



U.S. DEPARTMENT OF ENERGY

# **American-Made Buildings Prize Rules for the Envelope Retrofit Opportunities for Building Optimization Technologies (E-ROBOT) Prize**

## **OFFICIAL RULES**

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# Modifications

All modifications are [HIGHLIGHTED] in the body of the rules document.

Mod. No.	Date	Description
Modification 1	08/18/21	Modifications to this rules document include: <ul style="list-style-type: none"><li>• Update to Phase 2 Important Dates</li><li>• Increased Technical Narrative page limit from 5 to 10 pages</li><li>• Changed submission document “Technology Transition Plan” to “Business Plan,” updated suggested content, and increased page limit from 3 to 5 pages</li><li>• Phase 2 Demo Day addition (in-person) and clarified the requirement for functional prototype</li><li>• Update to Phase 2 Scoring Criteria</li><li>• Minor edits for clarity and consistency.</li></ul>
Modification 2	02/03/22	Modifications to this rules document include: <ul style="list-style-type: none"><li>• Addition of two Virtual Demo Day submission elements:<ul style="list-style-type: none"><li>○ Virtual Demonstration Video Plan</li><li>○ Virtual Demonstration Video</li></ul></li><li>• Change from in-person demo day event to a virtual format</li></ul>

# I. PROGRAM SUMMARY

## 1. INTRODUCTION: A TWO-PRONGED APPROACH

The American-Made Envelope Retrofit Opportunities for Building Optimization Technologies (E-ROBOT) Prize, administered by the U.S. Department of Energy (DOE) Building Technologies Office (BTO), under the authority of the America COMPETES Reauthorization Act of 2010, consists of two parallel and integrated features: **The E-ROBOT Prize** and the **American-Made Network**.

The E-ROBOT Prize is focused on developing advanced robotics for building envelope retrofits in alignment with the Advanced Building Construction (ABC) Initiative. Advancements in robotics capabilities and controls allow for workers to reach places and perform activities that were previously difficult to access or were unsafe. For example, robots can safely enter small spaces and cavities, such as ductwork, to perform air-sealing or other efficiency activities. Robots can complement and support the existing workforce by creating new employment and business opportunities while also helping to ensure quality and consistency when installing energy efficiency measures. The E-ROBOT Prize incentivizes research and development (R&D) to improve the energy efficiency of residential and commercial buildings, as well as open new opportunities for the buildings and construction workforce without sacrificing the comfort of occupants.

The overarching goal of E-ROBOT is to catalyze the development of minimally invasive, low-cost, and holistic building envelope retrofit solutions that make retrofits easier, faster, safer, and more accessible for workers. Successful competitors will provide solutions that provide significant advancements in robot technologies that will advance the energy efficiency retrofit industry and develop building envelope retrofit technologies that meet the following criteria:

- **Holistic:** The solution must include mapping, retrofit, sensing and inspection.
- **Low cost:** The solution should reduce costs significantly when compared to current state-of-the-art solutions. The target for reduction in costs should be based on a 50% reduction from the baseline costs of a fully implemented solution (not just hardware, software, or labor; the complete fully implemented solution must be considered). If costs are not at the 50% level, there should be a significant energy efficiency gain achieved.
- **Minimally invasive:** The solution must not require building occupants to vacate the premises or require envelope teardown or significant envelope damage.
- **Utilizes long-lasting materials:** Retrofit is done with safe, nonhazardous, and durable (30+ year lifespan) materials.
- **Completes time-efficient, high-quality installations:** The results of the retrofit must meet common industry quality standards and be completed in a reasonable timeframe.
- **Provides opportunities to workers:** The solution enables a net positive gain in terms of the workforce by bringing high tech jobs to the industry, improving worker safety, enabling workers to be more efficient with their time, improving envelope accessibility for workers, and/or opening up new business opportunities or markets.

The E-ROBOT Prize provides a total of \$5 million in funding, including \$4 million in cash prizes for competitors and an additional \$1 million in awards and support to Network partners. **Through this prize, DOE will stimulate technological innovation, create new opportunities for the buildings and construction workforce, reduce building retrofit costs, create a safer and faster retrofit process, ensure consistent, high-quality installations, enhance construction retrofit productivity, and improve overall energy savings of the built environment.**

The American-Made Network amplifies competitors' efforts through connections with: (1) DOE and its national laboratories; and (2) a stakeholder community that rapidly assists entrepreneurs and brings innovative concepts to market. This community will include organizations such as building technology incubators and investors, seasoned industry leaders, labor unions, regional energy efficiency offices, academia, and think tanks, all of whom provide technical and market insight, marketing expertise, product validation, and other support. Using the resources available through the DOE American-Made Network, teams will innovate to develop topic-focused solutions. Throughout the competition, these diverse experts are labeled "connectors" and comprise key components of the Network.

## 2. BACKGROUND

America's 119 million homes and 5.6 million commercial buildings account for approximately 40% of the nation's total energy demand and use 75% of its electricity for a total energy bill of more than \$410 billion annually. Approximately one-half of America's homes and commercial buildings were constructed before 1980—before the existence of today's efficient products and most equipment standards and building codes. These buildings represent a significant opportunity to unlock energy savings through building envelope improvements such as air sealing and adding insulation. Building envelope retrofit approaches developed under this Prize will be designed to positively enhance the market by providing a low-cost minimally invasive solution to improve the energy efficiency of today's buildings. Specifically, robots can complement and support the existing workforce by creating new employment and business opportunities. Cutting the energy use of U.S. buildings by just 20% would save some \$80 billion annually on energy bills.<sup>1</sup>

A 2017 report by McKinsey Global Institute shows that the construction sector can benefit from adopting advanced technologies and digital tools that have propelled other industries forward.<sup>2</sup> The goal of the E-ROBOT Prize is to bring robotics and buildings experts together to develop transformational building envelope retrofit approaches using robotics and other advanced retrofit methods in existing buildings.

The E-ROBOT Prize also hopes to expand the buildings industry to include robotics experts developing technical solutions, as well as building industry professionals who create new business opportunities to sell, operate, and maintain the robotic envelope retrofit equipment.

Low-cost building envelope retrofit solutions that include the following elements, at a minimum, are needed:

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<sup>1</sup> U.S. Department of Energy Building Technologies Office website: <https://www.energy.gov/eere/buildings/about-building-technologies-office>.  
<sup>2</sup> McKinsey Global Institute. *Reinventing Construction: A Route to Higher Productivity*, February 2017, <https://www.mckinsey.com/~media/McKinsey/Industries/Capital%20Projects%20and%20Infrastructure/Our%20Insights/Reinventing%20construction%20through%20a%20productivity%20revolution/MGI-Reinventing-construction-A-route-to-higher-productivity-Full-report.ashx>.

- **Sensing and Inspection Tools.** Nondestructive and fast inspection techniques to assess and identify envelope defects (e.g., excessive air infiltration, missing insulation, and so on) for pinpointed retrofit and to verify the results post retrofit. Provide real-time information with data visualization for operators and as direct input to the retrofit tool.
- **Retrofit Tools.** Semi- or fully autonomous robotic deposition tool to apply minimally invasive techniques to rapidly retrofit building envelopes including, but not limited to, air sealing areas identified by sensing and inspection tools. Ideally, the retrofit tool also addresses insulation deficiencies. In all cases, the tool needs to mitigate any underlying envelope deficiencies related to bulk moisture and vapor control to ensure durable envelopes post retrofit. As an option, the retrofit tool could use any developed mapping tools to automatically direct the retrofit tool in real time.
- **Mapping Tools** Mapping of building envelope geometry and envelope defects to be retrofitted with spatial relationships is needed to support the retrofit process. Ideally, envelope mapping tools would be deployed on the retrofit tool and/or sensing and inspection tool. Real-time data visualization will be required to support real-time decisions in the field as mapping, retrofit, and inspection processes are underway.

Submissions will also be evaluated based on how the solution(s) can complement and support the existing workforce by creating new employment and business opportunities while also helping ensure quality and consistency when installing energy efficiency measures. Solutions that offer benefits to workers such as improved safety, improved time efficiency, or increased access to previously unavailable areas are of particular interest.

