that can deliver water in disaster relief and recovery and in remote coastal communities?*

Suggested Content You Provide

- How this solution is unique from what has been demonstrated or is currently available.
- Any novel or unique material technologies, fit-for-purpose water quality technologies, wave energy capture technologies, or any other choices driving innovation.
- How this technology is specifically suited to serve remote communities and/or disaster response/recovery scenarios. This can include ease of operation, how a system can be operated by a broad range of end-users, ease of transport, or other characteristics.
- The integration challenge between the proposed wave energy technology and desalination technology and your innovative solution.
- If the system uses electricity from the wave device, describe any storage capabilities associated with the system.
- Describe how the solution presents as an interdisciplinary challenge and opportunity.

Judges Score Each Statement on 1-6 Scale

- The proposed solution presents an innovative approach to wave-powered desalination systems.
- The wave energy device demonstrates an innovative deployment and installation approach.
- The desalination process includes innovative elements or fundamental advances in water treatment against incumbent solutions.
- The proposed solution has unique attributes that make it more likely to serve the needs of a coastal community than incumbent or existing technologies.
- The proposed solution has unique attributes that enable long-term operation and durability.
- The proposed solution integrates a wave energy extraction technology and a desalination technology with a strong interdisciplinary approach.
- The proposed solution is easily adaptable to a wide range of wave and water resource conditions.

Question 2: Technical Feasibility - *Is the solution technically feasible?*

Suggested Content You Provide

- Supporting body of knowledge that provides confidence that the system is capable of producing potable water from wave energy (e.g. literature, expert review, etc.).
- Technology risks/challenges (e.g. equipment, material, or processes) associated with your concept and how they will be mitigated.
- Design strategies relevant to survivability, and the widest range of wave conditions.
- Design strategies for how electricity will be provided continuously - or at a necessary level - if the system is reliant on the wave device for electricity for desalination.
- Expected efficiency of the system.
- Expected output of the system.
- How this solution will address the ability to deploy quickly and easily in a disaster response scenario where there is large uncertainty around site conditions.
- How your solution will be modeled and simulated if selected to move forward in the DESIGN Stage (e.g. analytical, high-fidelity numerical simulation, etc.)
- Where you stand in your solution's development cycle and define goals for DESIGN, CREATE, and DRINK Stages.

Judges Score Each Statement on 1-6 Scale

- The proposed technology is free of any major technical flaws on the wave energy extraction method.
- The proposed technology is free of any major technical flaws in the desalination method.
- A proof of concept has been documented and adequately presented.
- Primary working principles have been demonstrated in either a lab or ocean setting.
- The risks associated with the proposed solution are well understood and articulated.
- The technology, as described, can be practically deployed with minimal tools and access to infrastructure.
- The system is modular and, as described, can be practically deployed in less than 48 hours once on site.
- The modeling and simulation efforts described are appropriate for the physics of the proposed system.
- The general goals laid out in the DESIGN, CREATE, and DRINK Stages described in Section 1.2 of this document are attainable given the timeline of the prize.

Question 3: Scalability and Other Benefits - *Does the proposed solution have additional attributes or produce other benefits that would be valuable for other applications beyond the prize?*

Suggested Content You Provide

- Other additional benefits that would be attractive to industry or end-users, beyond just water production and water quality metrics.
- Describe the manufacturability of your system, including expected processes.
- The unique value proposition of your solution.
- The scalability of your solution to other market or technological applications.
- Potential for generation of additional revenue streams or innovative business model developments beyond drinking water production.
- Describe any reuse, harvesting, or utilization of brine discharge or other waste streams by the desalination system.
- Describe any advancements in environmental risk mitigation strategies, or other sustainability considerations.
- Additional consideration of end-user requirements or needs.

Judges Score Each Statement on 1-6 Scale

- The proposed system has additional value propositions or revenue streams that may be desirable for end users.
- The technology can be scaled up for diverse end users.
- The proposed solution can be mass-produced with widely-used manufacturing processes.
- The proposed system will reduce or eliminate environmental concerns.

