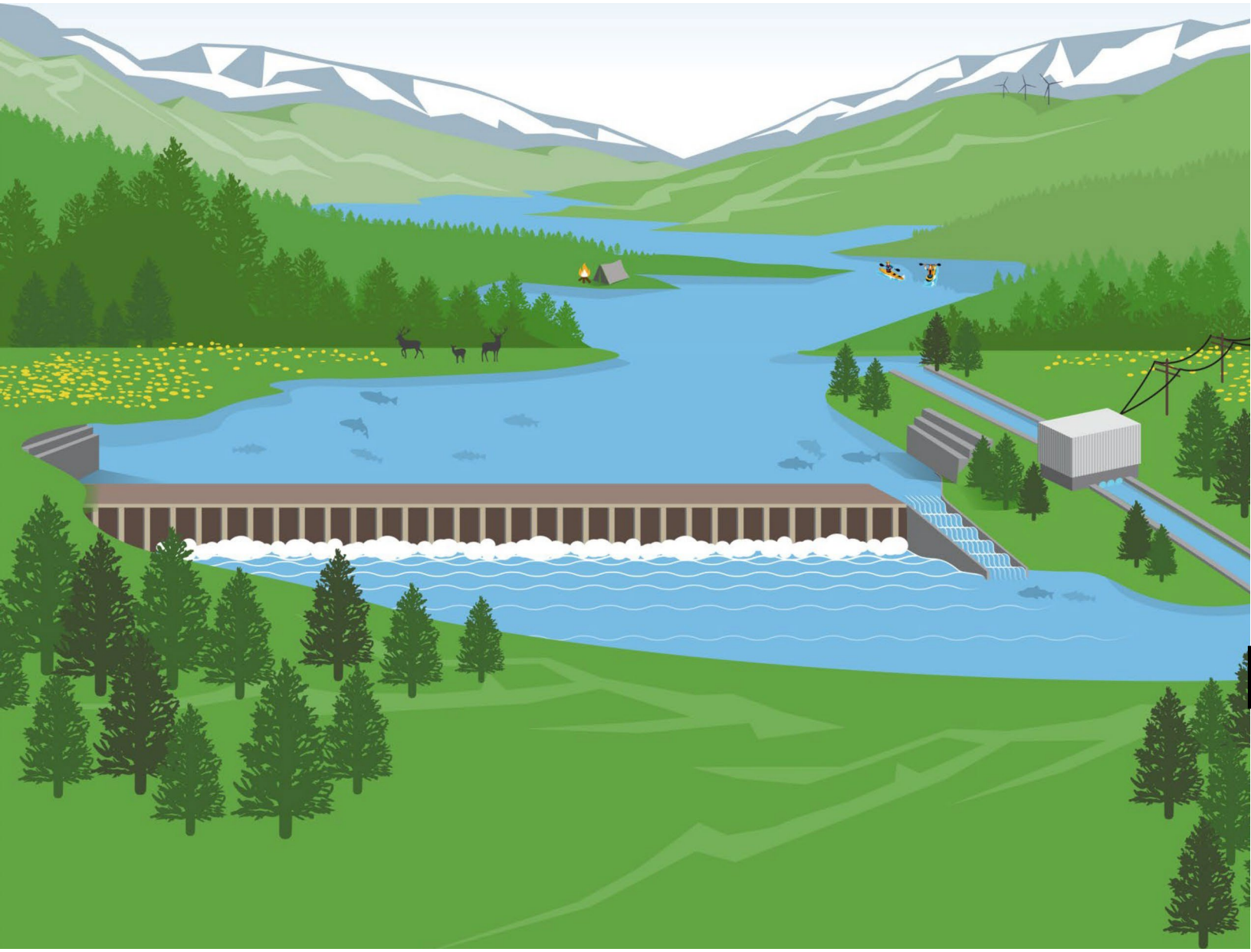
Hydropower
COLLEGIATE COMPETITION

U.S. DEPARTMENT OF ENERGY



Hydropower Collegiate Competition 2025
Rules Document

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2 Introduction

2.6 Purpose

The U.S. Department of Energy (DOE) Water Power Technologies Office's (WPTO's) Hydropower Collegiate Competition (HCC, also referred to as the "competition" in this rules document) invites interdisciplinary teams of postsecondary, undergraduate, and graduate students from a variety of academic programs to solve complex hydropower challenges. Through the competition, WPTO intends to offer students direct industry experience, valuable exposure to hydropower career pathways, and greater knowledge of hydropower's potential to contribute to a clean energy future. The HCC will consist of three required and concurrent challenges: a Siting Challenge, a Design Challenge, and a Community Connections Challenge. Teams may additionally compete in optional challenges: Build and Test Bonus Challenge and/or the Cyber in Hydro Bonus Challenge.

2.7 Prizes

The competition will select up to 14 teams to compete for a cash prize pool of up to $333,000.

Teams that submit all required submission materials in the HCC will be eligible for up to $15,000 each in cash awards, and will compete for part of the $25,000 grand prize cash pool. Teams that compete in the optional Build and Test Challenge will be eligible for an additional $5,000 cash prize each. Teams competing in the Cyber in Hydro Bonus Challenge will be eligible for an additional $2,000 cash prize each.

Specific requirements for each stage of the competition are included in the following sections.

Table 1. Cash Prize Distributions

All amounts are up to the total noted and are not guaranteed.

Stage	Cash Prize per Team	Total Cash Prize Pool
Application to Participate	$5,000	$70,000
Midyear Submissions	$5,000	$70,000
Optional Midyear Submission for Build and Test Bonus Challenge	$5,000	$70,000
Optional Midyear Submission for Cyber in Hydro Bonus Challenge	$2,000	$28,000
Final Event	$5,000	$70,000
Grand Prize*	*TBD**	*$25,000***
Total	**$15,000 (plus $7,000 if participating in Optional Challenges and additional Grand Prize)**	**$333,000**

*Grand Prize cash prizes will only be distributed to first-, second-, and third-place winners. Specific amounts for winner placements will be announced closer to the final event.

**Should all teams not participate in the optional build and test activity, funds may be reallocated to augment the Grand Prize pool.

As part of the HCC, competitors will have the opportunity to engage in networking events with hydropower industry experts during an industry event. This engagement is intended to encourage connections between competitors and industry professionals to inform students about career prospects in the hydropower industry. Logistics will be shared closer to the event and will include information about event registration, lodging, local resources, team booths, shipping and storage of materials, event feedback protocol, and more.

2.8 Background

As one of the nation's largest sources of renewable electricity, hydropower provides electricity, energy storage, and essential services to the electric grid, and jobs in communities across the country. Yet about a quarter of the current U.S. hydropower workforce[1] is eligible for retirement, or will be, within the next decade.

The hydropower industry is critical to the federal government's goal of achieving a carbon-pollution-free power sector by 2035. Hydropower already plays an important role in our power system—it provides 37% of total U.S. renewable electricity generation and 93% of grid-scale energy storage—and has untapped potential and significant opportunity for growth. This growth can be realized with further innovation and a new generation of passionate, motivated innovators and entrepreneurs to support the clean energy transition.

WPTO and the National Renewable Energy Laboratory (NREL), in partnership with the Hydropower Foundation, established the HCC in 2022 to pave the way for next-generation innovators and entrepreneurs to start their careers in clean energy.

2.9 The 2025 Competition: Opportunities With Non-Powered Dams and Closed-Loop Pumped Storage Hydropower Systems

The 2025 student teams will have 10 to 12 months to address a series of hydropower challenges relevant to the industry, and then present their concepts at Water Power Week or a similar industry event in the spring of 2025. Teams will also submit written documents demonstrating their progress throughout the competition for the three required challenges, attend monthly all-team calls, receive an assigned industry mentor, and have access to educational webinars and networking opportunities with hydropower experts.

The 2025 HCC theme expands upon the 2024 theme of **converting non-powered dams (NPDs) to hydroelectric dams to also include closed-loop pumped storage hydropower (PSH) systems**. Competition organizers have expanded the 2025 competition around this broader theme since both hydropower scenarios are of near-term relevance to the hydropower industry. The United States has more than 80,000 non-powered dams. At these locations, adding electricity generation systems to the existing dam structure can be a cost-efficient way to bring more benefits to the surrounding community and generate clean electricity. As for PSH, according to the *U.S. Hydropower Market Report 2023 Edition*, "despite very strong growth in battery installations in 2020–2022, the U.S. PSH feet continued to provide most of the utility-scale power storage capacity (70%) and energy storage capacity (96%) in 2022."[2]

The Competition will consist of three required and concurrent challenges: a Siting Challenge, a Design Challenge, and a Community Connections Challenge. Selected teams also have the option to

[1] https://www.nrel.gov/docs/fy23osti/83817.pdf
[2] https://www.energy.gov/sites/default/files/2023-09/U.S.%20Hydropower%20Market%20Report%202023%20Edition.pdf.

compete in the concurrent Build and Test Bonus Challenge and/or Cyber in Hydro Bonus Challenge. Each challenge includes distinct submissions that selected teams are expected to complete to be awarded cash prizes.

The following describes the three required challenges and the two optional challenges:

1. **Siting Challenge:** Teams will perform a hydropower site selection process from either (1) a subset of non-powered dams that have the potential to produce between 1 megawatt (MW) and 10 MW of power or (2) a subset of closed-loop PSH systems that can provide any amount up to 1 gigawatt (GW) of power and provides between 8 and 24 hours of storage. Teams will then develop a feasibility assessment for the selected site (this subset is available through the use of open-source tools that will be made available by the Prize Administrators upon selection of the teams). **Submissions in this challenge will count for approximately 35% of the total final score.**
2. **Design Challenge:** Teams will choose from two tracks. In Track 1, Facility Conceptual Design, teams will create a conceptual design of the selected hydropower site from the Siting Challenge. In Track 2, Hydropower Component Deep Dive, teams will complete a final design package for an individual component or system related to the development of the selected hydropower site from the Siting Challenge. **Submissions in this challenge will count for approximately 40% of the total final score.**
3. **Community Connections Challenge:** Teams will engage with the hydropower industry and their communities to achieve three goals: make connections with professionals to discuss a challenge in the industry that the team is passionate about, create unique solutions to address these challenges, and take action toward one of these solutions. **Submissions in this challenge will count for approximately 25% of the total final score.**
4. **Optional Build and Test Bonus Challenge:** Teams will build a scaled prototype of their concept or powerhouse and perform a series of tests. **Submissions in this challenge are worth 120 points, and do not count toward the final score.**
5. **Optional Cyber in Hydro Bonus Challenge:** Teams will respond to a case study challenge that involves cybersecurity issues. **Submissions in this challenge are worth 100 points, and do not count toward the final score.**

Results from each challenge will be incorporated into final reports and presentations, described in further detail in the following sections. Teams will present their results at the final event. Through participation in the three required and two optional challenges, teams can win up to $22,000 in prizes ($15,000 for the required challenges and an additional $5,000 for the optional Build and Test Challenge and $2,000 for the optional Cyber in Hydro Bonus Challenge).