The Prize will also be evaluated based on the prize competitor's team and partnering strategy. The team's partnering strategy should advance the team's efforts to develop and/or commercialize the proposed solution. Partners that are critical to the success of the project (such as homebuilders, remodelers, or trade unions interested in piloting the solution) have demonstrated their support by being part of the team or offering a letter of support.

Led by BTO within DOE's Office of Energy Efficiency and Renewable Energy (EERE) and in partnership with the National Renewable Energy Laboratory (NREL), the American-Made Buildings Prize program will leverage the program structure used for other American-Made Challenges: a series of prize competitions combined with the use and expansion of the American-Made Network.

### 3. E-ROBOT PRIZE: PHASE 1 AND PHASE 2

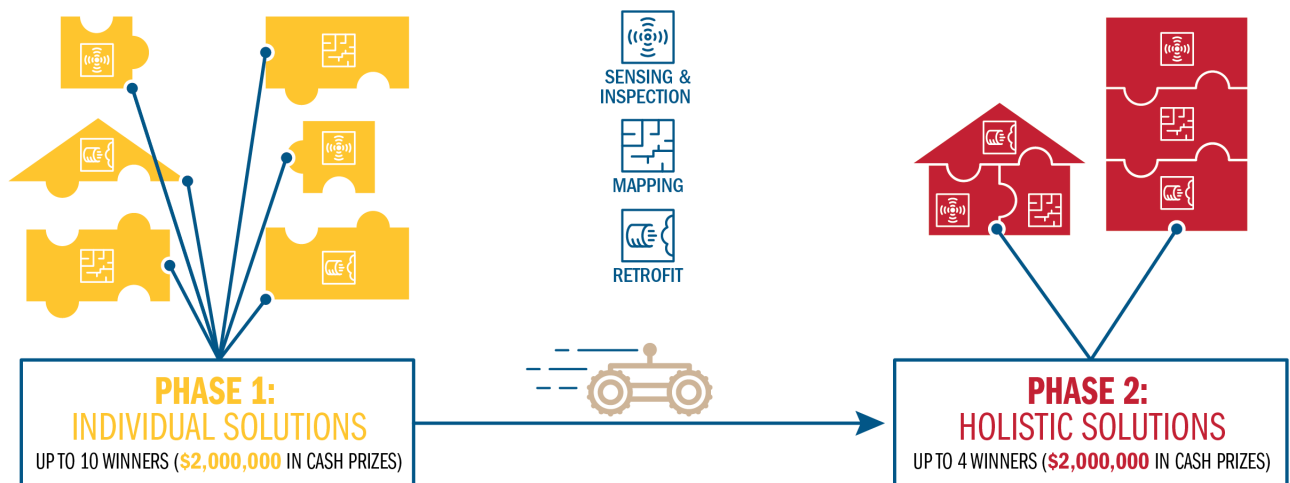
The E-ROBOT Prize is made up of two phases that will fast track efforts to identify, develop, and validate disruptive solutions to meet building industry needs. Each phase will include a contest period in which participants will work to rapidly advance their solutions. DOE invites anyone, individually or as a team, to compete to transform a conceptual solution into product reality.

**Phase 1: Concept and Design:** In this phase, teams are expected to present an innovative idea that solves a known industry problem for building envelope retrofits. Experts from both the robotics and buildings industries should inform the concept and design. This phase is focused on proving that the solution solves a critical building envelope need, developing a concept and design, and forming a

team that is capable of achieving success. Competitors may focus on one component or multiple components of the following: (1) sensing and inspection; (2) mapping; and (3) retrofit tools. Competitors will need to describe their plans for integrating their products into comprehensive service offerings through partnering or other commercialization plans. A partnering event (virtual or in-person) will take place during Phase 1 to help competitors make connections with other teams and Network partners. **Up to 10 Phase 1 winners will win \$200,000 in cash prizes and will then be eligible to compete in Phase 2.** A panel of expert reviewers from industry, national labs, and government will evaluate submissions. The final decision will be based on the input from the reviewers but determined by BTO.

**Phase 2: Build and Validate:** In Phase 2, winning competitors from Phase 1 will take their individual components and add the other required functionality to create a **working prototype** that is a holistic and “turnkey” integrated product offering. Cooperation between competitors is encouraged. Solutions must be low cost, minimally invasive, and encompass all areas—including sensing and inspection, retrofit, and mapping with one tool or a compatible suite of tools for addressing building envelope retrofit challenges. Applicants are required to validate technical viability and demonstrate a path toward commercial viability. Conducting field validation of the working solution with a commercial partner (e.g., manufacturer, service provider, and so on) is highly encouraged. **Phase 2 teams will be required to participate in a virtual demonstration day event (Demo Day) at the conclusion of Phase 2 to pitch their innovation and demonstrate their prototype.** Up to four Phase 2 winners will split a \$2 million prize pool equally.

## BUILDINGS PRIZE **E-ROBOT: Envelope Retrofit Opportunities for Building Optimization Technologies**



Phase	Winners	Duration	Description
Phase 1: Concept and Design	Up to 10 winners: \$200,000 each	6 months	In this phase, teams are expected to provide an innovative idea that solves a critical building envelope need and will serve as the foundation for the work in follow-on phases. In addition, a robust team of experts from both the robotics and buildings industries should be developed. This phase is focused on proving that the solution addresses a key envelope need, developing a design, and demonstrating that the team is capable of achieving success.
Phase 2: Build and Validate	Up to 4 winners: \$2 million prize pool split equally between winners	6 months	In this phase, successful teams from Phase 1 will create a prototype for a single holistic and integrated solution, then validate that the solution will work during a virtual Demo Day. This could include partnering with other experts to take existing robotics hardware and software solutions and integrate those solutions to address building retrofit, repair, and remediation needs. Validating the working solution for technical viability and demonstrating a path toward commercial viability is required. In addition, field validating the working solution/prototype with a commercial partner is highly encouraged.

## 4. AMERICAN-MADE NETWORK

The American-Made Network will cultivate resources and build connections that enhance, accelerate, and amplify the efforts of the competitors. The objective is to link participants with ideas, people, resources, investors, and relevant industry expertise, all of which are necessary to take innovative ideas, refine them, and bring them to market.

The Network comprises the following elements:

**Prize and Network Administrator: NREL:** DOE has partnered with the National Renewable Energy Laboratory to administer the American-Made Buildings Prize. NREL, as the administrator, will help competitors locate and leverage the vast array of Network resources, as described below.

**Connectors:** Connectors are entities capable of helping competitors navigate the innovation process and identify, recruit, and support contest participants. Connectors can be building technology incubators, industry groups, labor unions, regional energy efficiency offices, academia, think tanks, or any enabler seeking to support the Prize and competing teams. Connectors may be rewarded for specific actions they take to support the E-ROBOT Prize and competing teams. Find more information about becoming a Connector and how the recognition awards work in the Connector Guidelines on the Buildings Prize Website.



- **Recruitment Event Awards:** Approved Connectors can host recruitment events, either virtually (or in person when possible) to promote the Prize and help recruit new teams and/or competitors. These Connectors may be eligible for a recognition award of \$1,000 per event that they hold during Phase I of the contest. To receive the prize award, each Connector must be an approved Connector in the American-Made Network, DOE and the Prize Team must receive an invite to the event (and be informed about the event logistics) prior to holding the event, the Connector must agree to allow DOE to speak at the event or play a prerecorded video about the Prize, and the event must produce at least 30 participants who are likely to compete in Phase 1 of this Prize. Prizes are paid on a first-come, first-served basis until the prize pool of \$25,000 is exhausted.
- **Mentorship Awards:** The E-ROBOT Prize is offering Connectors an opportunity to be rewarded for excellent mentorship and support provided to teams. For both Phases, Connectors who help winning and nonwinning teams, and who are listed in the team submission form on HeroX, will be rewarded with a recognition award prize. Awards will be provided to those helping winning as well as nonwinning teams. Each competing team must list the Connector in the submission form on HeroX in order for the Connector to be considered for a recognition award. Teams can only list one Connector that will receive an award. Teams should only list a Connector who has most significantly helped the team. If no Connector has significantly helped a team, it is not a requirement to list a Connector on the submission form. The Connector must be an approved AMN Connector by submission day and the team must enter the Connector organization in the HeroX form at the time of the submission. Each phase of the competition will have a mentorship award prize pool of \$350,000.
  - **Phase 1 (\$350,000 prize pool):** Awards will be up to \$10,000 for Connectors who help winning teams and up to \$5,000 for Connectors who help nonwinning teams (the total number of awards will be dependent on the number of submissions that list a Connector). DOE reserves the right to reevaluate the number of prizes in the event that there are more than 50 Connectors listed by teams that did not advance to Phase 2.
  - **Phase 2 (\$350,000 prize pool):** Awards will be up to \$50,000 for Connectors who help winning teams and up to \$25,000 for Connectors who help nonwinning teams (a total of up to 10 awards).