Question 4: Team - *Does the submission include an exceptional and committed team to accomplish the stated goals of the proposed solution?*

Suggested Content You Provide

- Introduce your team, explain how it came together, and highlight the knowledge and skills that make it uniquely capable of achieving success. This should include a

Judges Score Each Statement on 1-6 Scale

- The team's track record demonstrates notable entrepreneurial qualities such as adaptability, creativity, decisiveness, and resourcefulness.
- The team's drive, knowledge, and

discussion of relevant experience aligned to the various challenges of the prize, which could include: coastal testing, marine renewable energy, and desalination.

- Highlight your team's experience in trying new things, solving difficult problems, and overcoming barriers to bring ideas to reality.
- Describe what drives your team to realize this solution and why you will continue when facing difficulties.
- Describe your efforts to advance your solution since the announcement of the prize contest.

complementary skillsets provide a strong competitive edge and assurance that the team will be able to deploy a system for open-water testing at the end of the prize.

Technical Specifications

Appendix on Technical Specifications (Optional)

Attach any graphics or drawings supporting your submission. Any material submitted beyond five pages will not be reviewed.

Letters of Commitment or Support

Letters of Commitment or Support (Optional)

Attach one-page letters (of support, intent, or commitment) from other relevant entities (e.g. potential users of the proposed innovation) to provide context. This could include Letters of Support from partners or others that you believe are critical to the success of your proposed solution. Please do not submit multi-page letters.

See Appendix 1 of this document for additional requirements. **COMPETITORS THAT DO NOT COMPLY WITH THE ADDITIONAL REQUIREMENTS IN APPENDIX 1 OF THIS DOCUMENT MAY BE DISQUALIFIED.**

3.5 HOW WE DETERMINE WINNERS

The Prize Administrator screens all completed submissions and, in consultation with DOE, assigns reviewers to independently score the content of each submission. The reviewers will be composed of Federal and non-Federal subject matter experts with expertise in relevant areas. Reviewers will review CONCEPT Stage submissions according to the described evaluation criteria.

Reviewer Panel Scoring: The scoring of submissions will proceed as follows:

- Each bullet listed in the judging criteria under the video submission and the four questions will receive a score between 1 and 6.
- The score from each reviewer for a submission package equals the total sum of the scores for all the bullets.

Interviews: WPTO, at its sole discretion, may decide to hold a short interview with a subset of the CONCEPT Stage competitors. The interviews would be held prior to the announcement of winners and would serve to help clarify questions the reviewers or judge may have. Attending interviews is not required and interviews are not an indication of winning.

Final Determination: The Director of WPTO is the judge of the competition and will make the final determination. Final determination of winners by the judge will take the reviewers' scores and the interview findings (if applicable) into account. The judge may not (a) have personal or financial interests in, or be an employee, officer, director, or agent of any entity that is a registered participant in the Prize; or (b) have a familial or financial relationship with an individual who is a registered participant.

Announcement: Approximately 30 days after the contest closes, the Prize Administrator notifies winners and requests the necessary information to distribute cash prizes. The Prize Administrator will then publicly announce winners.

3.6 PROGRAM GOAL REQUIREMENTS

Only submissions relevant to the technology goals, as laid out in Section 1.1 of this document, may compete. The Prize Administrator must conclude that all of the following statements are true when applied to your submission:

- The proposed solution utilizes wave energy to create drinking water.
- The proposed solution represents an innovation that will move the industry beyond its current state.
- The proposed solution does not involve the lobbying of any federal, state or local government.
- The proposed solution is based on sound fundamental technical principles.

3.7 ADDITIONAL TERMS AND CONDITIONS

See Appendix 1 for additional requirements. COMPETITORS THAT DO NOT COMPLY WITH THE ADDITIONAL REQUIREMENTS IN APPENDIX 1 MAY BE DISQUALIFIED.

**MORE DETAILS ON RULES FOR EACH STAGE WILL BE PROVIDED
PRIOR TO THE OPENING OF EACH SUBSEQUENT STAGE**

4. DESIGN Stage Rules and Requirements

OVERVIEW

The competitors in the DESIGN Stage will have 90 days to develop and submit a technical report expanding on their solution proposed in the CONCEPT Stage. This will include:

- Information on how their system meets the goals of the prize;
- Modeling of the proposed system; and
- Plan for how the competitor plans to fabricate a functional or proof-of-concept prototype in the subsequent CREATE Stage.

The competitors that demonstrate they have the technical capability to build a functional or proof-of-concept prototype will be awarded a cash prize that can be used to supplement prototype costs for the CREATE Stage.

