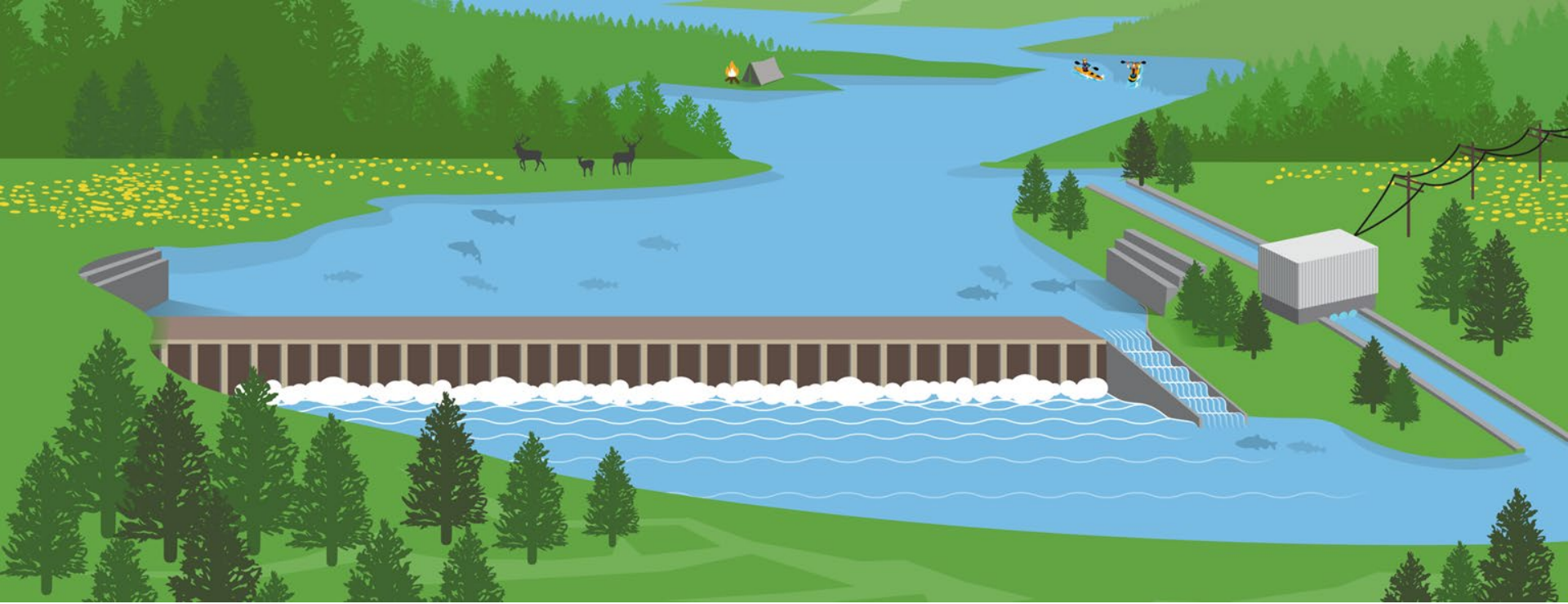
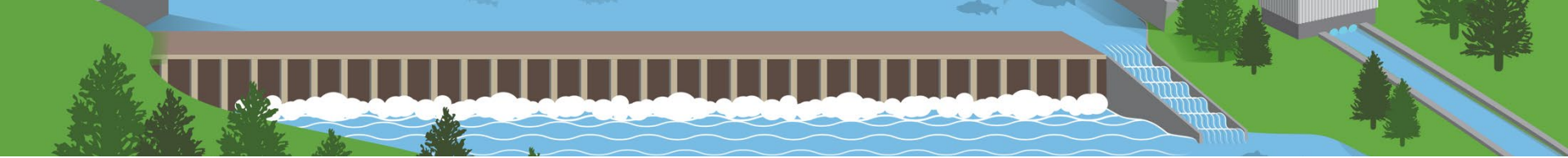