Connector awards are designed to incentivize connectors to engage in mentoring and support activities for competitors, such as:

- Attracting a diverse range of talented individuals to join competing teams. This includes bringing new experts with diverse expertise, robotics experts, and other nonbuilding experts into the prize and connecting them with competing teams.
- Helping competitors refine their innovations, develop business plans, and connect with investors and industry partners

- Connecting teams to other teams and resources that can expand their capabilities and lead to a strong holistic solution
- Raising nonfederal funding to support this prize program and its participants
- Providing in-kind resources, tools, and facilities to accelerate competitors' abilities to innovate, test, validate, and refine their solutions while reducing technology and business risks
- Connecting competitors to regional prototyping and manufacturing expertise, facilities, and experts.

PHASE 1 CONNECTOR AWARDS			
Award Name	Prize Pool	Number of Awards	Details
<b>Connector Recruitment Event Award</b>	\$25,000	Up to 25; at \$1,000 each	Payment of \$1,000 per event that includes a minimum of 30 attendees likely to participate in this Prize. Must be registered as a Connector before the event takes place. Payments made on a first-come, first-serve basis.
<b>Team Support to Winning Teams</b>	\$100,000	Up to 10; at \$10,000 each	Each winning team may list one Connector to receive an award. Must be registered as a Connector before Phase 1 closes to receive an award.
<b>Team Support to Nonwinning Teams</b>	\$250,000	Split evenly; up to \$5,000 per submission*	This award goes to Connectors who helped teams that submit eligible applications but did not win. Each team may list one Connector to receive an award. Must be registered as a Connector before Phase 1 closes to receive an award.

\*DOE and the Prize Administrator will re-evaluate the number of awards in the event there are more than 50 Connectors listed by teams that did not advance to Phase 2.

## PHASE 2 CONNECTOR AWARDS

Award Name	Prize Pool	Number of Awards	Details
Team Support to Winning Teams	\$200,000	Up to four; at \$50,000 each	Each winning team may list one Connector to receive an award. Must be registered as a Connector before Phase 2 closes to receive an award.
Team Support to Nonwinning Teams	\$150,000	Split evenly among Connectors submitted; up to \$25,000	This award goes to Connectors who helped the eligible applications that did not win. Each team may list one Connector to receive an award. Must be registered as a Connector before Phase 2 submission closes to receive an award.

Competitors and expert reviewers in any given round cannot also be a Connector for that round. If a Connector formally joins a team, they forego any financial incentive and recognition payment for that Phase. Entities interested in participating as Connectors can visit the following site for details: <https://americanmadechallenges.org/network.html>.

**Power Connectors:** Power Connectors are a subset of Connectors that play a more substantial role in the competition and receive funds to expand and amplify BTO and NREL’s efforts. Power Connectors operate under a subcontract with NREL and may host a national Demo Day. Not only will these organizations work to identify talent and support participants in the contests, but they also partner with NREL to envision and execute a long-term sustainable strategy for scaling the American-Made Challenges Contests. Power Connectors are ineligible for all recognition awards. Power Connector contracts may include the following tasks:

- Increasing the number of new, high-quality competitors
- Matching team needs with industry resources and diverse expertise and national laboratory facilities and resources
- Expanding the network of partners, resources, and tools
- Increasing the diversity of funding sources
- Hosting well-attended teaming event(s)
- Producing engaging and well-attended national Demo Day showcases
- Repeated support of contests with an increasingly robust American-Made Network and expanded funding from nongovernmental sources.

Entities interested in participating as Power Connectors can visit the following site for details: <https://americanmadechallenges.org/network.html>.

## 5. IMPORTANT DATES

### Phase 1:

- Submission Open:** Nov. 16, 2020
- Submission Close:** May 12, 2021, 5 p.m. ET
- Winner Notification:** August 2021

### Phase 2:

- Submission Open:** Aug. 19, 2021
- Virtual Demo Day Plan Due:** Feb. 10, 2022
- Submission Close:** March 4, 2022, 5 P.M. ET
- Demonstration Video Due:** March 30, 2022, 5 p.m. ET
- Virtual Demo Day Event:** April 6–7, 2022
- Winner Announcement:** April 2022

## 6. ELIGIBILITY AND TEAMS

The competition is open to individuals, private entities (for-profits and nonprofits), nonfederal government entities such as states, counties, tribes, and municipalities, and academic institutions. **Phase 2 is only open to teams who receive awards from Phase 1 of the competition, and those with whom they choose to partner.** All team members are subject to the following requirements:

- An individual prize competitor (who is not competing as a member of a group) must be a United States citizen or a permanent resident.
- A group of individuals competing as one team may win, provided that the online account holder of the submission is a United States citizen or a permanent resident. Individuals competing as part of a team may participate if they are legally authorized to work in the United States.
- Private entities must be incorporated in and maintain a primary place of business in the United States with majority domestic ownership and control. If an entity seeking to compete does not have majority domestic ownership and control, EERE may consider issuing a waiver of that eligibility requirement where the entity submits a compelling justification; the entity is incorporated in and maintains a primary place of business in the United States; and the entity otherwise meets the eligibility requirements. EERE may require additional information before making a determination on the waiver request. There are no rights to appeal DOE's decision on the waiver request. See Appendix 2 for more information on the waiver process.
- Academic Institutions must be based in the United States.
- 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 the Prize.
- Federal entities and federal employees, acting within the scope of their employment, are also not eligible to participate in any portion of the Prize.
- DOE national laboratory employees cannot compete in the Prize during their official duty hours or using lab equipment.

- Entities and individuals publicly banned from doing business with the U.S. government such as entities and individuals debarred, suspended, or otherwise excluded from or ineligible for participating in federal programs are not eligible to compete.
- Entities identified on a Department of Homeland Security (DHS) Binding Operational Directives (BOD) as an entity publicly banned from doing business with the United States government are not eligible to compete. See <https://cyber.dhs.gov/directives/>.
- Entities and individuals identified as a restricted party on one or more screening lists of Department of Commerce, State, and the Treasury are not eligible to compete. See Consolidated Screening List [https://2016.export.gov/ecr/eg\\_main\\_023148.asp](https://2016.export.gov/ecr/eg_main_023148.asp).
- This prize is expected to positively impact U.S. economic competitiveness. Participation in a foreign government talent recruitment program<sup>3</sup> could conflict with this objective by resulting in unauthorized transfer of scientific and technical information to foreign government entities. Therefore, individuals participating in foreign government talent recruitment programs of foreign countries of risk<sup>4</sup> are not eligible to compete. Further, *teams* that include individuals participating in foreign government talent recruitment programs of foreign countries of risk are not eligible to compete.
- To be eligible, an individual authorized to represent the competitor must agree to and sign the following statement upon registration with HeroX:

The name of the individual responsible for the registration I am submitting this submission package as part of my participation in this Prize. I certify under penalty of perjury that the named competitor meets the eligibility requirements for this prize competition and complies with all other rules contained in the Official Rules document. I understand false statements or misrepresentations may result in civil and/or criminal penalties under 18 U.S.C. § 1001.

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<sup>3</sup> Foreign government talent recruitment program is defined as an effort directly or indirectly organized, managed, or funded by a foreign government to recruit science and technology professionals or students (regardless of citizenship or national origin, and whether having a full-time or part-time position). Some foreign government-sponsored talent recruitment programs operate with the intent to import or otherwise acquire from abroad, sometimes through illicit means, proprietary technology or software, unpublished data and methods, and intellectual property to further the military modernization goals and/or economic goals of a foreign government. Many, but not all, programs aim to incentivize the targeted individual to physically relocate to the foreign state for the above purpose. Some programs allow for or encourage continued employment at U.S. research facilities or receipt of Federal research funds while concurrently working at and/or receiving compensation from a foreign institution, and some direct participants not to disclose their participation to U.S. entities. Compensation could take many forms including cash, research funding, complimentary foreign travel, honorific titles, career advancement opportunities, promised future compensation, or other types of remuneration or consideration, including in-kind compensation.