Any eligible competitor can compete in this stage, even if they did not compete in the CONCEPT Stage.

PRIZES

The DESIGN Contest offers up to 10-20 cash prizes. \$800,000 in cash prizes will be divided equally by the number of winners not exceeding 20, with a \$100,000 maximum prize, even if the number of winners is less than 8.

ANNOUNCEMENT – Approximately 45 days after the contest closes, the Prize Administrator notifies winners and requests the necessary information to distribute cash prizes. The Prize Administrator will then publicly announce winners. After winning the CONCEPT Stage prize, competitors who wish to advance will develop their solutions in accordance with their plan to compete in the DESIGN Stage.

IMPORTANT DATES



Expected Start: October 2019

Expected Close: January 2020

Expected Winner Notification: February 2020

CONCEPT STAGE PRIZES

Prize Pool Up to \$800,000

10-20 Prize Winners split prize pool equally, with a maximum of \$100,000

5. CREATE Stage Rules and Requirements

OVERVIEW

Competitors in the CREATE Stage will have 180 days to build and document a proof-of-concept or functional prototype of their wave-powered desalination system and develop a plan to participate in the DRINK Stage of the prize. Requirements for this stage will include:

CREATE STAGE PRIZES

Prize Pool Up to \$500,000

5-10 Prize Winners split prize pool equally, with a maximum of \$150,000, and advance to DRINK

- Delivery of video demonstrating the operating principles and a functioning system;
- Technical document that demonstrates the feasibility of the system, and how the system functions; and
- A plan for how the full-scale system will be developed and delivered for testing at the DRINK Stage.

Any eligible competitor can compete in this stage, even if they did not compete in the CONCEPT or DESIGN Stages. Successful competitors will be invited to build their full system and ship to the test site at the end of the DRINK Stage. No new competitors will be allowed entry into the prize after the CREATE Stage.

PRIZES

The CREATE Stage offers up to 5 - 10 winners that will be awarded equally from a total prize pool up to \$500,000. The prize pool will be shared equally by the number of winners not exceeding 10, with a \$150,000 maximum prize, even if the number of winners is less than 4.

ANNOUNCEMENT – Approximately 45 days after the contest closes, the Prize Administrator notifies winners and requests the necessary information to distribute cash prizes. The Prize Administrator will then publicly announce winners.

IMPORTANT DATES



Expected Start: February 2020

Expected Close: August 2020

Expected Winner Notification: September 2020

6. DRINK Stage Rules and Requirements

OVERVIEW

Winners of the CREATE stage will have up to 180 days to build and ship their systems to conduct a test for up to 5 days at an open ocean testing environment. The competition will culminate in a demonstration, to include up to 5 days of testing, to demonstrate their solutions at an ocean test site and compete on efficiency, logistics and system integration metrics. The prize competition will be held in an open ocean environment and/or nearshore environment. DRINK competitors will be evaluated against the plan they propose at the end of the CREATE Stage.

DRINK STAGE PRIZES

Prize Pool Up to \$1,000,000

1 Grand Prize \$500,000 Winner

Individual Metrics Prizes Up to \$500,000 with Multiple Winners

All teams will be required to uncrate and deploy their technologies using “readily available” equipment (e.g. two-person dinghy, etc.), and will be timed. Once all teams have successfully deployed their devices, systems will be required to operate for 5 days. During the 5 days, teams will be scored on the amount of time they intervene (e.g. cleaning, fueling, etc.) in the contest, with the lowest amount of intervention time yielding the highest score. In addition to competing amongst one another, it is anticipated that a diesel and a PV desalination system will be used as control systems during the 5-day testing.

PRIZES

At the end of the testing period the devices will be evaluated based on the requirements and metrics and a Grand Prize winner will be awarded. Multiple winners will be selected, including:

- **Grand Prize:** A Grand Prize in the amount of \$500,000 will be awarded to the competitor with the best overall score.
- **Individual Metrics Prizes:** There will be other prizes awarded to the competitors for a total prize pool of \$500,000.

ASSESSMENT – DOE will select the winners of this Stage, based on the performance of the systems from the 5-day test period.

ANNOUNCEMENT – The Prize Administrator and DOE intend to announce the winners at the end of the open-water testing period.