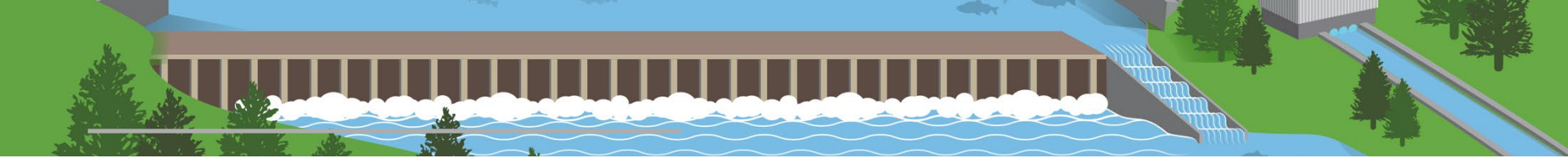
2025 Hydropower Collegiate Competition Informational Webinar

Hydropower
COLLEGIATE COMPETITION
U.S. DEPARTMENT OF ENERGY



Agenda

- DOE WPTO Overview and Why we Care about Hydropower
- About the Hydropower Collegiate Competition
- Overview of Events and Deliverables
- How to Apply and Review of Criteria
- Prize Funding
- What to Expect
- Incorporating Feedback and Lessons Learned

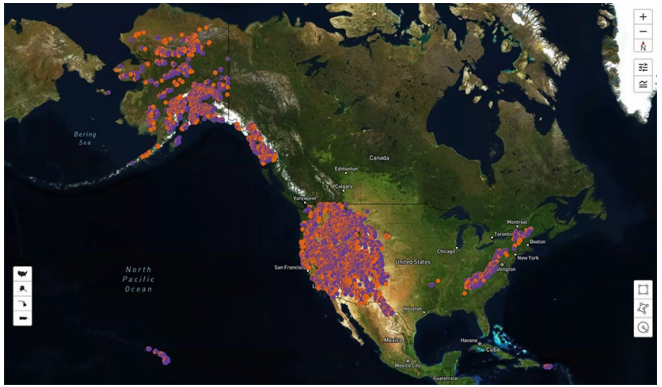


About DOE WPTO and Hydropower

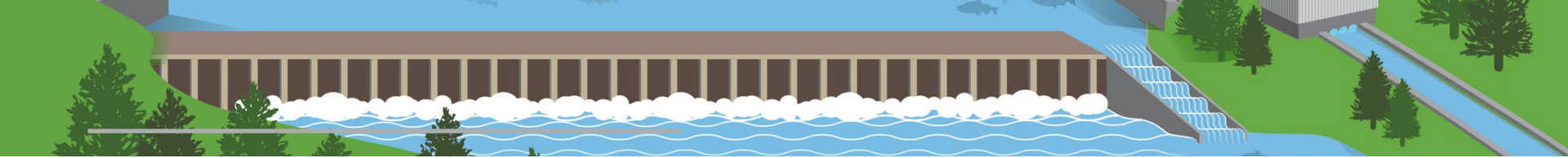
The U.S. Department of Energy's (DOE's) Water Power Technologies Office (WPTO) enables research, development, and testing of emerging technologies to advance marine energy as well as next-generation hydropower and pumped storage systems for a flexible, reliable grid.

The WPTO Hydropower Program works to advance hydropower through R&D projects focused on five core activity areas:

- Innovations for Low-Impact Hydropower Growth
- Grid Reliability, Resilience, and Integrations (HydroWIRES)
- Fleet Modernization, Maintenance, and Cybersecurity
- Environmental and Hydrologic Systems Science
- Data Access & Analytics.



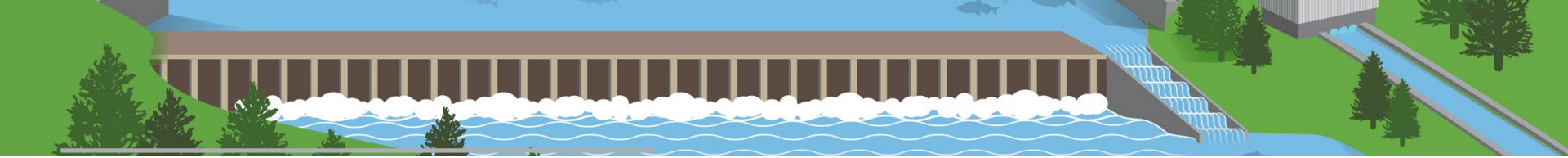
Pumped storage hydropower (PSH): 95% of U.S. electricity storage.
Graphic from Interactive Map and Geospatial Data, NREL