<sup>4</sup> Currently, the list of countries of risk includes Russia, Iran, North Korea, and China.

# Phase 1: Concept and Design (CLOSED)

PHASE 1 PRIZES
Prize pool up to \$2,000,000 (Up to 10 winners)
<b>\$200,000 in prizes per team</b>

## 1. INTRODUCTION

In this phase, teams are expected to present an innovative idea that solves a known industry problem for building envelope retrofits. Experts from both the robotics and buildings industries should inform the concept and design. This phase is focused on proving that the solution solves a critical building envelope need, developing a concept and design, and forming a team capable of achieving success.

In Phase 1, competitors may focus on one component or multiple components of the following: (1) sensing and inspection; (2) mapping, and (3) retrofit tools in Phase 1. A holistic solution that includes all three elements is required to win Phase 2. Teams should be forward-thinking about future partnerships and teaming approaches that will eventually create a successful holistic solution by Phase 2.

## 2. TECHNOLOGY GOALS

Rapidly develop an innovative building envelope retrofit concept that integrates robotics and a robust team to develop to compete in Phase 2. Successful solutions will meet the following criteria:

- **Holistic:** The solution must include mapping, retrofit, sensing, and inspection by Phase 2. For Phase 1, a team may focus on one, or several, of these topics, with the understanding that by Phase 2 the team will be working on a complete holistic solution.
- **Low cost:** The solution should reduce costs significantly when compared to current state-of-the-art solutions. The target for reduction in costs should be based on a 50% reduction from the baseline costs of a fully implemented solution (not just hardware, software, or labor; the complete fully implemented solution must be considered). If costs are not at the 50% level, there should be a significant energy efficiency gain achieved.
- **Minimally invasive:** The solution must not require building occupants to vacate the premises or require envelope teardown or significant envelope damage.
- **Utilizes long-lasting materials:** Retrofit is done with safe, nonhazardous, and durable (30+ year lifespan) materials.
- **Completes time-efficient, high-quality installations:** The results of the retrofit must meet common industry quality standards and be completed in a reasonable timeframe.
- **Provides opportunities to workers:** The solution enables a net positive gain in terms of the workforce by bringing high tech jobs to the industry, improving worker safety, enabling workers to be more efficient with their time, improving envelope accessibility for workers, and/or opening up new business opportunities or markets.

### 3. PRIZES TO WIN

Up to 10 winners will receive awards from a \$2 million prize pool. Up to 10 winning teams will receive \$200,000 each.

### 4. HOW TO ENTER

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

### 5. PHASE 1 CONTEST PROCESS

The Phase 1 Contest consists of the following important steps:

1. **Preparation, Activation, and Submission:** Competitors identify and take action on a critical need in building envelope retrofits using advanced robotics, develop a conceptual design of the solution, and strategize to build a robust team that can provide a holistic solution in Phase 2. Competitors also engage the American-Made Network for help and support and may attend a teaming event during Phase 1. Finally, competitors complete their submission packages and submit online before Phase 1 of the contest closes.
2. **Assessment:** The Prize Administrator screens all completed submissions and assigns DOE-approved subject matter expert reviewers to independently score the content of each submission. DOE's BTO takes into account the input from the expert reviewers and makes the final decision on all winners. The judging criteria will assess elements described in Section 7.
3. **Announcement:** Approximately 60 days after Phase 1 closes, the Prize Administrator notifies winners and requests the necessary information (IRS W-9 form, ACH Form, and Prize Acceptance Form) to distribute cash prizes. The Prize Administrator will then publicly announce winners.

### 6. SUBMISSION PACKAGE

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

- i. Cover page (to be made public)
- ii. Summary slide (to be made public)
- iii. 90-second–2-minute video (to be made public)
- iv. Technical narrative (up to five pages using a font that is at least 11 point)<sup>5</sup>
- v. Design specifications (up to five pages using a font that is at least 11 point)
- vi. Optional: Letters of commitment or support

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<sup>5</sup> Competitors who do not want the technical narrative or other documents (e.g., design specifications) to be made public will need to mark them according to the instructions in paragraph 11 of Appendix 1.

Cover Page Content

Cover Page: List basic information about your submission (will be made public)	
<ul style="list-style-type: none"> <li>Title</li> <li>Short description</li> </ul>	<ul style="list-style-type: none"> <li>Key project members (names, contact information, links to their professional profiles)</li> <li>Your city and state</li> <li>Other partners (if any)</li> </ul>

Summary Slide

**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. The recommended template for the slide includes:

- Need/Challenge**  
What is the critical envelope retrofit need being addressed? Why is that an important problem?
- Proposed Solution**  
Include a picture and/or graphic that best captures the solution, innovation, and/or approach with short description.
- Partnering/Team**  
Describe your team and why your team has a competitive edge.

Please make any text readable in a standard printout and conference room projection. Do not include any proprietary information, as this slide will be made public.

Video

**Online Public Video: (will be made public)**

**Suggested Content You Provide (2-minute max limit)**

- What building envelope retrofit challenge will be addressed.
- Description of your solution and how it will work.
- How your solution will impact building envelope retrofits and advance the industry.
- Who you are and why your team has a competitive edge.



## Technical Narrative

The individual answers to the questions do not have a word limit; however, the aggregate response to these questions must not exceed five pages using a font that is at least 11 point.

**Technical Narrative:** You should answer each of the following questions with information that address the evaluation criteria outlined in Section 7.

### Questions to Guide the Content You Provide

1. What building envelope retrofit challenge does your solution address and how will it work?
2. How will you validate the technical capabilities and demonstrate a path toward commercial viability of your solution in Phase 2?
3. How do you plan to distribute the product and work with service providers to use the new tool?
4. Materials: Please list the materials your solution includes along with a statement regarding their availability and durability. How are you sure that your materials will meet the 30+ year lifespan?
5. Cost: What is the current cost for this type of retrofit, and how will the proposed solution achieve a 50% cost reduction when compared to the current state of the art?
6. Invasiveness: Describe the occupant experience during the retrofit. How will your robot access the building and how will it impact building occupants?
7. Productivity: How long will it take for your robot to apply your solution to what area/square footage, and how easy is it to train users?
8. Energy Efficiency: What level of energy efficiency improvements are expected after applying your solution (e.g., air leakage reduction, insulation performance, and so on)? Please quantify these metrics.
9. Quality: Is the solution of sound quality, will it mitigate any underlying envelope deficiencies related to bulk moisture and vapor control, and will it ensure durable envelopes post-retrofit?
10. Worker Benefits: Does your solution offer benefits to workers such as improved safety, improved time efficiency, or increased access to areas previously unavailable?
11. What is your plan for commercialization, and what makes your team qualified to commercialize this solution?
12. Who will you partner with to develop and/or validate your solution?
13. Who is your target market, and how do you plan to work with your stakeholders (labor unions, trades, industry, building owners, and so on) to utilize your solution in the industry?
14. What roles will all your partners play (validation, testing, building, commercialization, business planning, and so on)?
15. What skills are on your team? Consider that having building science expertise paired with robotics expertise will be beneficial to achieving a holistic solution.
16. How do you plan to develop a holistic solution in Phase 2 that includes a single tool or suite of compatible tools that include sensing, inspection, mapping, and retrofit?

### *Design Specifications*

Limited to up to five pages using a font that is at least 11 point. Please ensure all text is readable within images.

<b>Design Specifications</b>
Provide graphics, digital drawings, and technical specifications that show the design of your solution and how it works. Hand drawings are specifically prohibited. Material submitted beyond five pages will not be reviewed.

### *Letters of Commitment or Support*

<b>Letters of Commitment or Support (Optional)</b>
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 multipage letters.

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

## **7. HOW WE DETERMINE WINNERS**

All items in the submission package, with the exception of the cover page, will be considered when scoring each submission. After reviewing all elements of the submission package, expert reviewers will assign a score between 1 and 6 for each of the four categories below, taking into account the questions described under each category. Each category will be weighted as described below.