Additionally, teams will be eligible to compete for cash prizes from an additional final grand prize cash pool of $25,000.

2.9.1 Key Dates

- HCC Application Opens: March 22, 2024
- HCC Application Closes: May 6, 2024
- Midyear Submissions Deadline: January 27, 2025
- Final Report Deadline: 2 weeks prior to final event, exact date TBA
- Metrics Report Deadline: 1 week prior to final event, exact date TBA
- Final Event: Exact Dates TBA

2.10 Prize Goals

The competition's goals are to:

1. Bring together diverse groups of students from multiple disciplines.
2. Encourage teams to explore opportunities for hydropower using real-world concept development experiences.
3. Inspire future innovators to tackle the challenges and opportunities surrounding hydropower development.

Although hydropower-specific advanced degrees are rare, having related experience within a wide range of clean energy opportunities can provide a foundation for future opportunities in the sector; careers include opportunities for researchers, scientists, engineers, educators, project managers, entrepreneurs, sales forces, and many others.

In alignment with DOE's climate and emissions reduction goals, teams participating in this competition will address the challenge of how hydropower can play a critical role in enabling a 100% clean energy economy. The specifics of the challenges will continue to evolve annually to address evolving industry needs and foster innovation, collaboration, and creativity.

2.11 Eligibility and Competitors

Up to 14 teams will be selected to participate in the competition. The Competition seeks to bring together interdisciplinary undergraduate and graduate student teams and is only open to academic institutions, subject to the following requirements:

- Interested teams must submit an initial application to act as a competitor in the competition and be selected to compete.
- Teams may consist of a combination of undergraduate and graduate students but must be at least 50% students who are pursuing their bachelor's and/or associate degree at the beginning of the competition. Only 50% of the team may be pursuing an advanced degree (masters, Ph.D., etc.).
- U.S. academic institutions must be accredited by the U.S. Department of Education to be eligible for cash prizes.
- Non-U.S. institutions are eligible to participate on their own, without a U.S. university partner; however, these teams will not be eligible to receive cash prizes and must provide their own funding to support travel and competition expenses.
- Multiple institutions are eligible to form a singular team; however, multi-institutional teams must designate the lead institution and partner institution(s). For teams comprising U.S. and non-U.S. institutions, the lead institution must be an eligible U.S. institution to receive cash prizes.
- Each institution may only sponsor one team. Multiple teams applying from an institution will be asked to partner internally. Institutions appearing on multiple teams, either acting as the lead or partner institution, will be required to choose only one team to participate in.
- DOE employees, employees of sponsoring organizations, members of their immediate families (e.g., 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.

- For the family members of lab employees participating in the competition, the lab employee's scope of their employment cannot overlap with any aspect of the prize competition.

- Individuals who worked at DOE (federal employees or support service contractors) within six months prior to the submission deadline of any contest are not eligible to participate in any prize contests in this program.
- Federal entities and federal employees are not eligible to participate in any portion of the prize.
- Students who are employed at labs can participate, including interns, however, they cannot use their Federal lab facilities as part of the competition since these facilities are not open to all competitors.
- 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.
- Individuals participating in a foreign government talent recruitment program[3] sponsored by a country of risk and teams that include such individuals are not eligible to compete.
- Entities owned by, controlled by, or subject to the jurisdiction or direction of a government of a country 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:

  > I am providing this submission package as part of my participation in this prize. I understand that the information contained in this submission will be relied on by the federal government to determine whether to issue a prize to the named competitor. 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 and § 287, and 31 U.S.C. §§ 3729-3733 and 3801-3812.

In keeping with the goal of growing a community of innovators, competitors are encouraged to form multidisciplinary teams while developing their concept. The HeroX platform provides a space where parties interested in collaboration can post information about themselves and learn about others who are also interested in competing in this contest.

All cash prizes will be paid directly to the lead academic institutions.

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[3] Foreign Government-Sponsored Talent Recruitment Program is defined as an effort directly or indirectly organized, managed, or funded by a foreign government, or a foreign government instrumentality or entity, to recruit science and technology professionals or students (regardless of citizenship or national origin, or 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 relocate physically to the foreign state for the above purpose. Some programs allow for or encourage continued employment at United States 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.

Based on prior experience with collegiate competitions, HCC Prize Administrators recommend a team size of six to eight participants, but there is no official limit to the number of participants per team. However, for each team, the number of students participating in the scored presentations may be limited based on timing and/or space restrictions. Interdisciplinary teams including students with backgrounds in the following areas are highly encouraged: engineering, environmental science, business, marketing, communications, policy, and social sciences.

Throughout the competition, teams will have the opportunity to gain insights into hydropower and clean energy careers and access workforce development resources and career opportunities in these sectors. All teams will be invited to attend regular educational webinars and industry presentations that will enhance their educational experience. The HCC has helped students in the past by connecting them with job opportunities and instilling an interest in and understanding of renewable energy careers.

Specific application requirements and evaluation criteria are included in this document. The Prize Administrator has the right to refuse any submission for incompleteness or unresponsiveness to the prize goals.

2.12 Assigned Mentors

Eligible teams selected to participate will be assigned a mentor for support throughout the competition. These hand-selected industry mentors will play a critical role throughout the competition, providing teams with real-world experience, technical insight, and other important support. **Mentors will be assigned to teams by September 1, 2024.**

3 Application Requirements

Interested teams must submit an application in PDF format to participate on the HeroX platform by **11:59 p.m. MT on May 6, 2024**. Teams will not be eligible to compete if an application is not submitted by the deadline. Submissions will be reviewed and scored by national laboratory researchers and U.S. Department of Energy (DOE) staff using the evaluation criteria listed below and in the scoring rubric.

Ultimately, this collegiate competition is designed to foster educational programs and would benefit from classroom curriculum as well as the creation of remote learning, industry partnerships, informal independent-study projects, industry mentorships, and clubs.

3.6 What to submit

Each application for the HCC must be a maximum of 1,500 words and include a response for each of the following sections.

3.6.1 Team Contact Information

The team contact information must include:

- Lead institution
- Partner institutions (if applicable)
- Team Faculty Advisor(s) name and department (faculty member or primary representative)
- Faculty Advisor(s) email
- Faculty Advisor(s) phone number
- Collegiate Team Student Leader(s) name and declared/intended major (if known)
- Collegiate Team Student Leader(s) email.

3.6.2 Introduction

Teams should provide a brief introduction of their team, why they are interested in participating in this competition, and their commitment to engage in the HCC educational opportunities. This includes but may not be limited to subject matter expert speakers, tools overviews, and other educational webinars.

3.6.3 Educational Objectives and Integration (35%)

Table 2. Scoring Rubric for Educational Objectives and Integration

Description	Maximum Possible Points
Educational Objectives and Integration: The application provides an achievable and detailed description of: • How the competition would be integrated into their academic experiences (e.g., courses integrating competition elements or other programs that otherwise support competition-related work, scholarships, independent-study projects, or research assistantships designed to support successful student participation in the competition). Or, if this is not possible due to lack of available programs of this type, the plan to cultivate knowledge through other means (e.g., remote learning, industry partnerships, informal independent-study projects, industry mentorships, and clubs).	35

3.6.4 Organization and Project Planning (30%)

Table 3. Scoring Rubric for Organization and Project Planning

Description	Maximum Possible Points
Organization and Project Planning: The application provides an achievable and detailed description of: • How the team will execute elements of the competition, including how unique obstacles, such as academic calendars or virtual collaboration challenges, will be overcome (if applicable, noting previous participation in similar competitions). • How the team will be supported by faculty and staff, and external partners, where applicable, to ensure that students can be successful in achieving the competition objectives (e.g., list faculty, staff, and other mentors and how they will advise students throughout the competition). • Which departments across the institution will participate and actively support the team to meet competition requirements, including a description of what this support will look like across each of these departments. • Resumes of students from international institutions, which includes university affiliation(s) and the physical location of where they will perform the work for this prize. Non-domestic participation may be subject to DOE review, see Appendix A "General Conditions." •	30

3.6.5 Team Diversity and Inclusivity (25%)

Teams should describe efforts to ensure that the team makeup will be consistent with DOE's and the National Renewable Energy Laboratory's (NREL's) efforts to cultivate a water power workforce comprising diverse backgrounds, skill sets, and educational training.

Table 4. Scoring Rubric for Team Diversity and Inclusivity

Description	Maximum Possible Points
Team Diversity and Inclusivity: The application includes: • Ambitious yet achievable diversity, equity, and inclusion objectives that will be incorporated in the competition that are applicable across multiple academic disciplines. These objectives must be specific, measurable, assignable, realistic, and time-related (often called SMART). • A clear plan to measure the success of the proposed diversity, equity, and inclusivity objectives. • Justification for why the team will be successful in achieving the objectives they have defined and engaging team members of diverse or unique backgrounds.	25

3.6.6 Institutional Support and Fundraising (10%)

Cash prizes will be awarded per team by the Prize Administrator as outlined in Table 1. Teams should clearly describe how they expect to spend these funds and how the funds will help them achieve their project goals. Note that these funds may not cover the full expenses of team projects or participation for all students; therefore, applicants should describe how they will seek additional resources (e.g., software, educational materials, project planning tools, and so on) that they anticipate needing as part of the competition.

Table 5. Scoring Rubric for Institutional Support and Fundraising

Description	Maximum Possible Points
Institutional Support and Fundraising: The application includes a detailed and achievable description of how the team will seek additional resources (e.g., software, educational materials, project planning tools, and so on) they anticipate needing as part of the competition.	10

4 Competition, Challenges, Submissions, and Awards

The HCC in its entirety consists of all the activities leading up to and during the final event. The final event is where the teams present their results from the three required challenges and, if applicable, the optional challenges; the competing teams must have also submitted their written reports by the dates specified in this document.

The primary theme of the competition is opportunities in hydropower, specifically, (1) the conversion of non-powered dams to hydroelectric dams and (2) closed-loop pumped storage hydropower. Competing teams are allowed to either advance existing technology through this competition or develop new technologies.

4.6 Submissions and Award Overview

During the HCC, participating teams will create and submit or present:

- **Application to participate**.
- **Midyear submissions**, which will include reports on progress made for each of the challenges.
- A final **written report** describing the work completed in the Siting Challenge and the Design Challenge.
- A **closed-door presentation** on the outcomes from the Siting Challenge and Design Challenge. This presentation will be followed by a private Q&A with a panel of reviewers.
- A **public presentation** on the outcomes of the Community Connections Challenge followed by a public Q&A. Teams shall also present their challenge activities in a multimedia summary using media of their choice.
- A **poster** summarizing the outcomes from the Siting Challenge and Design Challenge.
- A **metrics report** that details the metrics on the outcomes of their Community Connections Challenge activities throughout the year.
- A **prototype** of the concept that the team builds and tests in a laboratory setting as part of the Optional Build and Test Bonus Challenge, if applicable, including a short presentation at the final event discussing their methodology followed by Q&A.
- A Cyber in Hydro Bonus Challenge **presentation** discussing their methodology followed by Q&A.