The following table represents anticipated minimum requirements that will need to be met at the competition to be eligible for the Grand Prize at the DRINK Stage, and some of the key evaluation metrics that competitors will be scored against in the DRINK Stage.

Minimum Requirements		Evaluation Metrics	
Water Quality	Must be able to produce water with a maximum TDS level of 1,000 mg/L.	Water Quality	Higher scores will be awarded for water produced by the system at a higher quality standard.
Produced Volume	Amount of water produced that meets the minimum quality requirements.	Water Production	Higher scores will be awarded for increased water production.
Shipping Weight	The weight of the entire system, including the box, must be under a certain weight.	System Weight	Higher scores will be awarded for reduced weight.
48-Hour Setup	Systems must demonstrate that they can be set up in under 48 hours.	Time to Deploy & Maintenance	Higher scores will be awarded for technologies that can be deployed quicker and require less maintenance during the testing period.
		Reliability	Higher scores will be awarded for devices that indicate an operational life longer than the prescribed test.

IMPORTANT DATES



Expected Start: October 2020

Expected Close: March 2021

Expected Testing at Demonstration Site: April 2021

Expected Winners Announced: April 2021

Appendix 1 - Additional Terms and Conditions

1. REQUIREMENTS

Your submission for the Waves to Water Prize is subject to the following terms and conditions:

- You must post the final content of your submission or upload the submission form online at <https://www.herox.com/WavestoWater> Prize before the CONCEPT Stage closes. Late submissions or any other form of submission may be rejected.
- All submissions that you wish to protect from public disclosure must be marked according to the instructions in Paragraph 10 of Appendix 1. Unmarked or improperly marked submissions will be deemed to have been provided with unlimited rights and may be used in any manner and for any purpose whatsoever.
- You must include all the required submission's elements. The Prize Administrator may disqualify your submission after an initial screening if you fail to provide all required submission elements. Competitors may be given an opportunity to rectify submission errors due to technical challenges.
- Your submission must be in English and in a format readable by Microsoft Word or Adobe PDF. Scanned hand-written submissions will be disqualified.
- Submissions will be disqualified if they contain any matter that, in the sole discretion of DOE or the Prize Administrator, is indecent, obscene, defamatory, libelous, lacking in professionalism, or demonstrates a lack of respect for people or life on this planet.
- If you click "Accept" on the HeroX platform and proceed to register for any of the Stages described in this document, these rules will form a valid and binding agreement between you and the U.S. Department of Energy and is in addition to the existing HeroX Terms of Use for all purposes relating to this contest. You should print and keep a copy of these rules. These provisions only apply to the contest described here and no other contest on the HeroX platform or anywhere else.
- The Prize Administrator, when feasible, may give competitors an opportunity to fix non-substantive mistakes or errors in their submission packages.

2. VERIFICATION FOR WINNER PAYMENTS:

The Prize Administrator will verify the identity of a participant selected to receive the prizes. Receiving a prize payment is contingent upon fulfilling all requirements contained herein. The Prize Administrator will notify winning participants using provided email contact information after the date that results are announced. Each participant will be required to sign and return to the Prize Administrator, within 30 days of the date the notice is sent, a completed NREL Request for ACH Banking Information form, and a completed W9 form (<https://www.irs.gov/pub/irs-pdf/fw9.pdf>). In the sole discretion of the Prize Administrator a winning competitor will be disqualified from the competition and receive no prize funds if: (i) The person/entity cannot be contacted; (ii) the person/entity fails to sign and return the required documentation within the required time period; (iii) the notification is returned as undeliverable; or (iv) the submission or person/entity is disqualified for any other reason.

3. TEAMS AND SINGLE ENTITY AWARDS

The Prize Administrator will award a single dollar amount to the designated primary submitter whether consisting of a single or multiple entities. The primary submitter is solely responsible for allocating any prize funds among its member competitors as they deem appropriate.

4. SUBMISSION RIGHTS

By making a submission, and consenting to the rules of the contest, a competitor is granting to DOE, the Prize Administrator, and any other third parties supporting DOE in the contest, permission to use the submission consistent with the Rules of this Prize. Portions of submissions that are marked as protected from public disclosure according to Section 10 will be treated accordingly. Potential uses of submissions include posting or linking to the non-protected portions of the submission on the Prize Administrator or HeroX platforms, including the contest website, DOE websites, and partner websites, and the inclusion of the submission in any other media, worldwide. The submission may be viewed by the DOE, administrator, and judges for purposes of the contest including but not limited to screening and evaluation purposes. The Prize Administrator and any third parties acting on their behalf will also have the right to publicize competitor's name and, as applicable, the names of competitor's team members and organization, and the abstract for their idea at the CONCEPT Stage on the contest website indefinitely.