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

**Expert reviewers give a score of 1 to 6 for each statement below:**

**Innovation and Impact (25% weighting)**

- The proposed solution presents an innovative approach to an important challenge in building envelope retrofits.
- The proposed solution meets the applicable performance targets outlined in the Phase 1 technology goals in Section 2 (minimally invasive, low cost, and so on).
- The proposed solution can make significant advancements in building envelope retrofits.
- The proposed solution is adaptable to a wide range of applications or customers or can serve a significant portion of the market.
- The proposed solution will provide new opportunities for workers or benefits such as improved safety or increased access to previously unavailable areas.

**Technical Feasibility (25% weighting)**

- The proposed solution is free of any major technical flaws.
- The proposed solution is technically feasible and practically deployable.
- The risks or limitations associated with the proposed solution are well understood and articulated.
- The solution will mitigate any underlying envelope deficiencies related to bulk moisture and vapor control and ensures durable envelopes post retrofit.
- The technology can be realistically integrated into a holistic solution in Phase 2.

**Technical Validation and Commercial Viability (25% weighting)**

- The applicant presents a technically appropriate test plan for validating the technical capabilities of the proposed solution in Phase 2.
- The applicant has access to the necessary tools and facilities to complete the technical validation.
- The proposed solution will create new market or business opportunities that may lead to safer, higher-paying, or more jobs in the building industry.
- The applicant has a sound plan for determining the commercial viability of the solution in Phase 2.
- The applicant has the necessary expertise or arrangements in place to develop a path toward commercial viability of the proposed solution.

**Team and Partnering Strategy (25% weighting)**

- The team's track record demonstrates notable entrepreneurial qualities and has a high likelihood of achieving commercial success.
- There are no major gaps in expertise or missing partners that may limit the success of the technology.
- The team's partnering strategy will advance the team's efforts to develop and/or commercialize the proposed solution (such as securing a validation partner, a manufacturing partner, and so on).

- Partners that are critical to the success of the project (such as homebuilders, remodelers, or trade unions interested in piloting the solution) have demonstrated their support by being part of the team or offering a letter of support.

The Prize Administrator screens all completed submissions and, in consultation with DOE, assigns subject matter expert advisory judges to independently score the content of each submission. The expert reviewers may be composed of federal and nonfederal subject matter experts with expertise in relevant areas. Expert reviewers will review submissions according to the statements listed in Section 7, and the final selection official 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.

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

- The submission package will be evaluated to derive scores against the criteria listed in each of the four categories described above.
- The final score from an individual judge will be collected via the HeroX platform and scores will be weighted as described above.
- All judges' scores will then be averaged for a final score for the submission package.

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

**Final Determination:** Final determination of winners by the final selection official will take the expert reviewers' scores and the interview findings (if applicable) into account. The Director of BTO is the final selection official of the competition and will make the final determination.

**Announcement:** Approximately 60 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 Phase 1 (Concept and Design) prize, competitors who wish to advance will develop their solutions in accordance with their plan to compete in Phase 2 (Build and Validate) of the contest.

## 8. PROGRAM GOAL REQUIREMENTS

Only submissions relevant to the technical areas, as laid out in the goals section of this document, may compete. The Prize Administrator, working with DOE, has the right to refuse any submission for incompleteness or non-responsiveness to the technical topic areas.

## 9. ADDITIONAL TERMS AND CONDITIONS

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

## Phase 2: Build and Validate

### PHASE 2 PRIZES

Prize pool up to  
**\$2,000,000**  
(Up to four winners)

### 1. INTRODUCTION

In this phase, successful teams from Phase 1 will build a prototype for their holistic solution and validate that the solution will work. Teams should either have, or partner with others to create, a cross-functional team of experts in building science, robotics, and other relevant disciplines. A holistic solution should include developing robotics hardware and software products that will answer building envelope retrofit needs focused on on-site repair and remediation aspects. Validating the working solution for technical viability and demonstrating a path toward commercial viability is required. The solution must also mitigate any underlying building envelope deficiencies related to bulk moisture and vapor control and ensure durable envelopes post-retrofit. In addition, completing field validation of the working solution with a relevant partner is highly encouraged. Competitors must submit proof that their solution is functional and operational and participate in a live demonstration event at a virtual Demo Day to be eligible for award.

### 2. TECHNOLOGY GOALS

The goal in Phase 2 is to develop a holistic building envelope retrofit solution that includes sensing and inspection, mapping tools, and retrofit tools. The solution must meet the following criteria:

- **Holistic:** The solution must include mapping, retrofit, sensing, and inspection capabilities.
- **Low cost:** The solution should reduce costs significantly when compared to current state-of-the-art solutions. The target for reduction in costs should be based on a 50% reduction from the baseline costs of a fully implemented solution (not just hardware, software, or labor; the complete fully implemented solution must be considered). If costs are not at the 50% level, there should be a significant efficiency gain achieved.
- **Minimally invasive:** The solution must not require building occupants to vacate the premises or require envelope teardown or significant envelope damage.
- **Utilizes long-lasting materials:** Retrofit is done with safe, nonhazardous, and durable (30+ year lifespan) materials.
- **Completes time-efficient, high-quality installations:** The results of the retrofit must meet common industry quality standards and be completed in a reasonable timeframe.
- **Provides opportunities to workers:** The solution enables a net positive gain in terms of the workforce by bringing high-tech jobs to the industry, improving worker safety, enabling workers to be more efficient with their time while on the job site, improving envelope accessibility for workers, and/or opening up new business opportunities or markets.

### 3. PRIZES TO WIN

The Phase 2 Contest offers a \$2,000,000 prize pool for up to four winners.

### 4. HOW TO ENTER

Complete a submission package online at <https://www.herox.com/erobot> before the contest closing date. Only winning teams from Phase 1 of this prize contest are eligible to compete in Phase 2.

### 5. PHASE 2 CONTEST PROCESS

The Phase 2 Contest consists of the following important steps:

**1. Preparation, Activation, and Submission:** To be eligible to compete in Phase 2, your team must include a listed team member from a winning team from Phase 1. Winning teams from Phase 1 are eligible to continue competing to advance their solution and integrate it into a holistic approach that will take action on a critical need in **on-site** building envelope retrofits using robotics. Phase 2 is focused on building **a prototype** and validating a holistic solution. Teams should be interdisciplinary and have strong partners to build, test, validate, and enhance their solutions. By the end of Phase 2, teams should be prepared to demonstrate a working prototype to prove that their solution works and meets the goals of the prize. Finally, competitors complete their submission packages and submit online before Phase 2 of the contest closes.

**2. Demo Day:** Competitors will participate in a demonstration event with a panel of expert reviewers and members of the public. The details and agenda for the event will be provided at least 30 days in advance of the event. **This event will be held virtually April 6–7, 2022.**

**3. Assessment:** The Prize Administrator screens all completed submissions and assigns DOE-approved subject matter expert reviewers to independently score the content of each submission. BTO takes into account the input from the expert reviewers and **performance at Demo Day** to make the final decision on all winners. The judging criteria will assess elements described in Section 7.

**4. Announcement:** Approximately 60 days after Phase 2 closes, the Prize Administrator notifies winners and requests the necessary information (IRS W-9 form, ACH Form, and Prize Acceptance Form) to distribute cash prizes. The Prize Administrator will then publicly announce winners.

## 6. WHAT TO SUBMIT

The following items constitute the submission package<sup>6</sup> and must be submitted through the HeroX platform:

- i. Cover page (to be made public)
- ii. Summary slide (to be made public)
- iii. Three-minute video (to be made public)
- iv. Technical narrative (up to 10 pages using a font that is at least 11 point)
- v. Design specifications (up to 12 pages using a font that is at least 11 point)
- vi. Test plan and validation report (up to five pages using a font that is at least 11 point)
- vii. Business plan\* (up to five pages using a font that is at least 11 point)
- viii. Optional: Letters of commitment or support (see scoring guidelines).

\*Note: If the concept/innovation has substantially pivoted from what was originally submitted in Phase 1, an explanation of how and why this happened must be provided. It is understood that innovation and entrepreneurship are not usually a linear path, but major changes in direction should always be well rationalized. You were selected on the strengths of the idea submitted in the Phase 1 contest, and significant changes without justification are unlikely to be successful. Please include the rationale in the business plan.