About DOE WPTO and Hydropower

Challenges we are facing in R&D:

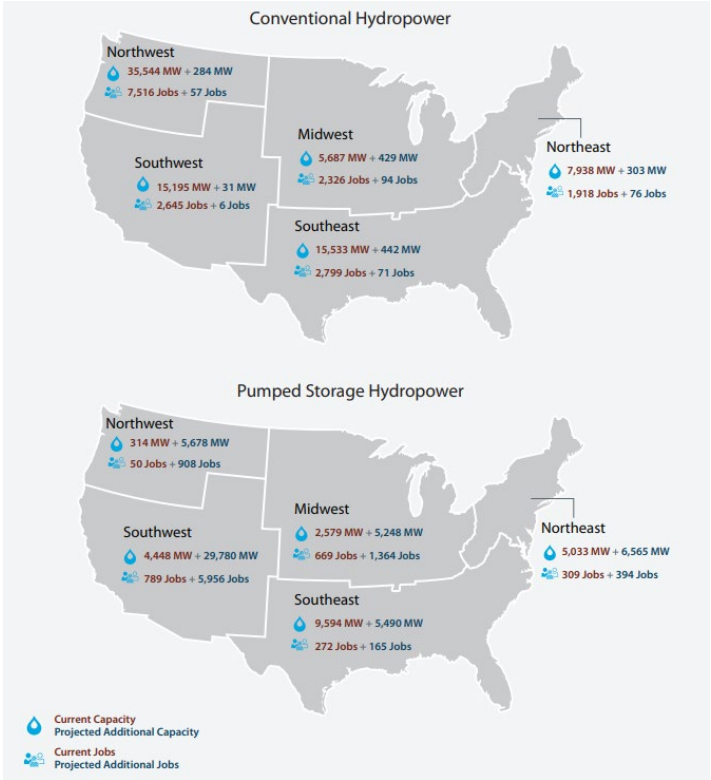
- Some existing facilities were not designed for flexible operation.
- As the electricity system is changing rapidly, there is limited understanding of which flexibility services will be needed, as well as limited ability to accurately value those services.
- There are gaps in information regarding how to best modernize and optimize hydropower for current and future grid needs.
- Environmental impacts, such as safe fish passage, must be mitigated.
- Building new hydropower facilities is difficult due to long permitting timelines, significant construction costs, and market uncertainty.



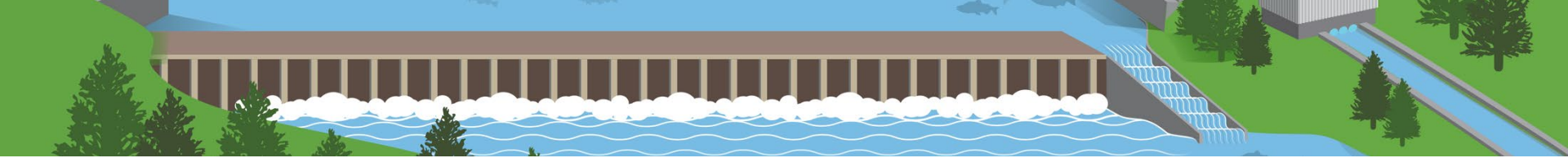
State of the U.S. Hydropower Workforce

Currently:

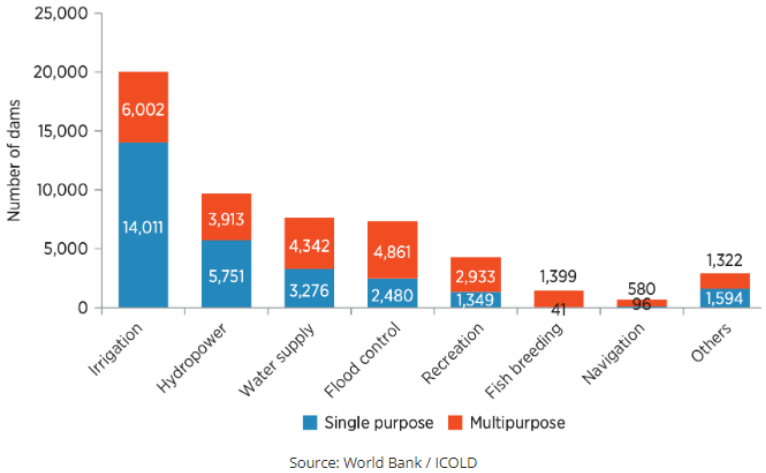
- Hydropower jobs are found in all 50 states, with most on-site jobs at hydropower facilities in remote areas.
- Approximately 26% of the hydropower workforce is 55 and older and will reach retirement age within the next decade.
- The need to quickly hire many workers presents recruitment challenges and makes the transfer of knowledge difficult, but it also presents an opportunity to build the workforce to better reflect the demographics of the United States.
- Few hydropower degree or training programs exist, yet institutions of higher learning reported seeing growing demand from employers for students with hydropower education.