The details of the required and optional submissions for each challenge are provided in the following sections for each of the challenges and summarized in Table 7.

Table 6. Challenge Submissions Overview

Required Submissions	Siting Challenge	Design Challenge	Community Connections Challenge	Optional Build and Test Bonus Challenge	Optional Cyber in Hydro Bonus Challenge
Midyear Submissions	X	X	X	X	X
Written Report	X	X	X		
Presentation and Q&A	X	X	X	X	X
Poster	X	X			
Prototype				X	

All of the required submissions will be scored as described in Table 7. Details on what to include in these submissions and the scoring criteria used to evaluate them are described in the following sections for each of the challenges.

Table 7. Scoring Summary for the Competition Submissions (900 Points Total)*

Description	Maximum Possible Points
Siting Challenge (35%)	**300**
Midyear Submission: Site selection and justification document	50

Siting Challenge portion of written report*	100
Siting Challenge portion of presentation**	100
Siting Challenge portion of poster	50
Design Challenge (40%)	**350**
Midyear Submission: Design Challenge	50
Design Challenge portion of written report*	150
Design Challenge portion of presentation**	100
Design Challenge portion of poster	50
Community Connections Challenge (25%)	**250**
Midyear Submission: Community Connections Challenge	50
Final report	50
Final presentation	150
Build and Test Challenge (Optional – does not count toward total score)	**120*** **
Midyear Submission: Build and Test Challenge	20
Prototype	40
Presentation	60
Cyber in Hydro Challenge (Optional – does not count toward total score)	**100*** **
Midyear Submission: Cyber in Hydro Challenge	20
Presentation	80
Total for Competition	**900**

* Formatting requirements are in place to ensure an equal amount of space for all teams to tell their stories to the reviewers. Reports not formatted to the requirements and/or that are deemed to be utilizing more than the allotted words will be penalized at the discretion of the reviewers proportional to the infraction. Furthermore, extra words will be ignored.
**The final presentation must be submitted online to the Prize Administrators in advance of a team's presentation during the final event, and teams should bring a USB with the presentation as a backup.
*** Teams can earn up to 220 points for the optional Build and Test and Cyber in Hydro Bonus Challenges that are not included in the main Competition scores but will make teams eligible for bonus challenge trophies.

4.7 Siting Challenge and Design Challenge

The Siting Challenge and the Design Challenge are described in this section.

4.7.1 Siting Challenge (35%)

Teams will need to perform a hydropower site selection process from a subset of NPDs that have the potential to produce between 1 and 10 MW of power or a subset of closed-loop PSH that can provide any amount up to 1 GW of power and provides between 8 and 24 hours of storage. Teams will be expected to develop a feasibility assessment for the selected site for power generation and/or storage. Teams will have the resources to do this using open-source tools[4] that will be made

[4] Such as NPDamCat, NPD Hydro, the NPD Resource Assessment, SMH Exploring, the Hydropower Baseline Cost Model, and more found at https://hydrosource.ornl.gov/tool/npd_tools for NPDs. LCA of Closed-Loop

available by the Prize Administrators. Teams are encouraged to identify at least one new co-development opportunity at their selected site. Co-development opportunities include but are not limited to:

- Hybrid designs (wind, solar, storage, hydrogen, etc. in addition to hydropower).
- Environmental improvements.
- Recreation.
- Energy resilience.
- Species rehabilitation.
- Food and/or energy security.
- Tourism.
- Workforce development/education.

Teams will need to explain how and why this location was chosen, what risks exist to install these systems, and how they could theoretically be mitigated. Should a team determine that risks are not able to be mitigated for their originally selected site, the team may opt to choose a different site.

Many characteristics should be researched and considered in the selection of an appropriate site including but not limited to:

- High-level costs.
- Resource and generation availability.
- Dam safety and geotechnical data.
- Access to transmission/grid integration.
- Transportation access.
- Environmental factors, e.g., fish passage, sensitive species.
- Cultural effects, e.g., historical landmarks.
- Social metrics.
- Operations and maintenance requirements.
- Triple-bottom-line assessment of options (economic, environmental, and social outcomes).
- Opportunities to reduce the cost of adding power to existing civil infrastructure.

Teams will be scored based on the thoroughness of the assessment rather than the feasibility of the site as described in Table 11. As long as the team does not select a site with significant liabilities that make them unlikely to be developed (for instance, they include endangered species or historically protected structures), the team states all assumptions made, the assumptions made are reasonable, and the quantitative analysis is relatively error-free, a team has the ability to be scored high in this challenge.

Siting Challenge Submissions

Competitors will develop the following submission elements for the Siting Challenge:

- **Siting Challenge Midyear Submission**: Site Selection and Justification document that includes the team's down-select process in determining a site along with risk identification and approach to minimizing risk. This document should also include information on how outcomes helped inform the design track selected in the Design Challenge.
- **Siting portion of the Siting and Design Report** that shows the analysis performed in detail.

PHS: https://doi.org/10.1021/acs.est.2c09189; Closed Loop PSH Resource Assessment for the U.S. https://www.nrel.gov/docs/fy22osti/81277.pdf for PSH.

- **Siting Challenge Presentation and Q&A session**: Teams will present their Siting Challenge and Design Challenge results. This presentation will be followed by questions and answers with the panel of reviewers.
- **Siting and Design Poster**: Teams will submit one poster summarizing their activities in the Siting Challenge and the Design Challenge.

Table 8. Possible Points per Submission Element of the Siting Challenge

Points allocated below contribute to the total competition award.

Submission Element	Possible Points
Midyear Submission: Site Selection and Justification document	50
Siting section of Siting and Design Report	100
Siting portion of the Siting and Design Presentation and Q&A Session	100
Siting portion of the Siting and Design Poster	50
Maximum Possible Points for the Siting Challenge	**300**

Midyear Submission: Site Selection and Justification Document

Each team must submit an up to 1,500-word Siting Selection and Justification document on the HeroX website that includes the team's down-select process to a maximum of three possible dam sites where the team believes a powerhouse could be developed. The document should also include identification of risks and a proposed approach to risk minimization. **This midyear submission is due Jan. 27, 2025, 11:59 p.m. MT.**

4.7.2 Design Challenge (40%)

For the Design Challenge, teams will have the option to choose one of the following two tracks:

- **Track 1: Facility Conceptual Design:** Teams will create a conceptual design of the selected hydropower site from the Siting Challenge. This will include equipment selection, conceptual drawings, and a more detailed feasibility assessment (e.g., beyond socioeconomic and technical feasibility, this should also include operational models to determine operational feasibility).
- **Track 2: Hydropower Component Deep Dive:** Teams will design a component or system related to the development of the selected site. This will include engineering designs, drawings, cost estimates, and relevant models.

Track 1: Facility Conceptual Design

Teams will create a conceptual design of the hydropower assets that will enable conversion of the NPD to produce power or the closed-loop PSH system, encompassing all required components from the water supply to the powerline (sometimes referred to as "water to wire"). The components of an NPD powerhouse are described in Oak Ridge National Laboratory's report, *Non-Powered Dam Retrofit Exemplary Design for Hydropower Applications*.[5] These components typically include but are not limited to the components that can be found in a hydropower plant as shown in Figure 1.

[5] Deneale, Scott, et al. 2022. *Non-Powered Dam Retrofit Exemplary Design for Hydropower Applications.* Oak Ridge, TN: Oak Ridge National Laboratory. ORNL/TM-2021/2232. https://info.ornl.gov/sites/publications/Files/Pub167488.pdf.

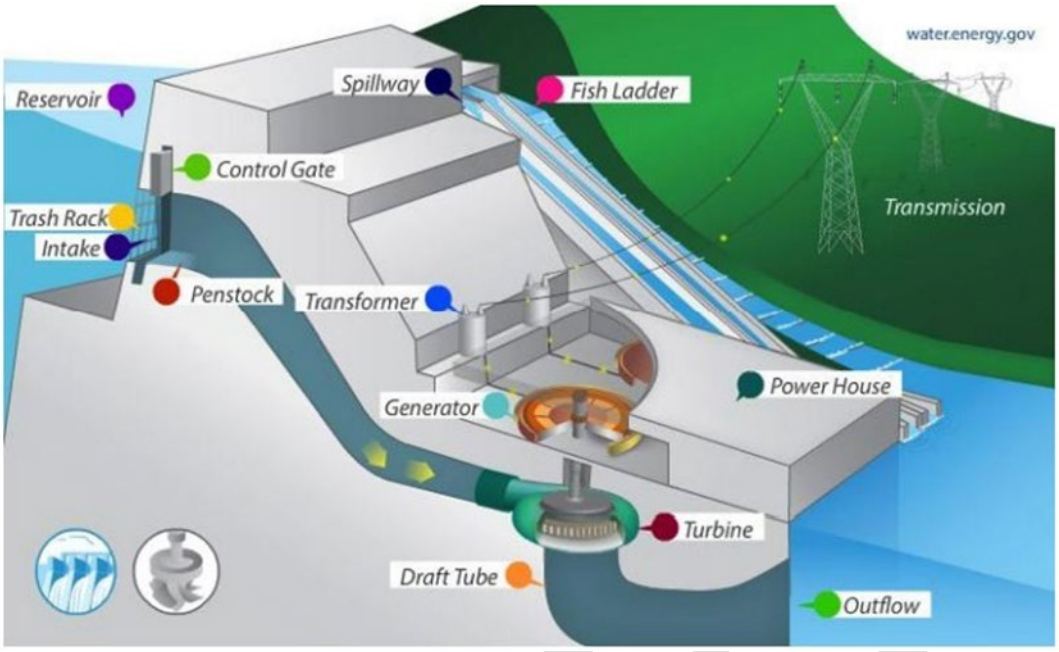
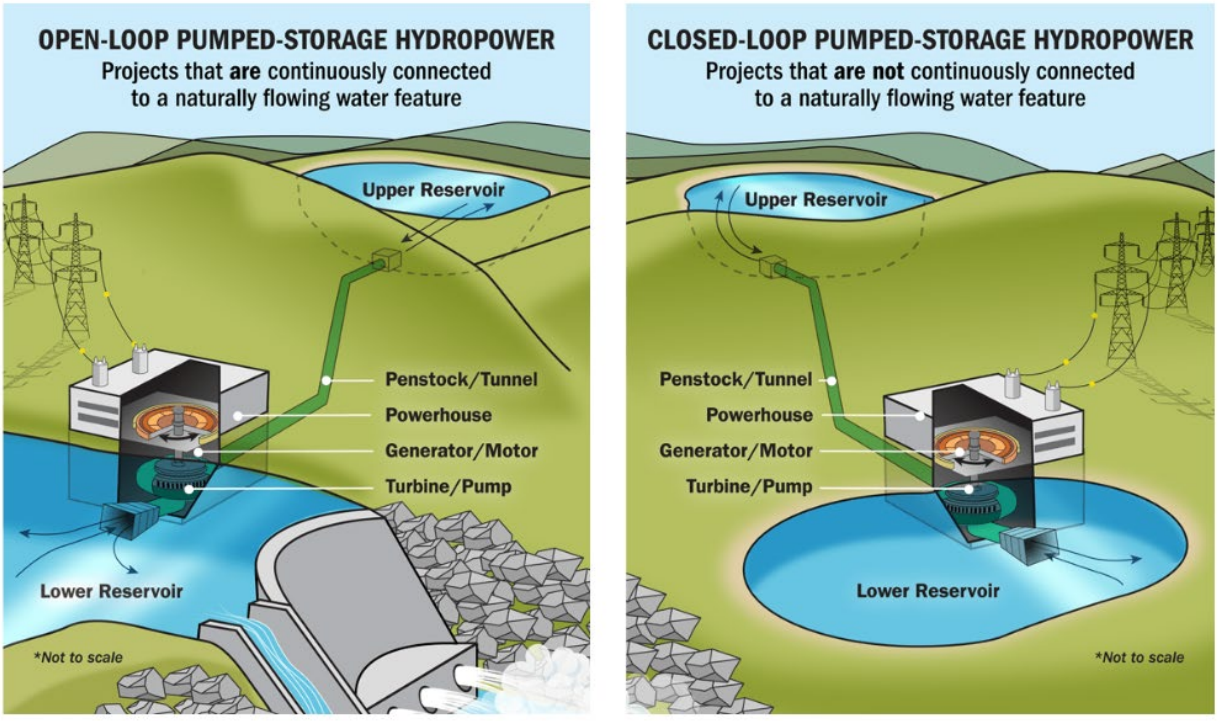