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### Cover Page Content

Cover Page: List basic information about your submission (will be made public)	
<ul style="list-style-type: none"><li>● Title</li><li>● Short description</li></ul>	<ul style="list-style-type: none"><li>● Key project members (names, contact information, links to their professional profiles)</li><li>● Your city and state</li><li>● Other partners</li></ul>

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<sup>6</sup> Competitors who do not want the technical narrative or other documents (e.g., design specifications) to be made public will need to mark them according to the instructions in see Paragraph 11 of Appendix 1.

## Summary Slide

### 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. The recommended template for the slide includes:

- **Need/Challenge**  
What is the critical envelope retrofit need being addressed? Why is that an important problem?
- **Proposed Solution**  
Include a picture and/or graphic that best captures the solution, innovation, and/or approach with short description.
- **Business Plan**  
Include a general description of your business plan (e.g., target market, potential market opportunity, business model, price point).
- **Partnering/Team**  
Describe your team and why your team has a competitive edge.

Please make any text readable in a standard printout and conference room projection. Do not include any proprietary information, as this slide will be made public.

## Video

### Online Public Video (will be made public)

#### Suggested Content You Provide (3-minute max limit)

- Description of your team, the solution, and what it will do to overcome a building envelope retrofit challenge.
- **Show us your working prototype** by recording the performance tests and/or validation process.
- Tell us about your next steps to technically advance your solution.
- What are the next steps to commercialize your product for performing building envelope retrofits?



## Technical Narrative

The individual answers to the questions do not have a word limit; however, the aggregate response to these questions must not exceed 10 pages using a font that is at least 11 point.

**Technical Narrative:** You should answer each of the following questions with information that addresses the evaluation criteria outlined in Section 7.

### Questions to Guide the Content You Provide

1. **Problem:** What building envelope retrofit challenge does your solution address and how does it work?
2. **Holistic:** How did you develop either a single tool, or suite of compatible tools, that includes sensing, inspection, mapping, and retrofit?
3. **Cost:** What is the current cost for this type of retrofit, and how will the proposed solution achieve a 50% cost reduction when compared to the current state of the art?
4. **Invasiveness:** Describe the occupant experience during the retrofit and how your robot's access to the structure will impact the building occupants.
5. **Materials:** Please list the materials your solution includes, along with a statement regarding their availability and durability. How are you sure that your materials will meet the 30+ year lifespan?
6. **Productivity:** How long will it take for your robot to apply your solution to what area/ square footage and how easy is it to train users?
7. **Energy Efficiency:** What level of energy efficiency improvements are expected after applying your solution (e.g., air leakage reduction, insulation performance, and so on)? Please quantify these metrics.
8. **Quality:** Is the solution of sound quality, will it mitigate any underlying envelope deficiencies related to bulk moisture and vapor control, and will it ensure durable envelopes post retrofit?
9. **Worker Benefits:** Does your solution offer benefits to workers such as improved on-site safety, improved time efficiency, or increased access to areas previously unavailable?

## Design Specifications

Limited to up to 12 pages using a font that is at least 11 point. Please ensure all text is readable within images.

### Design Specifications

Provide graphics, digital drawings, and technical specifications that show the design of your solution and how it works. Hand drawings are specifically prohibited.

Material submitted beyond 12 pages will not be reviewed.

## Test Plan and Validation Report

Up to five pages using a font that is at least 11 point.

**Test Plan and Validation Report:** You should summarize the process for validating the robot's performance and include results from your validation efforts.

Please submit your test plan and documentation showing the performance of the robot. Results may be obtained from field validations, lab testing, or simulations.

**Field or lab validations are preferred.**

Limit: Five pages using a font that is at least 11 point.

## Business Plan

Up to **five** pages using a font that is at least 11 point.

### Business Plan

The business plan should detail a roadmap for advancing the technology toward a commercially viable and market-ready product. The plan should identify your commercialization pathway(s), as well as explore and evaluate market, manufacturing, intellectual property, and next-stage resource factors. It will target positioning the technology for commercial viability, private sector investments, and market impact. The team should review the business plan with relevant industry advisors during the competition and incorporate their feedback.

The plan should define a reasonable path for the proposed technology toward commercial viability and success. The business plan could include components from the following:

- **Value Proposition:** Describe the value proposition of your solution. To achieve this, competitive technologies should be surveyed and evaluated, competitive advantages should be assessed, and how/where the technology can best be inserted should be addressed.
- **Customer/Stakeholder Discovery:** Stakeholder interviews should be conducted that involve key players in the technology space such as end users, homebuilders, remodelers, trade unions, or manufacturers. This includes understanding the interaction of players and stakeholders in the value chain; who these players/stakeholders, competitors, customers, end users are; and how buying decisions are made. Lessons learned from stakeholder engagement should be clearly articulated and incorporated into your solution.
- **Market Opportunity:** Quantify the market opportunity and competitive differentiation. Include an explanation of why the proposed solution would be commercially relevant. Special consideration should be given to identify specific target markets, regions of focus, and/or building types of focus.
- **Financial Pro Forma:** The business plan should include revenue/cost estimates, cashflow analysis, and outline pathways to scale.
- **Cost-Performance Model:** Identify the key cost and performance drivers for the proposed technology, as well as use cases for buildings. Payback analysis for the solution should also be analyzed and evaluated.

- **Manufacturing and Scalability Analysis:** This analysis should include a plan to mitigate factors that may significantly affect production costs or the ability to scale-up the technology. Analysis should reflect different complementary perspectives offered by engaged industrial advisors on the team.
- **Commercialization Pathway(s) and Distribution Plan:** Define your paths to market and plan for commercial entry subsequent to the end of the competition (e.g., creating a startup, licensing the technology to a partner).
- **Marketing and Distribution Plan:** A description of the value chain and distribution channels may be included. Describe pathways to reach with your target markets and plans to achieve effective market penetration within the building industry. Innovative or successful models to communicate to and/or market the solution to the end user should be considered.
- **Risk Mitigation Strategy:** Identify techno-economic challenges to be overcome for the proposed technology to be commercially relevant and discuss any scalability, regulatory, cost, intellectual property, or integration risks and considerations associated with the technology. Describe your strategy to address and/or mitigate these challenges. Discuss any other factors key to the successful realization of energy savings potential, cost reduction targets, installation time targets, as well as any known or perceived barriers to market adoption/dissemination and your plans for enhancing or mitigating these.

### Letters of Commitment or Support

#### Letters of Commitment or Support (Optional)

Attach one-page letters commitment from relevant entities (e.g., potential users, pilot partners, manufacturing facilities, and so on) from entities that you believe are critical to the success of your proposed solution. Please do not submit multipage letters. One-page letters from multiple sources should be combined into a single .PDF document.

### OTHER REQUIREMENTS

#### Virtual Demo Day

At least one team member must participate in a virtual demonstration event that will feature a panel of judges who will weigh in on the final decision. The event may involve a pitch, a question-and-answer session, and a technical demonstration of your working prototype. Judges will review and score your submitted materials before the demonstration event and then, based on your Demo Day performance and deliberation with the other judges, will finalize their recommendations for winners.

In preparation for virtual Demo Day, teams are required to submit two items to the Prize Administration Team:

## 1. Virtual Demonstration Plan (due Feb. 10, 2022)

Teams are required to submit a virtual demonstration plan that describes how each team will conduct their remote demonstration. Plans must include a description of infrastructure with real life obstacles. Schematics, diagrams, and/or photos are required. A template will be provided to teams. All plans must be approved by the Prize Administration team. Teams must submit their remote demonstration plan by Feb. 10, 2022.

## 2. Proof-of-Operation Prototype Demonstration Video (due March 30, 2022, 5 p.m. ET)

Teams are required to submit a video demonstration of prototype, operating as described in the **approved** virtual demonstration plan. The video must show the detailed operation of the prototype as it would operate in real life circumstances. Videos will not be made public. Videos should be no longer than 10 minutes in length.

- Winning teams will be required to submit an IRS W-9 form, an ACH form, and sign a prize acceptance form to issue payment.

## 7. HOW WE DETERMINE WINNERS

All items in the submission package, with the exception of the cover page, will be considered when scoring each submission. After reviewing all elements of the submission package, expert reviewers will assign a score between 1 and 6 for each of the **three** categories below, taking into account the questions described under each category. Each category will be weighted as described below.