Source: NREL. 2022. U.S. Hydropower Workforce: Challenges and Opportunities



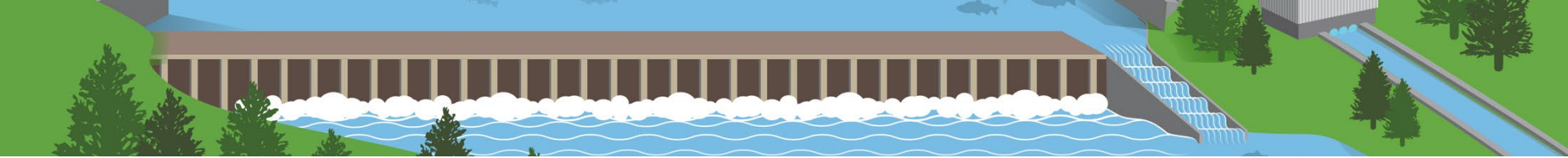
Why Should You Care about Hydropower?



Hydropower:

- Is carbon neutral.
- Enables a 100% clean energy grid.
- Offers a multitude of benefits beyond energy generation.
- Has as much flexibility as any generation source.
- Includes pumped storage hydropower, accounting for 95% of U.S. utility-scale storage.
- Sits at the intersection of many important systems as energy and water systems are becoming increasingly integrated.

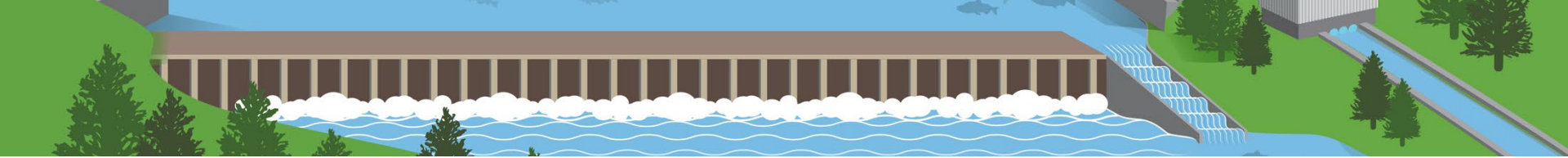
 Graphic from https://www.hydropower.org/iha/discover-facts-about-hydropower



The Future of U.S. Hydropower Can Only Be Realized with a Strong Workforce

Aging workforce + Few hydropower degrees or training programs + Perception that hydropower is not exciting or innovative = Need to excite our future hydropower workforce

17,000 on-site hydropower jobs will need to be filled by 2040

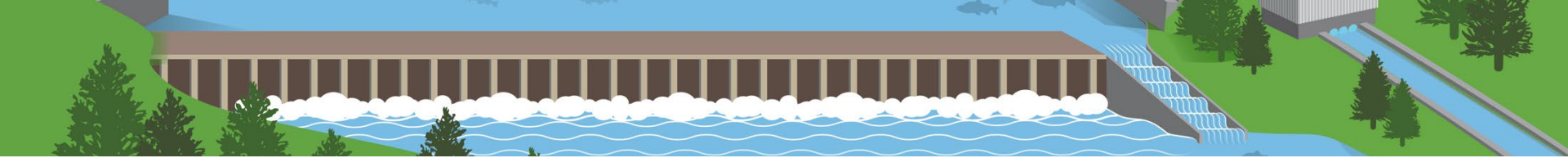


Goals of a WPTO-Funded Hydropower Collegiate Competition

What do we want to get out of the Hydropower Collegiate Competition (HCC)? We want to share that:

- Hydropower is critical to reach 100% clean energy and decarbonization by 2035.
- We have challenges, and we will meet them.
- Hydropower is exciting and pioneering, considering the full suite of low-impact options available to us.
- The future of U.S. hydropower can only be realized with a strong workforce.