Figure 1. Major components of a hydropower plant

The following figure shows the features of both open loop and closed-loop PSH. This competition will focus on closed-loop PSH.



Open-loop pumped storage hydropower systems connect a reservoir to a naturally flowing water feature via a tunnel, using a turbine/pump and generator/motor to move water and create electricity.

Closed-loop pumped storage hydropower systems connect two reservoirs without flowing water features via a tunnel, using a turbine/pump and generator/motor to move water and create electricity.

Figure 2. Components of open-loop and closed-loop pumped storage hydropower systems

Teams will be evaluated on the thoroughness and feasibility of their design. Reviewers will consider the appropriateness of the equipment selected, critical design considerations described in the rubric in **Error! Reference source not found.**, the accuracy of the modeling work, and specific evaluation criteria described in Table 12 to score team designs.

Track 2: Component Deep Dive

Teams will choose a component of a hydropower system, which could be from the co- development concept and/or an electromechanical or civil engineering innovation that could reduce costs of adding that component to an existing structure and develop a detailed design of that component. Teams must complete a technical design report that explains the development process. Teams will be evaluated on the thoroughness and feasibility of their design. Reviewers will consider the appropriateness of the equipment selected, critical design considerations, the accuracy of the modeling work, and maximization of opportunities for innovation. The specific evaluation criteria are described in detail in **Error! Reference source not found.**.

Specific component deep-dive areas could include but are not limited to:

- Fish passage or recreation passage: areas of innovation could include modifications related to disruption minimization.
- Turbine: areas of innovation could include aspects like environmental improvements, fish passage, dissolved oxygen improvements, and controls.
- Water intake: areas of innovation could include aspects like reducing greenhouse gas emissions, conveyance efficiencies (and associated controls), and selective withdrawals.
- Structures: areas of innovation could include aspects like modular dams, gates, spillway designs, trash racks, selective withdrawal for environmental reasons related to greenhouse gasses, etc.[6]

The selected track (facility conceptual design or component deep dive) must also align with build and test activities if the team elects to participate in the Optional Build and Test Bonus Challenge.

Design Challenge Submissions

Competitors will develop the following submission elements for the Design Challenge.

- **Midyear Design Submission:** Design Selection and Justification document that includes the team's selected design challenge and details around their planned approach, associated risks, and risk management strategy.
- **Design portion of the Siting and Design Report** that meets the requirements outlined in the evaluation criteria.
- **Design Presentation and Q&A session:** Teams will participate in a Siting and Design presentation. This presentation will be followed by questions from a panel of reviewers.
- **Siting and Design Challenge Poster:** Teams will submit one poster summarizing their activities in both the Siting and Design Challenges.

Table 9. Possible Points per Submission Element of the Design Challenge

Submission Element	Possible Points
Midyear Submission: Design Selection and Justification document	50

[6] Areas of innovation could also be identified through the use of the Low Impact Hydropower Institute's certification criteria shared here: https://lowimpacthydro.org/criteria-standards/.

Design section of Siting and Design Report	150
Design portion of the Siting and Design Presentation and Q&A Session	100
Design section of the Siting and Design Poster	50
Maximum Possible Points	350

Midyear Submission: Design Selection and Justification Document

The midyear submission for the Design Challenge should be a maximum of 1,500 words and describe the preliminary design selection and justification document for the team's choice of either Track 1 or Track 2 and should be submitted on the HeroX website. **This midyear submission is due Jan. 27, 2025, 11:59 p.m. MT.**

The specifics of the preliminary design (Track 1) or component deep dive (Track 2) are not required at this time; however, reviewers will evaluate the process by which teams will be making design decisions, the identification of risks and the teams' approach to risk minimization, and the remaining components and potential issues to be explored and analyzed. Submissions will be evaluated in accordance with the Design Challenge rubrics shown in Table 12.

4.7.3 Siting and Design Final Report

Each team must complete a final written report describing the process and results of the Siting and Design Challenges. **The final report is due two weeks prior to the final event.**

The following format requirements apply to the written report:

- Length must not exceed 12,500 words (not including the cover and appendices), with no more than 5,000 words allocated to the Siting Challenge and no more than 7,500 words allocated to the Design Challenge. **Include the total word count on the cover.**
- Pages should be 8.5 inches by 11 inches, paginated, single-sided, and with 1-inch margins at a minimum, and include a cover sheet and a brief abstract (under one page).
- A cover sheet must include a list all team members who are involved in the project, including mentors, faculty, and others (e.g., sponsors and advisors) and clearly indicate each team member's role in the competition. **Include the total word count on the cover.**
- An abstract must include a summary of the Siting and Design Challenge activities as well as a mention of what the team accomplished within each challenge (included in the word count limit).
- The body of the report must use at a minimum an 11-point font.
- Captions for figures and tables must be numbered for easy navigation.
- The final document must be packaged into a single PDF file (see Appendix D).

Each section as outlined below should—where relevant—reference other sections. The written report is the primary means for a team to provide detailed information about their project and is expected to include the following sections:

Final Report: Siting Section

For the siting section of the report, teams must include the following:

- The team's approach and methodology to site selection.
- Risk identification and approach to risk minimization.
- Details on how their Siting Challenge activities led to the approach they selected for the Design Challenge.
- Details on the selected site, including co-development opportunities if applicable.

- Details on takeaways from the feasibility analysis (e.g., challenges faced, new discoveries not anticipated in pre-feasibility stage, expected challenge that could be encountered during actual development and suggested solutions).

Final Report: Design Section

For Track 1, the written report must explain the proposed dam or closed-loop PSH system and site modifications for the conversion of the NPD through engineering analysis and design drawings. Teams should provide adequate detail for a thorough review of the operating principles of the proposed system. At a minimum, the report must include:

- Design objective description.
- Feasibility assessment.
- System optimization.
- General compliance with siting limitations and requirements.
- Incorporation of expected user need.
- Merits/weaknesses of different concepts.
- Assumptions and calculations.
- Engineering diagrams, mock-ups, or sketches.
- Incorporation of environmental and sustainability factors.
- Demonstration of student learning.
- Risk identification and approach to risk minimization.

For Track 2, the final written report must present an engineering design review package for the selected component to include at a minimum:

- A description of the design objective and how the design components support this objective.
- An analysis of the expected mechanical loading and/or power requirement (where applicable), and associated safety factors within the design where applicable.
- Details on how the proposed technology is designed to withstand standard operating conditions.
- Engineering diagrams of all associated components.
- Risk identification and approach to risk minimization.

Each team will submit their report two weeks prior to the Competition on the HeroX website. Scoring criteria for the written report are provided in the written report sections of Table 10 and Table 11. At the conclusion of the competition, team reports will be posted to the competition website. Specific requirements for the siting and design sections of the report are included in the challenge- specific sections below.

4.7.4 Presentation and Q&A Session

Teams will also develop a final PowerPoint presentation to share the information contained in their report and submit it on the HeroX website. See Appendix D for instructions on formatting and submission.

Each team will have 20 minutes in total to share their Siting Challenge and Design Challenge activities and results. This will be followed by 10 minutes of questions from the reviewers. The full scoring criteria can be found in the presentation sections of Table 10 and Table 11.

Final presentation slides from each of the teams will be published on the competition website.

4.7.5 Poster

One poster summarizing the team's efforts in the Siting and Design Challenges is required for each team. The poster does not need to include a summary of the Community Connections Challenge.

Teams will bring their poster to the final event. Poster dimensions should be no bigger than 36 inches by 48 inches, and a template is available in the HeroX Resources page.

Teams are encouraged to showcase their creativity to tell a story of their efforts over the year. Teams will also be eligible to win a Best Poster trophy.

4.7.6 Siting and Design Challenges Scoring Statements

The Siting Challenge submission elements will be scored using the following statements:

Table 10. Scoring Statements for Siting Challenge Submissions (300 Points Total)*

Description	Maximum Possible Points
Midyear Submission: Site Selection and Justification document	**50**
Clear description of initial down-select to three sites and justification along with how the down-select to a final site has or will occur including criteria that will be used for site selection and how it has or will help inform the Design Track selected	30
Development of a risk matrix to include description of risks, assessment of probability of occurrence and consequence, along with approach for risk minimization	10
Clear and professional documentation	10
Siting Challenge Portion of Written Report**	**100**
Documentation of down-select to three sites and ultimately one with discussion of iterative process between siting and design where applicable	30
Site specification and identification of potential siting challenges and co-development opportunities (where applicable)	25
Articulation of impact mitigation approaches	25
Summary of takeaways that may be useful for those going into the hydropower industry as it relates to project siting and project development	20
Siting Challenge Portion of Presentation***	**100**
Compelling narrative of inspiration and purpose behind the siting decision and related co-development opportunities	25
Demonstrates consideration of deployment issues, challenges, and possible opportunities for mitigation	25
Illustrates integration with the technical design	20
Practiced and polished presentation style, professional appearance, and manner	15
High-quality graphics, media, and props to support presentation	15
Siting Challenge Portion of Poster	**50**
Poster and model are visually appealing	15
Concept is clearly understood	20

Important elements of the related Design Challenge are represented on poster	15
Total for Siting Challenge	**300**

*10 points will be deducted for each day the written report is late up to 3 days, at which point the team is no longer eligible to receive points for this challenge.
** Formatting requirements are in place to ensure an equal amount of space for all teams to tell their stories to the reviewers. Reports not formatted to the requirements in Section 3.2.3 that are deemed to be utilizing more than the allotted words will be penalized at the discretion of the reviewers proportional to the infraction. Furthermore, extra words will be ignored.
***The final presentation must be submitted online to the Prize Administrators in advance of a team's presentation during the final event, and teams should bring a USB with the presentation as a backup.