By entering, Competitor represents and warrants that:

1. Competitor has not included third-party content (such as writing, text, graphics, artwork, logos, photographs, dialogue from plays, likeness of any third party, musical recordings, clips of videos, television programs or motion pictures) in or in connection with the submission, unless (i) otherwise requested by the Prize Administrator and/or disclosed by competitor in the submission, and (ii) competitor has either obtained the rights to use such third-party content or the content of the submission is in the public domain without any limitations on use;
2. Unless otherwise disclosed in the submission, the use thereof by Prize Administrator, or the exercise by Prize Administrator or others acting on its behalf of any of the rights granted by competitor under these rules, does not and will not infringe or violate any rights of any third party or entity, including, without limitation patent, copyright, trademark, trade secret, defamation, privacy, publicity, false light, misappropriation, intentional or negligent infliction of emotional distress, confidentiality, or any contractual or other rights;
3. Competitor is not and will not conduct any activity pertaining to this prize competition that would infringe upon any intellectual property right of any third party, such as any patent, copyright, trade secret, or other intellectual property right; and that it has exercised reasonable efforts and diligence in making this representation and warranty. The foregoing representation and warranty shall be ongoing during the course of this competition and will be considered to have been made again and as of the date of each subsequent stage of the competition in which Competitor participates.
4. All persons who were engaged by the competitor to work on the submission or who appear in the Submission in any manner have:

- a. Given competitor their express written consent to submit the submission for exhibition and other use in any manner and in any and all media, whether now existing or hereafter discovered, throughout the world;
- b. Provided written permission to include their name, image or pictures in or with the submission (or if a minor who is not competitor's child, competitor must have the permission of their parent or legal guardian) and competitor may be asked by prize administrator to provide permission in writing;

5. COPYRIGHT

Each competitor represents and warrants that the competitor is the sole author and copyright owner of the submission; that the submission is an original work of the participant or that the participant has acquired sufficient rights to use and to authorize others, including DOE, to use the submission, as specified throughout the rules, that the submission does not infringe upon any copyright or upon any other third party rights of which the participant is aware; and that the submission is free of malware.

6. CONTEST SUBJECT TO APPLICABLE LAW

Contest is subject to all applicable federal laws and regulations. Participation constitutes each participant's full and unconditional agreement to these Prize Rules and Requirements and administrative decisions, which are final and binding in all matters related to the prize. This notice is not an obligation of funds; the final awards are contingent upon the availability of appropriations.

7. RESOLUTION OF DISPUTES

The U.S. Department of Energy is solely responsible for administrative decisions, which are final and binding in all matters related to the contest.

Neither the U.S. Department of Energy nor the Prize Administrator will arbitrate, intervene, advise on, or resolve any matters between team members or among competitors.

In the event of a dispute as to any registration, the authorized account holder of the email address used to register will be deemed to be the participant. The "authorized account holder" is the natural person or legal entity assigned an email address by an Internet access provider, online service provider or other organization responsible for assigning email addresses for the domain associated with the submitted address. Competitors and potential winners may be required to show proof of being the authorized account holder.

8. PUBLICITY

The winners of these prizes (collectively, "Winners") will be featured on the DOE and NREL websites.

Participation in the contest constitutes each winner's consent to DOE's and its agents' use of each winner's name, likeness, photograph, voice, opinions, and/or hometown and state information for promotional purposes through any form of media, worldwide, without further permission, payment or consideration.

9. LIABILITY

Upon registration, all participants agree to assume and, thereby, have assumed any and all risks of injury or loss in connection with or in any way arising from participation in this contest or development of any submission. Upon registration, except in the case of willful misconduct, all participants agree to and, thereby, do waive and release any and all claims or causes of action against the federal government and its officers, employees and related entities for any and all injury and damage of any nature whatsoever (whether existing or thereafter arising, whether direct, indirect, or consequential and whether foreseeable or not), arising from their participation in the contest, whether the claim or cause of action arises under contract or tort.