Ultimately, we want to inspire students across academic disciplines to join the hydropower workforce.



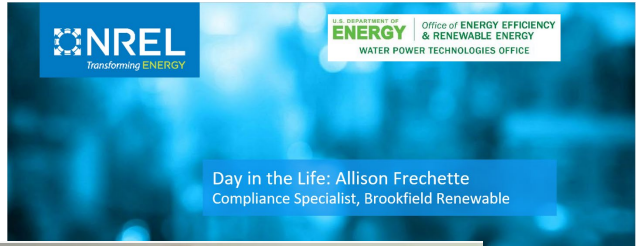
Hydropower Career Opportunities

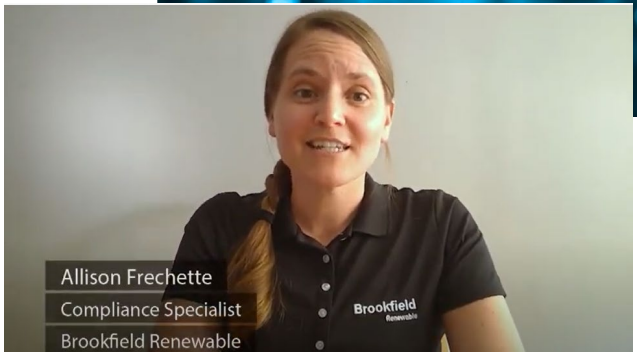
There are many different types of career opportunities in hydropower.

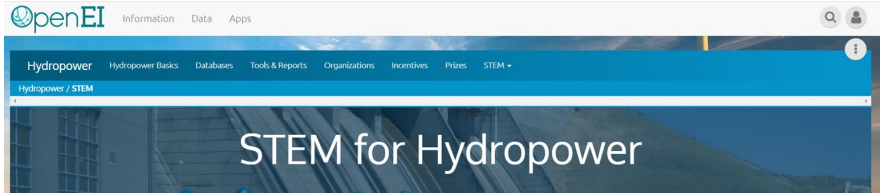
Learn about potential hydropower career pathways and get inspired by current hydropower professionals at:

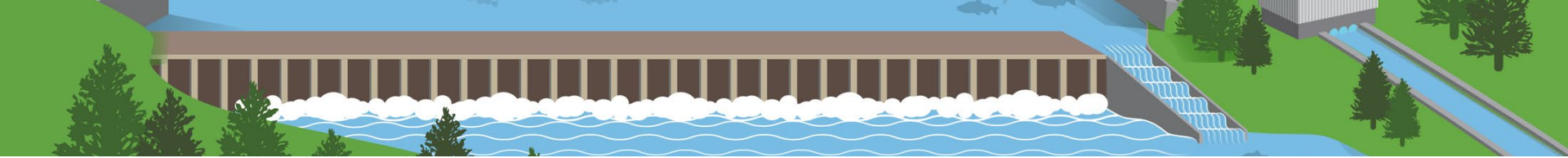
- https://openei.org/wiki/Hydropower/STEM/Resources/Career_Pathways
- https://www.pnnl.gov/best-dam-job.

More resources can be found on the Hydropower STEM Portal: https://openei.org/wiki/Hydropower/STEM





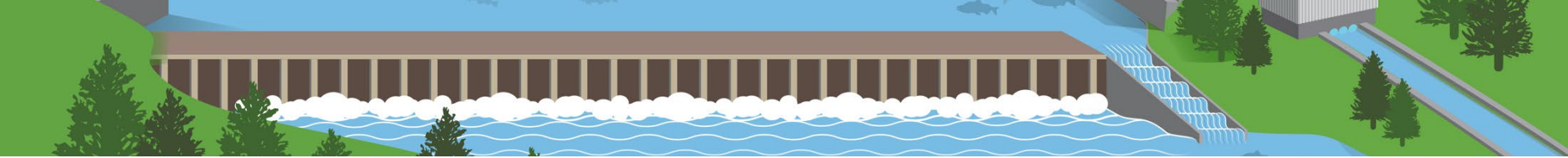




Introduction to HCC 2025

The HCC:

- Is administered by the National Renewable Energy Laboratory (NREL) on behalf of WPTO and in partnership with the Hydropower Foundation.
- Held its first Competition year in 2022/2023
- Consists of three required and concurrent challenges and two optional challenges
- Provides opportunities for cash prizes.
- Allows teams to engage in networking events and educational opportunities.