The Design Challenge submission elements will be scored using the following statements:

Table 11. Scoring Statements for Design Challenge (350 Points Total)*

Description	Maximum Possible Points
Midyear Submission	**50**
Documentation of Design Track selection process	20
Justification of decision as it relates to the Siting Challenge activities	20
Development of a risk matrix that includes description of risks, assessment of probability of occurrence and consequence, along with approach for risk minimization	10
Design Challenge Portion of Written Report**	**150**
Clear description of design objective and feasibility assessment	25
Demonstration of system optimization	20
Compliance with siting limitations and requirements and expected user need	20
Comprehensive description of the concept and related analysis	20
Complete and comprehensive calculations and engineering diagrams, mock-ups, or sketches	30
Incorporation of environmental and sustainability factors	20
Demonstration of student learning through discussion of takeaways and lessons learned	15
Design Challenge Portion of Presentation***	**100**
Compelling narrative of inspiration and purpose behind the design decisions and related co-development and innovative opportunities	25
Demonstrates consideration of deployment issues, challenges, and possible opportunities for mitigation	25
Illustrates integration with the Siting Challenge	20
Practiced and polished presentation style, professional appearance, and manner	15
Track 1: High-quality graphics, media, and props to support presentation ***Track 2:*** Summaries of educational webinars (shown in an appendix to the presentation)	15
Design Challenge Portion of Poster	**50**
Poster and model are visually appealing	15
Concept is clearly understood	20

Important elements of the related Siting Challenge are represented on poster	15
Total for Design Challenge	**350**

*10 points will be deducted for each day the written report is late up to 3 days, at which point the team is no longer eligible to receive points for this challenge.
** Formatting requirements are in place to ensure an equal amount of space for all teams to tell their stories to the reviewers. Reports not formatted to the requirements and/or that are deemed to be utilizing more than the allotted words will be penalized at the discretion of the reviewers proportional to the infraction. Furthermore, extra words will be ignored.
***The final presentation must be submitted online to the Prize Administrators in advance of a team's presentation during the final event, and teams should bring a USB with the presentation as a backup.

4.8 Community Connections Challenge (25%)

Hydropower workforce development requires a multidisciplinary approach, and hydropower is closely tied to communities and places where hydropower exists. In recognition of the multidisciplinary approach and the multiple areas of interest that impact hydropower and communities, this required challenge is designed to forge stronger connections between competition participants, the hydropower industry, and the local community to address the challenges they are facing. This challenge will also provide students opportunities to engage beyond engineering and site design, and allow for teams to take creative, scalable approaches to engaging with emerging workforce, communities, and the hydropower industry.

The purpose of this challenge is to:

1. Engage students so that they can get exposure to the hydropower industry.
2. Enable students to have a framework to be exposed (competitors in this prize) to the current problems that will need to be solved in the coming years.
3. Have students focus on technology development and work on issues/challenges extending beyond technology to better understand and appreciate those issues.
4. Come up with a repeatable framework to expose more students to opportunities in the hydropower space.

4.8.1 Topics for Community Connection Challenge

The following is a list of topic areas in the industry as identified by Prize Administrators that are critical to the hydropower industry. Students are encouraged to conduct their own research into their selected topic. Resources are listed in Appendix F.

- K–12 student engagement.
- Hydropower perception and/or community adoption.
- Workforce development.
- Diversity, equity, inclusion, and accessibility.
- Energy equity and environmental justice.
- Manufacturing and supply chain.
- Facility upgrades and modernization for existing hydropower.
- Opportunities for hydropower to be paired with other generation or storage technologies.

As part of this challenge, competitors will submit a midyear submission, a final report, and a presentation at the final event. All submissions will be made on the HeroX website.

In the midyear submission, teams will select a topic area from the list above and will conduct a minimum of four interviews with hydropower professionals to learn more about the state of this topic in the industry and the various problems and challenges that exist. Based on the information gathered from the interviews, in the midyear submission the teams will propose three to five solutions and take action toward one of those solutions, engaging the broader hydropower

community. The final report will include an after-action report on the event or activity undertaken to solve the solution identified.

The team will be required to present and summarize the process and impact of their work. Specific requirements are defined in the following challenge segments, and deadlines are included in Section 2.9.1.

The Prize Administrator has outlined best practices and suggested approaches in a resource available on HeroX.

Table 12. Scoring Statements and Possible Points for the Community Connections Challenge*

Description	Maximum Possible Points
Midyear Submission	**50**
Quality and informativeness of team overview with engaging and creative storytelling	15
Quality, depth, and specificity of the industry interviews, insights gained from interviews, and three to five proposed solutions	15
Quality and creativity of outreach activities as represented in the Outreach Strategy Report	20
Final Report	**50**
After-action report: concise, readable, and descriptive with logical flow; communicates information clearly	30
Quality of industry interview metrics reporting	5
Quality of action metrics reporting	5
Quality of outreach strategy metrics reporting	5
Quality of social media metrics reporting	5
Final Presentation**	**150**
PowerPoint is concise and visually engaging, and presentation to reviewers is professional and clear, uses effective storytelling techniques	30
Demonstrated execution and measurements of outreach to a diverse group of stakeholders	30
Execution and demonstrated impact of chosen action	30
Demonstrated development of best practices and lessons learned through insights gained	30
Successful completion and integration of contest elements	30
Total for Community Connections Challenge	**250**

*5 points will be deducted for each day a submission is late, up to 3 days, at which point the team is no longer eligible to receive points for this challenge.
**The final presentation must be submitted online to the Prize Administrators in advance of a team's presentation during the final event, and teams should bring a USB with the presentation as a backup.

4.8.2 Midyear Submission: Team Overview, Interview Summary, and Outreach Strategy

The midyear submission will include two separate documents: (1) a team overview and (2) an interview summary and outreach strategy. The team overview should be no more than 500 words, and the interview summary and outreach strategy should be no more than 1,500 words and formatted according to the following requirements.

- Pages should be 8.5 inches by 11 inches, paginated, single-sided, and with 1-inch margins at a minimum.
- Content should be at a minimum single-spaced.
- The body of the report must use at a minimum an 11-point font.
- Captions for figures and tables must be numbered for easy navigation.
- The final document must be packaged into a single PDF file (see **Error! Reference source not found.**).

Submissions will be evaluated on quality of the content and not the length of the submission. The deadline to submit these materials on the HeroX website is listed in Section 2.9.1.

Team Overview

The team overview will use storytelling to introduce team members and their vision for the competition and the clean energy community. The Prize Administrator will post excerpts from these reports as the team overview on the HCC website and may edit the text for consistency between teams and to meet necessary web standards on energy.gov. Teams should promote the components of the team overview through their social media channels and media connections once they are live on the HCC website. Students should include a strategy of how they will continue promotion.

This team overview may include topics such as:

- Team name, institution name, city, and state.
- Faculty advisor and student lead names and email addresses.
- An introduction to each team member, their current studies, and their professional goals.
- Why the team is participating in the HCC and what the team is most excited for in this competition.
- The team's vision for a clean energy future.
- Team structure, including if it is a club team, capstone, or other, and student leadership roles.
- The team's history and lessons learned from previous years, or how new teams got involved in the HCC.
- Brief overview of technology concept.
- A team photo, including the names of the team members in the order in which they appear. This photo must be submitted as a separate .jpg or .png file in addition to being included in the report.

Interview Summary and Outreach Strategy

An interview summary will detail the progress made to date in engaging hydropower professionals to explore the topic areas that the team has identified and the insights gained from those interviews. The outreach strategy is an industry best practice to help keep announcements on track and serve as an activity road map. The report should address the following and describe the team's proposed activities throughout the year:

- An overview of the interviews completed to include who was interviewed, the sector and state/region they represent, their job title and organization, and a summary of the topics area.

- Key takeaways and insights the team has gained from these interviews.
- A statement of the topic area they'd like to address and high-level goals the team aims to achieve with their outreach activities.
- Three to five proposed solutions to the topic area and how the team has identified these solutions.
- An overview of the actions the team plans to take by the end of the competition to address one of the proposed solutions.
- Any industry connections or partnerships that the team has, and how the team will leverage these connections to achieve their outreach goals.
- The team's social media and communications strategy that highlights progress and milestones, including team social media accounts with hyperlinks, and relationships developed with the team's school newspaper or local media outlets.
- A timeline of events presented in chart form (see the engagement toolkit in Resources on HeroX for an example), including:
    - Timeline for proposed events
    - Timeline for event development and promotion of event
    - Planned outreach announcements and social media posts.
- Up to 10 photos or social media images that have been developed for outreach purposes.

4.8.3 Final Report

Teams will submit a final report detailing the metrics of their Community Connections Challenge activities throughout the year on the HeroX website. **The report is due one week prior to the final event.**

The final metrics report should be no more than 2,000 words and follow these formatting requirements:

- Pages should be 8.5 inches by 11 inches, paginated, single-sided, and with 1-inch margins at a minimum.
- Content should be at a minimum single-spaced.
- The body of the report must use at a minimum an 11-point font.
- Captions for figures and tables must be numbered for easy navigation.
- The final document must be packaged into a single PDF file (see Appendix D).

Points will be deducted if formatting guidelines are not met.

Reports from each of the teams will be published on the competition website, used for reference for future events, and could be used to develop future competition submissions.

The final metrics report should serve as primary means for a team to provide detailed information about their activities undertaken during the challenge to the reviewers. The final report should include the following:

- After Action Report
    - Overview of actions taken to address the challenge topic since the midyear deliverable.
    - Discussion of challenges the team faced, how these challenges were mitigated, and lessons learned.