In accordance with the delegation of authority to run this contest delegated to the Director of the Water Power Technology Office, the Director has determined that no liability insurance will be required of participants to compete in this competition per 15 USC 3719(i)(2) in the Stage I: CONCEPT Stage. The Director will evaluate possible activities in the rest of the Stages and make additional determinations. Participants may be required to obtain liability insurance in future stages.

10. SUBMISSION MARKING AND FOIA

All materials submitted to DOE as part of a submission become DOE records. Any confidential commercial information contained in a submission should be designated in writing at the time of submission.

Participants are required to employ protective markings in the following manner:

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

Notice of Restriction on Disclosure and Use of Data:

Pages [list applicable pages] of this document may contain trade secrets or commercial or financial information that is privileged or confidential and is exempt from public disclosure. Such information shall be used or disclosed only for evaluation purposes. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source. [End of Notice]

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

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

Competitors will be notified of any Freedom of Information Act requests for their submissions in accordance with 29 C.F.R. § 70.26. Competitors may then have the opportunity to review materials and work with a FOIA representative prior to the release of materials.

11. PRIVACY

If you choose to provide HeroX with personal information by registering or completing the submission package through the contest website, you understand that such information will be transmitted to DOE and may be kept in a system of records. Such information will be used only to respond to you in matters regarding your submission and/or the contest unless you choose to receive updates or notifications about other contests or programs from DOE on an opt-in basis. DOE and NREL are not collecting any information for commercial marketing.

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.

12. GENERAL CONDITIONS

DOE reserves the right to cancel, suspend, and/or modify the contest, or any part of it, at any time. If any fraud, technical failures, or any other factor beyond DOE's reasonable control impairs the integrity or proper functioning of the contest, as determined by DOE in its sole discretion, DOE may cancel the contest.

Although DOE indicates in the Waves to Water Prize phases that it will select up to several winners for each phase, DOE reserves the right to only select competitors that are likely to achieve the goals of the program. If, in DOE's determination, no competitors are likely to achieve the goals of the program, DOE will select no competitors to be winners and will award no prize money.

13. PRIZE ADMINISTRATOR

The Prize Administrator is the Alliance for Sustainable Energy, LLC operating in its capacity as the Managing and Operating Contractor for the National Renewable Energy Laboratory (NREL). The U.S. Department of Energy, Water Power Technologies Office (WPTO) is the Federal Agency sponsor of the prize.

14. NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) COMPLIANCE

DOE's administration of the Waves to Water Prize is subject to NEPA (42 USC 4321, et seq.). NEPA requires federal agencies to integrate environmental values into their decision-making processes by considering the potential environmental impacts of their proposed actions. For additional background on NEPA, please see DOE's NEPA website, at <http://nepa.energy.gov/>.

While NEPA compliance is a federal agency responsibility and the ultimate decisions remain with the federal agency, all participants in Stage IV: DRINK will be required to assist in the timely and effective completion of the NEPA process in the manner most pertinent to their participation in the prize competition. Participants may be asked to provide DOE with information on fabrication and testing of their device such that DOE can conduct a meaningful evaluation of the potential environmental impacts.

ALL DECISIONS BY DOE ARE FINAL AND BINDING IN ALL MATTERS RELATED TO THE CONTEST.

Appendix 2 – Additional DRINK Technical Goals Details

Site Testing Conditions

All solutions competing in the DRINK Stage will be evaluated at an open-water test site with the following anticipated site characteristics:

- Significant wave height range³ between 0.5m - 2.0m;
- Average wave period range between 5-15 seconds;
- Water depth of 2-5m; and
- Deployed less than 1 km from shore.

This is an estimated range of conditions expected for the testing site. It is anticipated that the site will be representative of average to low-energetic wave resources, and at the bottom end of the ranges provided. Once a final test site has been selected, full technical details will be provided.

Ease of Deployment

Solutions need to address the ability to deploy quickly and easily in a disaster response scenario where there is large uncertainty around site conditions. Competitors should aim for systems that can be deployed in under 48 hours. Proposals should also consider how the water would be delivered to the shore. This could include either pumping, or transport between the device and shore. At the DRINK stage, there will be a set time for maintenance or transport from the device to the shore.