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

Judges give a score of 1 to 6 for each statement below:

### Technical Impact & Viability (40% weighted)

1. The proposed solution **represents a holistic solution** to an important challenge in building envelope retrofits and **significantly advances the state-of-the-art**.
2. The proposed solution is free of any major technical flaws and **includes mapping, sensing and inspection, and retrofit capabilities**. The risks or limitations associated with the proposed solution are well understood and articulated.
3. The cost of the solution is at least 50% less than today's solution.
4. The solution is minimally invasive to occupants and the building **during an on-site installation and/or renovation**.

5. The solution delivers high-quality on-site retrofits that improve the efficiency of the building envelope more than or in a better way than today's solutions.
6. The quality of the on-site retrofit is adequately assessed and ensured, the solution will mitigate any underlying envelope deficiencies related to bulk moisture and vapor control, and the solution ensures durable envelopes post-retrofit.
7. The solution offers benefits to workers during the on-site installation and/or retrofit such as improved safety or access to areas previously deemed inaccessible or unserviceable.
8. The applicant applied a rigorous validation effort to test the performance of the solution using appropriate tools and facilities to complete the validation, and the solution achieved its stated performance targets.
9. The applicant conducted the appropriate due diligence (e.g., engaging end users) to determine technical viability of the solution.

#### **Commercial Viability (40% weighted)**

1. The proposed solution has a high likelihood of being commercially successful.
2. The business plan addresses predicted revenue/costs and plans to achieve market penetration.
3. The plan defines a reasonable path for the proposed technology toward commercial viability and success.
4. The value proposition and market opportunity are strong and well-defined; the team provided sufficient evidence to quantify the opportunity.
5. The team adequately described their strategy to reduce risk and provided enough detail to prove that their solution is commercially relevant, can be scalable, meets regulations, reduce costs, addresses intellectual property, has energy savings potential, reduces installation time, and is prepared to overcome barriers to market adoption/dissemination.
6. The team provided adequate information to identify the key cost and performance drivers for the proposed technology, as well as use cases for buildings.
7. The plan adequately describes the manufacturing and scalability pathways.
8. Adequate market, customer, and stakeholder discovery has been done and identifies the best paths to market and positions the technology for commercial entry subsequent to the end of the competition.
9. The proposed solution will serve a significant or important portion of the market.
10. The proposed solution will create new market or business opportunities that may lead to safer, higher-paying, or more jobs in the building industry.

#### **Teaming and Stakeholder Engagement (20% weighted)**

1. The team's track record demonstrates notable entrepreneurial qualities and has a high likelihood of achieving technical viability and commercial success.

2. The team has engaged all stakeholders or partners necessary for successfully implementing the solution.
3. Inputs from stakeholder engagement is clearly articulated and incorporated into the technical design and/ or business plan.
4. Partners that are critical to the success of the project (e.g., end users, homebuilders, remodelers, trade unions, or manufacturers) have demonstrated their support by being part of the team or offering a letter of support.

**Demo Day (Pass/Fail):** Teams must participate in the virtual demo day event. This includes showcasing their solution at Demo Day and demonstrating how it meets the technical objectives of the prize and operates as intended. The submitted demonstration video (see page 28) may serve as proof of functionality and operation.

Reviewers will assign a score between 1 and 6 to indicate how strongly they agree or disagree with each statement, as shown below. Each statement is equally weighted within each category and then each category will be weighted as described above. DOE BTO will take the scores into account as well as a team's performance at Demo Day when determining Phase 2 winning teams.

The Prize Administrator screens all completed submissions and, in consultation with DOE, assigns subject matter expert reviewers to independently score the content of each submission. The expert reviewers may be composed of federal and nonfederal subject matter experts with expertise in relevant areas. Expert reviewers will review submissions according to the statements listed in section 6 and the final selection official may not: (1) 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 (2) have a familial or financial relationship with an individual who is a registered participant.

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

- The submission package will be evaluated to derive scores against the criteria listed in each of the three categories described previously.
- The final score from an individual judge will be collected via the HeroX platform and scores will be weighted as described previously.
- All judges' scores will then be averaged for a final score for the submission package.
- Final determination of winners is made by DOE. The decision will take into account judges' scores, team performance on Demo Day, judge deliberation, and program policy factors listed in Appendix 1.

**Final Determination:** Final determination of winners by the final selection official will take into account the advisory reviewers' scores and the interview findings. The director of BTO is the final selection official of the competition and will make the final determination.

## 8. PROGRAM GOAL REQUIREMENTS

Only submissions relevant to the technology goals, as laid out in goals section of this document, may compete. The Prize Administrator, working with DOE, will evaluate the submission to ensure that all of the following statements are true when applied to the submission. DOE and the Prize Administrator has the right to refuse any submission at its own discretion.

- The proposed solution is a clear advancement from the Phase 1 submission and represents a holistic solution with a diverse team of technical experts.
- The proposed solution utilizes robotics to improve or innovate on building envelope retrofit solutions.
- The proposed solution has been tested, validated, and can be proven to work through the prize submission materials and video.
- The proposed solution does not involve the lobbying of any federal, state, or local government.

## 9. ADDITIONAL TERMS AND CONDITIONS

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

## 10. IMPORTANT DATES

- **Submission Open:** Aug. 19, 2021

- **Virtual Demo Day Plan Due:** Feb. 10, 2022
- **Submission Close:** March 4, 2022, 5 P.M. ET
- **Demonstration Video Due:** March 30, 2022, 5 p.m. ET
- **Demo Day Event:** April 6–7, 2022 (Anticipated)
- **Winner Announcement:** April 2022 (Anticipated)

## 11. FIND HELP

Visit <https://americanmadechallenges.org/network.html> to review and contact the members of the American-Made Network that have signed up to help you succeed.



# Appendix 1: Additional Terms and Conditions

## 1. REQUIREMENTS

Your submission for the E-ROBOT 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/EROBOT> before each phase 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 Section 11. 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 handwritten submissions will be disqualified.
- Submissions will be disqualified if they contain any matter that, in the sole discretion of DOE or NREL, is indecent, obscene, defamatory, libelous, lacking in professionalism, or demonstrating 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 part of the contest described in this document, these rules will form a valid and binding agreement between you and the DOE and is in addition to the existing HeroX Terms of Use for all purposes relating to these contests. 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 nonsubstantive mistakes or errors in their submission packages.
- As part of your submission to this prize program, you will be required to sign the following statement:

I am providing this submission package as part of my participation in this prize. I understand that I am providing this submission to the Federal Government. I certify under penalty of perjury that the named competitor meets the eligibility requirements for this prize competition and complies with all other rules contained in the Official Rules document. I further represent that the information contained in the submission is true and contains no misrepresentations. I understand false statements or misrepresentations to the Federal Government may result in civil and/or criminal penalties under 18 U.S.C. § 1001.

## 2. VERIFICATION FOR PAYMENTS

The Prize Administrator will verify the identity and role of all competitors before distributing any prizes. Receiving a prize payment is contingent upon fulfilling all requirements contained herein. The Prize Administrator will notify winning competitors using provided email contact information for the

individual or entity that was responsible for the submission. Each competitor will be required to sign and return to the Prize Administrator, within 30 days of the date on the notice, a completed NREL Request for ACH Banking Information form and a completed W-9 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: (1) the person/entity does not respond to notifications; (2) the person/entity fails to sign and return the required documentation within the required time period; (3) the notification is returned as undeliverable; or (4) the submission or person/entity is disqualified for any other reason.

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 competitor. 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. All competitors may be required to show proof of being the authorized account holder.

### 3. TEAMS AND SINGLE ENTITY AWARDS

The Prize Administrator will award a single dollar amount to the designated primary submitter, whether consisting of single or multiple entities. The primary submitter is solely responsible for allocating any prize funds among its member competitors or teammates as they deem appropriate. The Prize Administrator will not arbitrate, intervene, advise on, or resolve any matters or disputes between team members or competitors.

### 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 a license to display publicly and use the parts of the submission that are designated as "public" for government purposes. This license includes posting or linking to the public portions of the submission on the Prize Administrator or HeroX applications, 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 DOE, Prize Administrator, and judges and reviewers for purposes of the contests, 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 competitors' names and, as applicable, the names of competitors' team members and organization, which participated in the submission on the contest website indefinitely.