    - Description of how these actions met the team's high-level outreach goals and impact to the hydropower community.
    - Reflection on Community Connections Challenge as a whole.
    - Teams may include up to 10 photos or social media images that depict their outreach activities.
- **Industry interviews outcomes**, including quantifiable numbers, such as:
    - Number and types of interviews.
    - Metrics on team and participant attendance at interviews.
    - Contact information for each interviewee, including; name, company, email address, origin of relationship (i.e., professional or alumni), sector in marine energy industry, and response regarding if this person would be open to continued participation in future HCC events.
- **Action outcomes for activities or events**, with quantifiable numbers, such as:
    - Number and types of activities or events.
    - Number of attendees, if applicable.
    - Types of attendees (industry, academia, community members, etc.).
    - Geographic regions represented.
    - Metrics on team and participant attendance at events.
- **Action outcomes for communications materials**, with quantifiable numbers, such as:
    - Number of page clicks.
    - Number of downloads.
    - Location of viewers.
    - Locations where materials were distributed.
- **Outreach strategy outcomes**, including quantifiable numbers, such as:
    - Number of persons engaged through outreach.
    - Types of outreach.
    - Reflection on outreach strategy, best practices, and lessons learned.
- **Social media strategy outcomes**, including quantifiable numbers, such as:
    - Metrics on social media account growth.
    - List each platform with number of followers, number of posts and likes, and how this grew throughout the year.
    - Reflection on the team's original social media plan versus results attained, lessons learned, and best practices.

When collecting data or feedback from stakeholders, attendees, or program participants, teams should communicate how their information will be used.

When collecting data or feedback from stakeholders, attendees, or program participants, teams should communicate how their information will be used. This report should be no more than 2,000 words in length and formatting guidelines. Points will be deducted if formatting guidelines are not met. Reports from each of the teams will be published on the competition website, used for reference for future events, and could be used to develop future competition submissions.

4.8.4 Final Presentation and Q&A

Teams will develop a final PowerPoint presentation to share their results on the challenge during the final event. This presentation must include:

- Details on the team, each team member's current studies, and future professional goals.
- A statement of the topic area the team has addressed, an overview of insights gained from industry interviews, a brief discussion of the three to five solutions identified to address this topic area, planning and execution of the action, and an assessment of action impact.

Teams should emphasize the quality and visual appeal of each slide and the accompanying presentation by the speaker. Slides should include high-resolution photos to represent each challenge element. Teams may use videos, but this is not required. There will be no template for these slides so teams can choose how to best convey their Community Connections Challenge experience.

Each team will have 10 minutes to present to a panel of reviewers and to the public during the final HCC event. This will be followed by 10 minutes of questions from the reviewers. Teams will be scored on the professional and clear structure of the presentation, use of effective storytelling techniques and visual elements, and their completion of each of the required submissions. Scoring rubric for the final presentation is detailed in Table 14.

4.9 Optional Build and Test Challenge

Based on a team's selection in the Design Challenge of Track 1, Facility Conceptual Design, or Track 2, Component Deep Dive, teams that elect to participate in the Optional Build and Test Challenge will have the option to build and test a prototype relevant to that track.

The team will build a scaled prototype of their proposed concept and develop video footage or take photographs of any tests and/or experiments of the prototype. Given the wide variety of concepts expected in this competition, there are no firm restrictions on the scale of the model that a team can test, what constitutes an appropriate experimental facility, or the testing parameters.

Teams will instead be measured on the development of a test and/or experiment plan that allows for data to be collected for incremental improvements to be made and attempts at successful execution of the test plan.

Prize Administrators expect the scale of the model will be determined by two factors: (1) the dimensions of the testing facility chosen (if not in open space) and (2) the available budget. Teams will be expected to share their prototype and present their process and attempts to test their prototype.

Teams that compete in this challenge will be eligible to be awarded an additional $5,000 in cash prizes in the competition. Teams are encouraged to use the first cash prize to fund their testing campaign, enabling them to complete the submission elements defined in the next section for the challenge.

4.9.1 Optional Build and Test Challenge Submissions

- **Midyear Submission**: Build and Test Strategy document that includes the competing team's proposed testing and experimentation strategy, including materials to be purchased, identification of risks, and approach for minimizing risks and preliminary approach to testing (including possibilities for where they will test and how they will test).
- **Prototype**: Teams participating in this challenge are expected to bring an assembled prototype to the event.
- **Presentation and Q&A Session**: Teams will participate in a presentation where they will describe their build and test activities and include video footage or photographs of testing and/or experimentation activities. Testing is required to take place in a laboratory setting. This presentation will be followed by questions from a panel of reviewers.

More details on the requirements and scoring criteria can be found below.

Table 13. Scoring Statements and Possible Points of the Optional Build and Test Challenge

These points do not contribute to the total competition score but allow for eligibility to receive a bonus challenge prize.

Description	Maximum Possible Points
Midyear Submission	**20**
Details on proposed approach including materials to be purchased and preliminary approach to testing (including possibilities for where they will test and how they will test)	15
Development of a risk matrix to include description of risks, assessment of probability of occurrence and consequence, along with approach for risk minimization	5
Prototype	**40**
Prototype build is of professional quality with evidence that it helped inform design activities and clear scaling	30
Prototype is relevant to the Siting Challenge and Design Challenge activities	10
Presentation*	**60**
Clear description of the scaling factors considered in designing and fabricating the model-scale facility (Track 1) and/or component (Track 2)	15
Clear description of the development of an experimental test plan and how the test plan would allow for the collection of data to prove the team's stated objective	15
Demonstration that the test plan was executed successfully and description of how the instrumentation (where applicable) and measurement design was completed, including pictures and/or videos	15
Summary of lessons learned during execution of the Build and Test Challenge and what modifications, new tests, or changes in recorded or simulated measurements the team would consider going forward	15
Total for Optional Build and Test Challenge	**120**

***The final presentation must be submitted online to the Prize Administrators in advance of a team's presentation during the final event, and teams should bring a USB with the presentation as a backup.**

Optional Build and Test Midyear Submission

Teams will submit a Build and Test Strategy document on the HeroX website. **This midyear submission is due Jan. 27, 2025, 11:59 p.m. MT.**

This document may not be more than 1,500 words and must communicate the team's intent to participate in the optional challenge, their proposed approach, including identification of risks, expected risk minimization approach and approach for minimizing risks, and their preliminary testing/experimentation strategy, including possibilities for where they will test and/or perform experiments of their prototype and the testing/experiments they anticipate carrying out. Testing must take place in a laboratory setting.

Upon this submission, teams who meet the requirements described will receive an additional $5,000 in prize funding to support activities around prototype development described below.

Optional Build and Test Prototype Development

The team will build a scaled prototype of their proposed concept. Test plans must be shared with Prize Administrators prior to testing their prototype. Teams must adhere to all prescribed safety requirements provided by an experimental facility as it relates to building and/or testing the prototype.

Optional Build and Test Presentation and Q&A Session

The competing teams will need to assess performance at scale for their prototype and present their results in a 10-minute presentation to a panel of reviewers at the final event of the competition, followed by 10 minutes of Q&A. The presentation should include the following information:

- The development of a physical model of their NPD powerhouse preliminary design (Track 1) or the prototype fabrication of their Design Challenge component (Track 2).
- The testing/experimentation process, including a list of instrumentation and methods used and a description of the measurements taken, which may be numerical modeling results (Track 1) or physical measurements (Track 2).
- An analysis of the testing/experimentation data and summary of results.
- Photos and/or video footage of tests/experiments with the prototype.
- A description of lessons learned from the design, build, and test processes.

The Build and Test Challenge evaluation criteria will focus on the quality of the model design, test plan development, instrumentation, and measurement techniques, and postprocessing of measured data rather than on the size and breadth of the experiment.

4.10 Optional Cyber in Hydro Bonus Challenge

Hydropower plants and the supporting infrastructure are crucial for ensuring grid stability and resilience. Cybersecurity analysis for hydropower plant operations is critical to avoid major energy delivery disruptions and ensure dam safety. Legacy infrastructure, operational technology interconnections with information technology solutions, combined with loosely implemented configurations, increase the cybersecurity threat landscape and allow for potential exploitation of vulnerabilities. Oftentimes, applying cybersecurity protections after the design has been completed leads to costlier, less efficient solutions. Engineering approaches that integrate cybersecurity considerations into the concept, design, build, and operation of any physical system that has digital connectivity, sensors, monitoring, or control is a proactive effort to reduce or eliminate catastrophic consequences.

During the Cyber in Hydro Bonus Challenge, teams are expected to use the Cyber-Informed Engineering Implementation Guide to identify, implement, and verify cyber protections and mitigations appropriate for their chosen hydropower system.

4.10.1 Optional Cyber in Hydro Bonus Challenge Submissions

- **Midyear Submission**: Teams will submit a preliminary memorandum to identify the areas of focus in the optional Cyber in Hydro Bonus Challenge and meet the requirements stated below.
- **Presentation and Q&A Session**: Teams will participate in a presentation where they will describe their response. This presentation will be followed by questions from reviewers.

Table 14. Possible Points per Submission Element of the Optional Cyber in Hydro Bonus Challenge

These points do not contribute to the total competition score but allow for eligibility to receive a bonus challenge prize.

Submission Element	Possible Points
Midyear Submission	20
Final Presentation* and Q&A Session	80

Maximum Possible Points	**100**

*The final presentation must be submitted online to the Prize Administrators in advance of a team's presentation during the final event, and teams should bring a USB with the presentation as a backup.

Optional Cyber in Hydro Midyear Submission

For this midyear submission, teams shall prepare an up to 5-page memorandum in which the team shall identify opportunities for cyber protections and mitigations appropriate for their chosen hydropower system. Competitors will submit this document on HeroX. **This midyear submission is due Jan. 27, 2025, 11:59 p.m. MT.**

In particular, in the memorandum, teams shall use the Cyber-Informed Engineering Implementation Guide[7]. This guide is also available as a resource on the HeroX website. Teams shall examine the Cyber-Informed Engineering Principles shown in the figure on page 9 of the guide and perform the following tasks:

- Using Principle 1, Consequence-Focused Design, discuss the implications of this principle on their hydropower system design.
    - Teams should focus only on phases A–D of Principle 1 (Concept–Development), which can be found on pages 14 through 18 of the guide.
    - Teams will then answer the questions listed on the Concept Phase (A) of Principle 1, which can be found on pages 14 and 15 of the guide (and listed below) and relate them to their hydropower project.
- Select 3 additional principles from the list below (page 9 of the guide) to consider throughout the rest of their design process.
    - Teams do not need to answer the Concept phase questions in their memorandum, but as part of their final presentation are expected to explain how their design was impacted by all four principles.

Table 15. Cyber-Informed Engineering Principles (extracted from *Cyber-Informed Engineering Implementation Guide*[8])

	Principle	Key Question
1	Consequence-Focused Design	How do I understand what critical functions my system must ensure and the undesired consequences it must prevent?
2	Engineered Controls	How do I select and implement controls to reduce avenues for attack or the damage that could result?
3	Secure Information Architecture	How do I prevent undesired manipulation of important data?
4	Design Simplification	How do I determine what features of my system are not absolutely necessary to achieve the critical functions?

[7] West, V. L. et al. 2023. Cyber-Informed Engineering Implementation Guide. Idaho Falls, ID: Idaho National Laboratory. INL/RPT-23-74072-Rev000. https://www.osti.gov/biblio/1995796.
[8] West et al. 2023.