Set Shipping Container Size

The contest is seeking technologies that can fit into a predefined container to standardize the shipping constraints that face many disaster response and recovery scenarios. A standard container enables a direct comparison with other energy solutions (i.e. solar, gasoline/diesel generator, etc.) by ensuring that whatever system is being deployed has the same shipping and logistics limitations. Specifically, the prize is targeting locations that may have damaged infrastructure and therefore may have limited access to on-road transportation. For this reason the container that has been selected is sized so that any light-duty pickup truck will be able to transport a single unit to its final location. The container that has been selected is a standard commercial off-the-shelf container that is approximately 45 x 48 x 42 inches (e.g. DuraGreen DGR454842). The internal dimensions that all system components must fit inside are approximately 41 x 44 x 35 inches. WPTO may supply the final contestants with one container to ensure that every competitor at the final DRINK Stage has the same shipping constraints.

Water Quality

Globally, 97% of seawater ranges from 33,000 - 37,000 total dissolved solids (TDS) mg/L, but can range up to 45,000 mg/L in the Persian Gulf.⁴ TDS in produced water of current saltwater reverse osmosis plants ranges from 100 to 400 mg/L (>99.4% rejection), which satisfies the TDS limitation (< 500 mg/L) as set by the Environmental Protection Agency (EPA) Secondary Drinking Water Standards. To make progress toward demonstrating wave powered desalination

³ Defined here: https://www.weather.gov/key/marine_sigwave

⁴ National Academy of Science 2008

systems, in this contest there will be both minimum threshold requirements for water quality as the output of the system and a target goal:

- **Maximum Level TDS:** 1,000 mg/L (World Health organizations advises water with TDS concentrations less than 1,000 mg/L)⁵
- **Target Level TDS:** Range of 300 - 600 mg/L TDS to achieve generally good acceptability in terms of taste.⁶

Ultimately the prize seeks to produce drinking water at the final DRINK Stage of the competition that meets both EPA's Secondary Standards and mandatory limits of the National Primary Drinking Water Regulations⁷.

Local water quality will vary considerably across different regions, and it is necessary to design systems so that fit-for-purpose pretreatment and post treatment can be adopted with minimum efforts. Disinfection technology that functions without chemical consumption is also important to establish for remote communities with limited operational capacity. Examples include UV, laser (local temperature increase for short time) or ultrasonication can prevent biofouling and reduce operating cost, including chemical cost. WPTO has yet to make a final decision on whether systems will be required to include disinfection technologies in the DRINK Stage.

Flexibility of Systems

It is important that the wave energy converter systems paired with these desalination systems be adaptive to varying wave resources. Ocean waves are time-varying and site-varying in wave frequencies and amplitudes. Competitors must develop systems that can operate under different wave conditions and different sites without major tuning to ensure operation at a wide variety of locations. Traditionally, early prototypes of wave energy devices have been designed to be tested in controlled environments. But, given the unpredictability of post-disaster recovery conditions, and variety of conditions at sites with remote community needs, these systems need to work in a variety of wave conditions.

Environmental Benefits and Management

Brine discharge, or other salt concentration issues from the process of desalinating water, will need to be managed effectively depending on existing environmental regulations. The development of zero or near-zero liquid discharge technologies can be tactically important toward achieving highly efficient desalination systems. In addition, it is important that desalination systems do not introduce biological or chemical contaminants, such as unregulated or nontraditional constituents (e.g. Boron). Brine management strategies that effectively address both the economic and environmental cost of brine diffusion, disposal, or other applications will be encouraged. Specific strategies that are robust across a variety of feedwater types could also be critical for some applications and should be considered. Another critical factor might be

⁵ Water containing TDS concentrations below 1000 mg/litre is usually acceptable to consumers, although acceptability may vary according to circumstances. However, the presence of high levels of TDS in water may be objectionable to consumers owing to the resulting taste and to excessive scaling in water pipes, heaters, boilers, and household appliances (see also the section on Hardness). Water with extremely low concentrations of TDS may also be unacceptable to consumers because of its flat, insipid taste; it is also often corrosive to water-supply systems.

⁶ World Health Organization 2003

⁷ <https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations>

the tradeoff between concentrating brine recovery versus brine volume and determining an optimal level of water production to resource recovery. Finally, truly innovative brine reuse or application are of interest.