By entering, the competitor represents and warrants that:

1. Competitor's entire submission is an original work by competitor and competitor has not included third-party content (such as writing, text, graphics, artwork, logos, photographs, likeness of any third party, musical recordings, clips of videos, television programs, or motion pictures) in or in connection with the submission, unless: (1) otherwise requested by the Prize Administrator and/or disclosed by competitor in the submission; and (2) competitor has either

obtained the rights to use such third-party content or the content of the submission is considered 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 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. All persons who were engaged by the competitor to work on the submission or who appear in the submission in any manner have: (1) Given the competitor their express written consent to submit the submission for exhibition and other exploitation in any manner and in any and all media, whether now existing or hereafter discovered, throughout the world; (2) 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 the minor's parent or legal guardian) and the competitor may be asked by the Prize Administrator to provide permission in writing; and (3) Not been and are not currently under any union or guild agreement that results in any ongoing obligations resulting from the use, exhibition, or other exploitation of the submission.

## 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 competitor or that the competitor 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 any other third-party rights of which the competitor is aware; and that the submission is free of malware.

## 6. CONTEST SUBJECT TO APPLICABLE LAW

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

## 7. RESOLUTION OF DISPUTES

DOE is solely responsible for administrative decisions, which are final and binding in all matters related to the contest.

Neither DOE nor the Prize Administrator will arbitrate, intervene, advise on, or resolve any matters between team members or among competitors.

## 8. PUBLICITY

The winners of these prizes (collectively, "winners") will be featured on the DOE and NREL websites. Except where prohibited, 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 any and all risks of injury or loss in connection with or in any way arising from participation in this contest. 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 agents 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 technologies office running this prize, the director has determined that no liability insurance naming DOE as an insured will be required of competitors to compete in this competition per 15 USC 3719(i)(2). Competitors should assess the risks associated with their proposed activities and adequately insure themselves against possible losses.

## 10. RECORDS RETENTION AND FREEDOM OF INFORMATION ACT

All materials submitted to DOE as part of a submission become DOE records and are subject to the Freedom of Information Act. The following applies only to portions of the submission not designated as public information in the instructions for submission. If a submission includes trade secrets or information that is commercial or financial, or information that is confidential or privileged, it is furnished to the Government in confidence with the understanding that the information shall be used or disclosed only for evaluation of the application. Such information will be withheld from public disclosure to the extent permitted by law, including the Freedom of Information Act. Without assuming any liability for inadvertent disclosure, DOE will seek to limit disclosure of such information to its employees and to outside reviewers when necessary for review of the application or as otherwise authorized by law. This restriction does not limit the government's right to use the information if it is obtained from another source.

Submissions containing confidential, proprietary, or privileged information must be 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. government is not liable for the disclosure or use of unmarked information and may use or disclose such information for any purpose.

The submission must be marked as follows and identify the specific pages containing trade secrets, confidential, proprietary, or privileged information:

#### Notice of Restriction on Disclosure and Use of Data:

Pages [list applicable pages] of this document may contain trade secrets, confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for evaluation purposes. [End of Notice]

The header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: “Contains Trade Secrets, Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure.” In addition, each line or paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double 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. DOE does intend to keep all submission materials private except for those materials not designated as “will be made public.”

#### 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.

#### 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 contests, as determined by DOE in its sole discretion, DOE may cancel the contest. Any performance toward contest goals is conducted entirely at the risk of the competitor and DOE shall not compensate any competitors for any activities performed in furtherance of this prize. Although DOE may indicate that it will select up to several winners for each contest, DOE reserves the right to only select competitors who 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. PROGRAM POLICY FACTORS

While the scores of the expert reviewers will be carefully considered, it is the role of the prize judge to maximize the impact of contest funds. Some factors outside the control of competitors and beyond the independent expert reviewer scope of review may need to be considered to accomplish this goal. The following is a list of such factors. In addition to the reviewers' scores, the below program policy factors may be considered in determining winners:

- Geographic diversity and potential economic impact of projects

- Whether the use of additional DOE funds and provided resources are nonduplicative and compatible with the stated goals of this program and the DOE mission generally.
- The degree to which the submission exhibits technological or programmatic diversity when compared to the existing DOE project portfolio and other competitors.
- The level of industry involvement and demonstrated ability to accelerate commercialization and overcome key market barriers.
- The degree to which the submission is likely to lead to increased employment and manufacturing in the United States or provide other economic benefit to U.S. taxpayers.
- The degree to which the submission will accelerate transformational technological, financial, or workforce advances in areas that industry by itself is not likely to undertake because of technical or financial uncertainty.
- The degree to which the submission supports complementary DOE funded efforts or projects, which, when taken together, will best achieve the goals and objectives of DOE.
- The degree to which the submission expands DOE's funding to new competitors and recipients who have not been supported by DOE in the past.
- The degree to which the submission enables new and expanding market segments.
- Whether the project promotes increased coordination with nongovernmental entities for the demonstration of technologies and research applications to facilitate technology transfer.
- Whether submission content sufficiently confirms the competitor's intent to commercialize early-stage technology and establish a viable U.S.-based business in the near future.

#### 14. NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) COMPLIANCE

DOE's of this 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 the Design Contest 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.

#### 15. DEFINITIONS

**Prize Administrator** means both the Alliance for Sustainable Energy operating in its capacity under the Management and Operating Contract for NREL and BTO. When the Prize Administrator is referenced in this document, it refers to staff from both the Alliance for Sustainable Energy and BTO staff. Ultimate decision-making authority regarding contest matters rests with the Director of the Building Technologies Office.

**Connector or Connector Organization** means an entity that seeks to support the efforts of the competitors. These must be U.S.-based organizations that have the capacity to connect competitors to mentoring, business resources, manufacturing resources, or introduce them to possible sources of funding. This definition is intentionally broad so that many different types of entities are able to participate. Connectors will earn recognition awards based upon their support of the competitors. Further details can be found at: <https://americanmadechallenges.org/network.html>.

**Power Connector** means a subset of Connectors that receive contracts from the Alliance for Sustainable Energy to play a more substantial role in the competition and receive funds to expand and amplify the American-Made Challenges: Buildings Prize. Not only will these stakeholders work to identify talent and support participants in the Contests, but they will partner with NREL to envision and execute a long-term sustainable strategy for scaling the American-Made Challenges.

#### 16. RETURN OF FUNDS

As a condition of receiving a prize, competitors agree that if the prize was made based on fraudulent or inaccurate information provided by the competitor to DOE, DOE has the right to demand that any prize funds or the value of other non-cash prizes be returned to the government.

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

## Appendix 2: Request to Waive the “Majority Domestic Ownership and Control” Eligibility Requirement

### Waiver

If an entity seeking to compete does not have majority domestic ownership and control, EERE may consider issuing a waiver of that eligibility requirement where the entity submits a compelling justification; the entity is incorporated in and maintains a primary place of business in the United States; and the entity otherwise meets the eligibility requirements. EERE will not waive the eligibility requirement that all competing entities must be incorporated in and maintain a primary place of business in the United States. Entities seeking a waiver should include a justification along with their submission. EERE may require additional information before making a determination on the waiver request. There are no rights to appeal DOE’s decision on the waiver request.

The justification must address the following waiver criteria and content requirements:

### Waiver Criteria

Entities seeking a waiver must demonstrate to the satisfaction of EERE that its participation: (1) has a high likelihood of furthering the objectives of this prize competition; and (2) aligns with the best interest of the U.S. industry and U.S. economic development.

### Content for Waiver Request

A waiver request must include the following information:

- a. Entity’s name and place of incorporation
- b. The location of the entity’s primary place of business
- c. A statement describing the extent the entity is owned or control by a foreign government, agency, firm, corporation, or person who is not a citizen or permanent resident of the United States, including the applicable percentage of ownership/control
- d. A compelling justification that addresses the waiver criteria stated previously
- e. A description of the project’s anticipated contributions to the U.S. economy
- f. A description of how the entity has benefitted U.S. research, development, and manufacturing, including contributions to employment in the United States and growth in new U.S. markets and jobs
- g. A description of how the entity has promoted domestic manufacturing of products and/or services.