5	Layered Defenses	How do I create the best compilation of system defenses?
6	Active Defense	How do I proactively prepare to defend my system from any threat?
7	Interdependency Evaluation	How do I understand where my system can impact others or be impacted by others?
8	Digital Asset Awareness	How do I understand where digital assets are used, what functions they are capable of, and our assumptions about how they work?
9	Cyber-Secure Supply Chain Controls	How do I ensure my providers deliver the security the system needs?
10	Planned Resilience	How do I turn 'what ifs' into 'even ifs'?
11	Engineering Information Control	How do I manage knowledge about my system? How do I keep it out of the wrong hands?
12	Organizational Culture	How do I ensure that everyone's behavior and decisions align with our security goals?

Table 16. Cyber-Informed Engineering Principle 1 Concept Phase A Questions (extracted from *Cyber-Informed Engineering Implementation Guide*[9])

1	What critical functions does the organization perform?
2	What is the purpose of this system? a. How does the system support the purpose of the organization? b. What system processes exist to ensure the success of this purpose? c. What system processes, if they fail or operate unexpectedly, will cause that purpose to fail?
3	What are the mission-critical functions this system is required to perform? a. How does the system connect to the critical functions of the organization? b. What needs does the system address and how does it meet those needs? c. Which specific aspects of the concept of operations (CONOPS) enable these critical functions?
4	What are the consequences that could result from a failure or unexpected operation of the system's critical functions? a. What impacts could there be to mission delivery, safety, security, the environment, equipment and property, financials, or corporate reputation? b. What happens if multiple consequences happen concurrently in time?
5	What business areas may be uniquely impacted by system failure or unexpected operation? a. Which parts of the business would be affected by each consequence? b. Which resulting consequences could be categorized as "acceptable" and could be managed within organizational risk management processes? c. Which consequences (physical or otherwise) are "unacceptable" and must be mitigated? Document these distinct consequences.
6	What regional or environmental consequences may result from system failure or unexpected operation? a. What entities would be affected for each consequence? Consider connected

[9] West et al. 2023.

	communities, infrastructure, and environments. b. What changes to the original design are needed to account for failure mechanisms that may vary from region to region?
7	What crucial assumptions have been made in the CONOPS that the system works as expected? a. What violations of those assumptions may result in high-impact consequences?
8	Where might routine system operations diverge from the expected CONOPS? a. At each instance where that might happen, what are the impacts?
9	Are there adverse operating modes that are prone to high-impact consequences? a. What circumstances require or cause these modes? b. In adverse operational conditions, how might system states evolve before the ultimate consequence occurs?
10	What staffing roles in the system have the most potential to interact with high-consequence events? What training or other supports will they need to perform those roles effectively? a. Where might a role gain access to functionality that was not anticipated and for which the requisite support or training is not in place? b. What are the impacts if an adversary gained access to this role and the requisite functions?

Upon this submission, teams who meet the requirements will receive an additional $2,000 in prize funding to support activities around cyber in hydro described below.

Table 17. Cyber in Hydro Bonus Challenge Midyear Submittal Rubric

These points do not contribute to the total competition score but allow for eligibility to receive a bonus challenge prize.

Description	Maximum Possible Points
Midyear Submission	**20**
Discussed implications of consequence-driven design on their hydropower system and showed critical thought through in-depth responses for all relevant questions in sections A of Principle 1 in the Implementation Guide	15
Chose 3 additional principles for focus that were relevant to their hydropower system and clearly described the relevance of these principles to their hydropower system	5

Optional Cyber in Hydro Presentation and Q&A Session

The competing teams will share their results in a 10-minute presentation to a panel of reviewers at the final event of the competition, followed by 10 minutes of Q&A. The presentation should include the following information:

- Using the *Cyber-Informed Engineering Implementation Guide* as a reference, teams shall identify, implement, and verify cyber protections and mitigations appropriate for their chosen hydropower system.
- In the presentation teams should plan to present the 3 additional principles they chose to consider throughout the rest of their design process along with highlights on how all four principles (Principle 1 and the 3 additional selected Principles) affected their design, contrasting the cyber threat landscape of their design with that of a design which would not have include these considerations.

Reviewers will evaluate the presentation and score it by using the following scoring criteria:

Table 18. Cyber in Hydro Bonus Challenge Q&A Scoring Rubric

Description	Maximum Possible Points
Presentation	**80**
Showed good understanding of Cyber-Informed Engineering concepts	20
Adequately explained the principles they chose to focus on	20
Thoroughly discussed how these principles affected their design and outlined the effects on cybersecurity without this approach	40

5 Final Event

The culmination of the HCC will occur with an in-person event (see Appendix E for event contingencies) to be held in the spring of 2025. The exact location and dates will be published during the 2025 competition.

During the final event, teams will present:

- A 30-minute closed-door presentation on the outcomes from the Siting Challenge (10 minutes) and Design Challenge (10 minutes). This presentation will be followed by 10 minutes of private Q&A with a panel of reviewers.
- A 20-minute public presentation on the outcomes of the Community Connections Challenge (10 minutes) followed by 10 minutes of public Q&A. Teams shall also present their challenge activities in a multimedia summary using media of their choice.
- A 10-minute presentation on the Build and Test Challenge (for teams competing in this challenge) followed by 10 minutes of private Q&A with a panel of reviewers.
- A 10-minute presentation on the Cyber in Hydro Challenge (for teams competing in this challenge) followed by 10 minutes of private Q&A with a panel of reviewers.
- A poster summarizing the outcomes from the Siting Challenge and Design Challenge.

5.6.1 How We Determine Award Winners

The Prize Administrator screens all completed submissions and, in consultation with DOE, assigns reviewers to independently score the applicable content of each submission. The reviewers will be composed of federal and nonfederal subject matter experts with expertise in relevant areas.

Reviewers will review submissions in each phase according to the described evaluation criteria. The Prize Administrator will tally the scores based on the scoring criteria described.

5.6.2 Final Determination

The Director of WPTO is the judge of the Competition and will make the final determination. Final determination of winners by the judge will take the reviewers' scores and program policy factors in Appendix A into account.

Table 19. How We Determine Award Winners for the Grand Prize Awards

Award	Criteria*	Prizes**
First Place	The team that earns the highest combined score in the Siting, Design, and Community Connections Challenges	Trophy

		Split a $25,000 grand prize cash pool. Cash prizes will be paid to each winning team's institution.
Second Place	The team that earns the second highest combined score in the Siting, Design, and Community Connections Challenges	
Third Place	The team that earns the third highest combined score in the Siting, Design, and Community Connections Challenges	
Individual Challenge Awards*** Siting Challenge Design Challenge Community Connections Challenge	The team that earns the highest score in the associated challenge	
* Specific details on earning points for each award are included in the following sections. The competition judge makes all final decisions in the allocation of prizes and awards. **All participating teams in the final event receive a participation plaque. ***Participation in the Build and Test and Cyber in Hydro bonus challenges can result in a portion of the prize pool for the team who ranks the highest in these optional challenges.		

6 Key Terms

Term	Definition
Competition	The competition is all aspects and activities leading up to and during the final event. It is the challenges, submissions, and final event, collectively referred to for a given year as the U.S. Department of Energy Hydropower Collegiate Competition.
Final Event	The final event is when and where the teams compete in the challenges. This could be during NHA's Water Power Week or a similar event.
Submissions	Submissions are what the team builds, writes, submits, and brings to compete in the final event. Submissions are measured against scoring statements, which determines whether a team will receive a prize for each challenge.
Team Booth	Each team is provided an assigned area during the final event, known as a team booth, to use as a central location to practice their presentation, regroup, and showcase their hard work throughout the year to the public. There will be electrical outlets available in the team booth area to allow students to access computers and other equipment that the teams deem necessary.

Appendix A. Additional Terms and Conditions

Your submission for the Hydropower Collegiate Competition is subject to the following terms and conditions:

- You must post the final content of your submission or upload the submission form online by the deadlines outlined in this rules document and listed on the HeroX website. 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 10 of Appendix A (Section A.10). 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 elements in your submission. The Prize Administrator may disqualify your submission after an initial screening if you fail to provide all required submission elements. Competitors may be given an opportunity to rectify submission errors due to technical challenges.
- Your submission must be in English and in a format readable by Microsoft Word or Adobe PDF. Scanned hand-written submissions will be disqualified.
- Submissions will be disqualified if they contain any matter that, in the sole discretion of the U.S. Department of Energy or the National Renewable Energy Laboratory (NREL), is indecent, obscene, defamatory, libelous, and/or lacking in professionalism, or demonstrates a lack of respect for people or life on this planet.
- If you click "Accept" on the HeroX platform and proceed to register for any of the prizes described in this document, these rules will form a valid and binding agreement between you and DOE and are 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 prize described here and no other prize 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, the competitor 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 the information contained in this submission will be relied on by the federal government to determine whether to issue a prize to the named competitor. 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 and § 287, and 31 U.S.C. §§ 3729-3733 and 3801-3812.

A.1 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 W9 form (https://www.irs.gov/pub/irs-pdf/fw9.pdf). In the sole discretion of the Prize Administrator, a winning competitor will be disqualified from the competition and receive no prize funds if: (i) the person/entity does not respond to notifications; (ii) the person/entity fails to sign and return the required documentation within the required time period; (iii) the notification is returned as undeliverable; (iv) 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.

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

A.2 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. The competitor’s entire submission is an original work by the competitor and the 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 (i) otherwise requested by the Prize Administrator and/or disclosed by the competitor in the submission, and (ii) competitor has either obtained the rights to use such third-party content or the content of the submission is 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:

a. 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;
b. Provided written permission to include their name, image, or pictures in or with the submission (or, if a minor who is not competitor's child, competitor must have the permission of the minor's parent or legal guardian) and the competitor may be asked by the Prize Administrator to provide permission in writing; and
c. 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.

A.3 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.

A.4 Challenge Subject to Applicable Law

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

A.5 Resolution of Disputes

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

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

A.6 Publicity

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

Except where prohibited, participation in the challenge 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.

A.7 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 judge responsible for this prize, the judge has determined that no liability insurance naming DOE as an insured will be required of competitors to compete in this competition per 15 U.S.C. § 3719(i)(2). Competitors should assess the risks associated with their proposed activities and adequately insure themselves against possible losses.

A.8 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 Freedom of Information Act representative prior to the release of materials. DOE does intend to keep all submission materials private except for those materials designated as "will be made public."

A.9 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.

A.10 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 failure, 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 that are likely to achieve the goals of the program. If, in DOE's determination, no competitors are likely to achieve the goals of the program, DOE will select no competitors to be winners and will award no prize money.

DOE may conduct a risk review, using Government resources, of the competitor and project personnel for potential risks of foreign interference. The outcomes of the risk review may result in the submission being eliminated from the prize competition. This risk review, and potential elimination, can occur at any time during the prize competition. An elimination based on a risk review is not appealable.