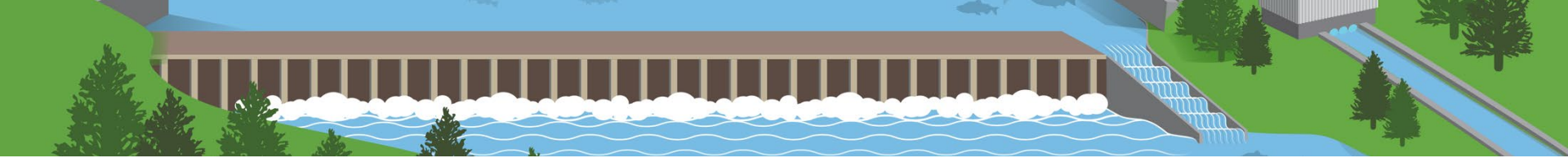


About HCC 2025

The 2025 HCC theme expands upon the 2024 theme of converting non-powered dams to hydroelectric dams to also include closed-loop pumped storage hydropower systems.

Three required challenges and two optional challenge:

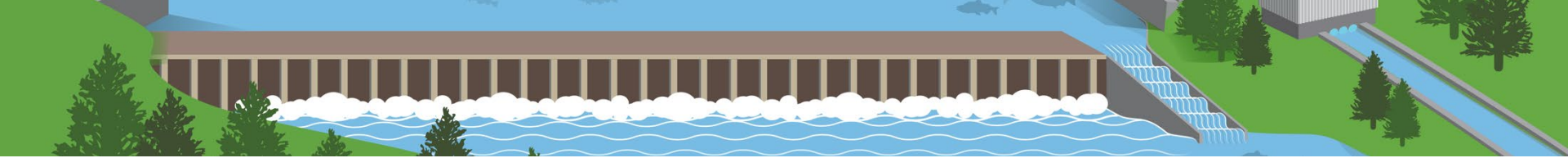
- **Siting Challenge**. Teams evaluate potential non-powered dam site or closed loop pumped storage hydropower site for one that fits the challenge requirements.
- **Design Challenge**. Teams choose from two tracks. In Track 1, Facility Conceptual Design, teams create a conceptual design of the selected hydropower site from the Siting Challenge. In Track 2, Hydropower Component Deep Dive, teams complete a final design package for an individual component or system related to the development of the selected hydropower site from the Siting Challenge.
- **Community Connections Challenge**. Teams create connections among each other, the hydropower industry, students, and local communities.
- **Optional Build and Test Bonus Challenge**. Teams build a scaled prototype of their concept or powerhouse and perform a series of tests.
- **Optional Cyber in Hydro Bonus Challenge**. Teams respond to a case study challenge involving cybersecurity issues.



Teams

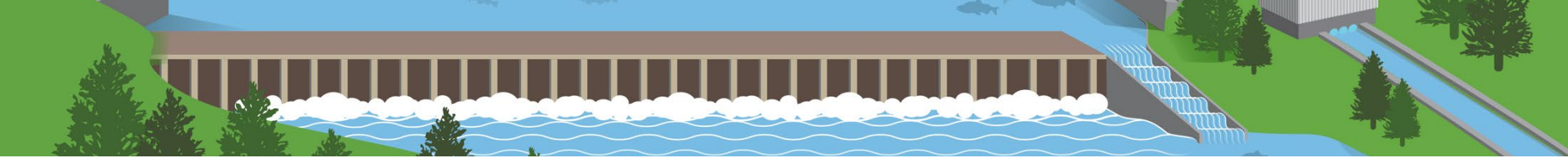
Up to 14 teams will be selected to participate in the competition. Teams must meet the following criteria to be eligible:

- 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.
- More detailed eligibility criteria can be found in the HCC 2025 Rules Document



Overview of 2025 HCC Challenge Submissions

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	

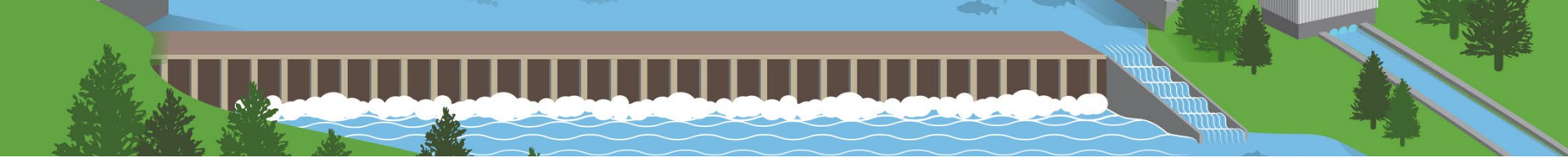


Siting Challenge

Teams will need to perform a hydropower site selection process from a subset of non-powered dams that have the potential to produce 1–10 megawatts of power or a subset of closed-loop pumped storage hydropower that can provide any amount up to 1 gigawatt of power and provides 8–24 hours of storage. Teams will be expected to develop a feasibility assessment for the selected site for power generation and/or storage.

Teams will be shown open-source tools.

Siting Challenge 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

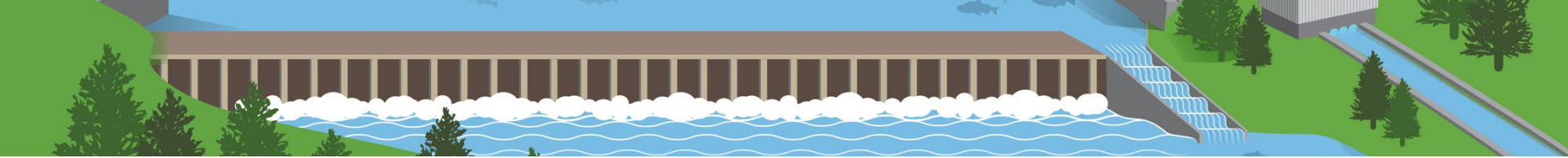


Design Challenge

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

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

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



Community Connections Challenge

Teams will create connections among competition participants, the hydropower industry, students, and local communities.

Midyear submissions include:

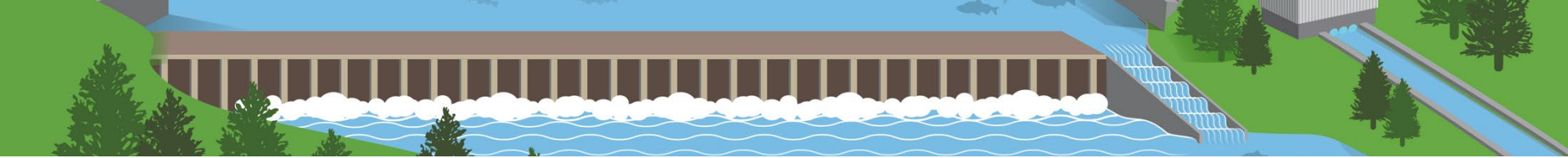
- A Team Overview (one to two pages)
- Interview Summary and Outreach Strategy.

Final submissions include:

- A metrics report up to 2,000 words long
- A 10-minute final presentation at the final event followed by 10 minutes of Q&A.

Community Connections Challenge Submission Element	Maximum Possible Points
Midyear Submission	50
Final Report	50
Final Presentation**	150
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.



Optional Build and Test Challenge

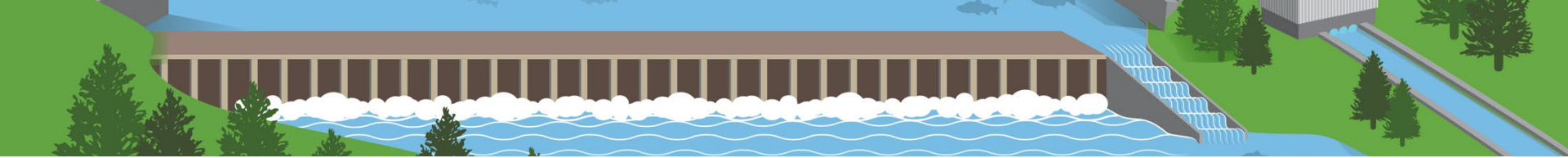
Teams who opt into the Build and Test Challenge need to build a scaled prototype of their proposed concept and develop video footage or take photographs of any tests and/or experiments of the prototype.