A.11 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 challenge 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 non-duplicative 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.

A.12 National Environmental Policy Act (NEPA) Compliance

This prize is subject to the National Environmental Policy Act (NEPA) (42 U.S.C. § 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 Marine Energy Collegiate Competition 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.

A.13 Definitions

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

A.14 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 CHALLENGE.

Appendix B. Roles and Responsibilities

Table B-1 shows the competition roles, the individual(s) responsible for performing in each role, and what each role entails.

Table B-1. Roles and Responsibilities

Role	Individual(s) Assigned	Responsibilities
Collegiate Team	Multiple	Team carries out work on the project within the rules and requirements of the competition, based on direction and advice from their fellow team members, Student Leader(s), and Faculty Advisor(s).
Collegiate Team Student Leader(s)	Minimum of one and maximum of two per team	The Student Leader(s) attends informational sessions with the Faculty Advisor, represents the team when communicating with competition Prize Administrators and other teams, and disseminates information received from the competition Prize Administrators over the course of the entire project, including monitoring communications. Minimum of one and maximum of two Student Leaders per team are allowed, but at least one must be an undergraduate. These names shall be reported to the Prize Administrators prior to the Team Student Leader kickoff meeting expected to occur in August 2024.
Collegiate Team Faculty Advisor(s))	Minimum of one per team	The Faculty Advisor serves as the lead faculty member and primary representative of a participating institution in the competition. This person also engages with competition Prize Administrators and provides guidance to the team throughout the project and ensures that the Student Leader(s) disseminates information received from the competition Prize Administrators. The Faculty Advisor advises, provides input to, and coaches the students on the skills necessary to compete in the various aspects of the competition. Some teams may specify multiple Faculty Advisors who contribute to the team. The name(s) shall be reported to the Prize Administrators prior to the Faculty Advisor kickoff meeting expected to occur in August 2024.
Collegiate Team Co- Advisors(s) or Supporting Faculty	Multiple	Supports the Faculty Advisor and Student Leader(s) in the above duties but typically does not directly engage with DOE/NREL Prize Administrators.
Prize Administrator	NREL	The Prize Administrator leads correspondence with the collegiate teams regarding contracts, challenge questions, and team expectations. During the competition, the Prize Administrator is the primary point of contact for questions related to engagement with the reviewers, logistics, and protocol. Tasks

		include developing team schedules, coordinating/collating scores and team feedback from the challenges in time for the awards ceremony, and supporting the collegiate teams and reviewers.
Challenge Reviewers	To be announced prior to the competition	The Challenge Reviewers conduct and evaluate each challenge.
Competition Judge	Director, WPTO	The director of WPTO is the judge of the competition and will make all final determinations.
Industry Mentor	One mentor will be assigned to each team by September 1, 2024	These hand-selected industry mentors will play a critical role throughout the competition, providing teams with real-world experience, technical insight, and other important support.

Appendix C. Conduct

The competition is a forum for students with an interest in hydropower to showcase innovative ideas and further develop their knowledge. The event is designed to be safe, fair, and competitive as well as a fun learning experience and professional growth opportunity. Each team is responsible for the safety of its operations. Participants are expected to conduct themselves in the spirit of the competition by being team players both within their own teams and among competitor teams.

As part of the culture of the U.S. Department of Energy and the National Renewable Energy Laboratory, renewable energy and sustainability go hand in hand—a common public perception as well. As a result, though the competition is about renewable energy, we expect that participants will embrace and showcase sustainability where possible during all aspects of the event (e.g., reducing waste in packaging for shipping, reusing packaging materials used in transporting items to the final event, and eliminating the use of nonrecyclable materials, such as foam packing peanuts). In addition, we encourage team members to engage in common sustainable activities, such as recycling paper and beverage containers. Team creativity to support this mission is encouraged but not scored.

While teams work on their submissions, faculty advisors, faculty co-advisors, graduate student advisors, and members of industry secured by each team for support can provide feedback about the team's design so the students can identify fatal flaws, prove technical rigor, or demonstrate feasibility of their concept. Teams are highly encouraged to pursue mentorships and sponsorships early in the competition, as it will provide immense benefit to the learning and overall competition experience. However, only student team members may take an active role in any competition event. It is the role of the nonstudent team members to provide a supportive environment and the educational background necessary for the students to achieve success in the competition.

In addition, teams are encouraged to bring to the Prize Administrator's attention rules that are unclear, misguided, or in need of improvement. The Prize Administrators will seriously consider suggestions that are feasible, within their constraints, and are intended to improve the competition, its rules, fairness, measurable outcomes, or precision.

Appendix D. How the Prize Administrator Will Communicate With Teams

It is each team's responsibility to stay abreast of the latest competition communications from the Prize Administrators. Communication between the teams and the Prize Administrators occurs via one or more of the following:

- **HeroX Forum**: Official communications suitable for viewing by all team members and Prize Administrators will be posted on the competition's HeroX Forum.
- **HeroX Resources**: All HCC resources, templates, and meeting recordings will be uploaded to the HeroX Resources page.
- **Virtual Meetings:** Teams are strongly encouraged to participate in scheduled virtual meetings with the Prize Administrators. Invitations and instructions for participation in these meetings are provided by the Competition Operations Manager(s) via email and on the HeroX Forum.
- **Email:** The official email address for the competition is Water.Competition@nrel.gov; questions should be sent directly to this email address, and answers that may be of interest to all teams will be posted on the competition's HeroX Forum. For expediency and to protect confidentiality, the Prize Administrators may choose to communicate with teams via team members' email addresses as listed in the HeroX database; however, official communications occur via the HeroX Forum.
- **Website:** The Hydropower Collegiate Competition (HCC) website will showcase the various elements of the competition, ongoing collegiate team engagement, and information about how to participate in future competitions. The website will also feature important documents, such as this manual and submission templates.

D.1 Branding

Teams are expected to set up a professional space in their team booths to highlight the team's branding. This can include the concept design, posters, team logo, and school information. The team booths are the teams' chance to showcase all the work they have put into their project over the course of the year and are the best way to communicate their efforts to the industry, especially at a visible industry networking event.

D.2 Reviewing and Scoring

A panel of Challenge Reviewers is responsible for scoring team performance in each challenge and for each submission. The Reviewers will have expertise related to the content they are responsible for evaluating. The panel will include diverse backgrounds that allow the Reviewers to evaluate performance from a variety of angles.

Prize Administrators will ensure that, to the extent possible, Reviewers will not:

- Have personal or financial interests in, or be an employee, officer, director, or agent of any entity that is a registered participant in the competition.
- Have a familial or financial relationship with an individual who is a registered participant.
- Provide advice to teams, although they can provide clarification on the reviewing process.
- Discuss team performance with other teams or their advisors.

Names of the selected reviewers will be announced prior to the final in-person event. Reviewers for midyear submissions may be different than those providing reviews at the final event. The director of WPTO is the Judge of the competition and will make the final determination.

Team Feedback

In an effort to provide as much feedback as possible, teams will receive their scores following completion of the competition. Teams will also receive a short narrative derived from the challenge reviewers' deliberations after each team's presentation.

D.3 Submissions and Submission Locations

Go to HeroX and follow the instructions for registering and submitting all required materials before the deadlines in Section 1 and as displayed on the HeroX website.

The HeroX platform provides a space where parties interested in collaboration can post information about themselves and learn about others who are also interested in competing. Teams can submit early copies and updated revisions until the deadline. If a team wants to submit after a deadline, you must contact the Prize Administrator and points will be deducted according to what is identified in the evaluation criteria.

D.4 Submissions

PDF Requirements: Submitted PDFs must meet the following criteria:

- Have embedded fonts.
- Have all images be a minimum resolution of 300 dpi.

Creating a PDF:

- From scans or by outputting the content into a raster image format (e.g., .jpg, .tiff, .png, or .gif) is not acceptable.
- That is, an all-raster PDF should be avoided because, despite being large files at 300 dpi, they are of unacceptable quality at lower resolutions and are not scalable without degradation.

Audiovisual Presentation Requirements: Audiovisual presentation format requires that:

- Videos, if used, are in a .MOV or H.264 compressed .MP4 (MPEG-4) file type with a resolution of 720 × 480.
- Presentations should be in a 16:9 aspect ratio.
- No background music that violates U.S. copyright laws is included; all incorporated music must be an original or royalty-free composition and proof of licensing must be submitted with the final file and transcript.

Electronic File-Naming Instructions: The required file-naming convention for all electronic files is:

[TEAM ABBREVIATION] _[SUBMISSION]_[SUBMISSION DATE (YYYY-MM-DD)].[EXTENSION]

For example, a report submitted by California Maritime Academy on April 24, 2024, would have the following file name: MARITIME_Report_2024-04-23.PDF.

Appendix E. Alternative Competition Structure

In the event of a cancellation of the in-person element of the final event, this document will be updated to reflect changes resulting in the cancellation. All the required submissions will remain unchanged, but the event and submission schedule may be updated. Should there be extenuating circumstances for some but not all teams, a hybrid solution between a standard in-person event and virtual will be developed and further communicated to the teams with as much advance notice as feasible.

The primary goal of the competition is to maximize learning, and the Prize Administrators will work with each team to determine what is possible.

The following best practices are highly recommended for remote participation in any event.

Prior to the Final Event

Prior to the final event, a team should:

- **Know the competition schedule.** Teams are responsible for keeping track of the final event schedule and confirming their meeting point of contact.
- **Test their technology.** Teams should explore the virtual meeting platform and test their audio and video capabilities. The Prize Administrators have built in transition time, but it is limited.
- **Check their internet connection.** Teams are encouraged to use a hard-wired internet connection (i.e., ethernet cord). Wi-Fi connections can be used but are not ideal because they are prone to more connection issues.

Day of the Final Event

On the day of the final event, a team should:

- **Note their audio settings.** Teams are responsible for muting their audio connection (phone or computer) when they are not intending to speak. The Prize Administrators will mute participants with excessive background noise. Ensure team members are only using one audio connection, connecting to audio via their phone or computer but not both. Connecting with two audio connections results in electrical feedback that is very uncomfortable for all involved.
- **Verify their video preferences.** Teams are encouraged (but not required) to use their webcam when presenting. Audio narration of slides is also acceptable. Ensure team members have a clean background while streaming their video (e.g., no inappropriate or offensive images in the background or people walking around) and avoid window backdrops because of lighting.
- **Be prepared.** Teams should look professional in their dress and speak professionally during their presentation. Refrain from distracting behavior while sharing their video and/or audio, such as drinking or eating.

Appendix F. Community Connections Challenge Resources

Students should research the current state of these topics in the industry before meeting with industry professionals. Resources include, but are not limited to:

- U.S. Hydropower Workforce: Challenges and Opportunities (nrel.gov)
- Hydropower STEM Portal
- NREL Hydropower Program News
- DOE WPTO Hydropower Program
- Competition meetings and webinars.