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 are instead 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.

Optional Build and Test Submission Element	Maximum Possible Points
Midyear Submission	20
Prototype	40
Presentation*	60
Total for Optional Build and Test Challenge	120

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

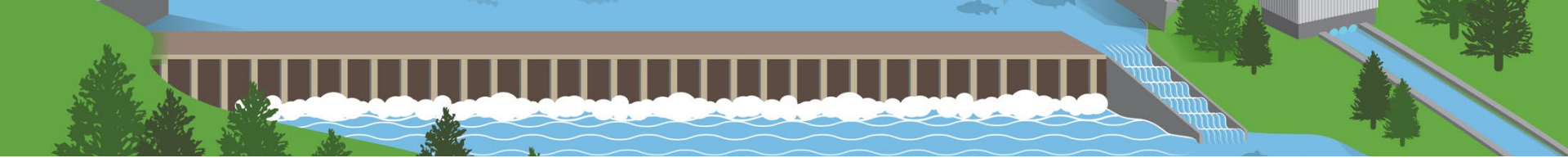


Optional Cyber in Hydro Bonus Challenge

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.

Optional Cyber in Hydro Submission Element	Maximum Possible Points
Midyear Submission	20
Final Presentation and Q&A Session*	80
Total for Optional Build and Test Challenge	100

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

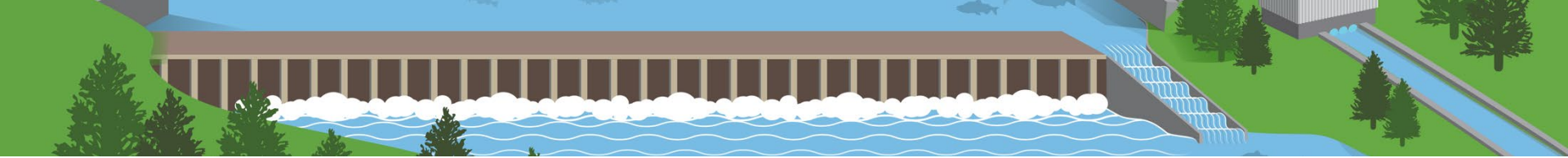


Timeline

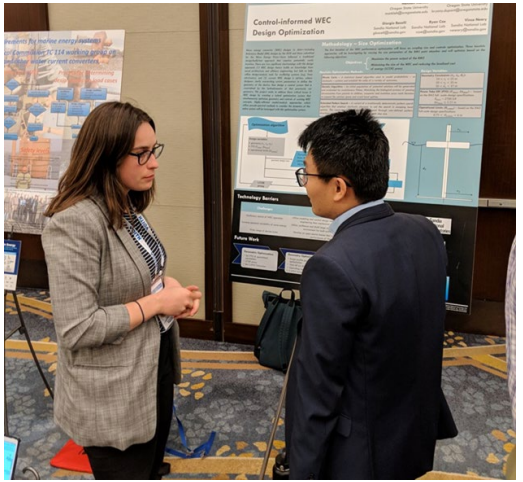
Stage	Cash Prize per Team (U.S. Institutions Only)	Total Cash Prize Pool
Application to Participate (due May 6, 2024)	$5,000	$70,000
Midyear Submissions (due Jan. 27, 2025)	$5,000	$70,000
Optional Midyear Submission for Build and Test Bonus Challenge (due Jan. 27, 2025)	$5,000	$70,000
Optional Midyear Submission for Cyber in Hydro Bonus Challenge (due January 27, 2025)	$2,000	$28,000
Final Report Deadlines (2 weeks prior to final event, exact dates to be announced)		
Final Event (exact dates to be announced)	$5,000	$70,000
*Grand Prize**	*To Be Determined**	*$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.

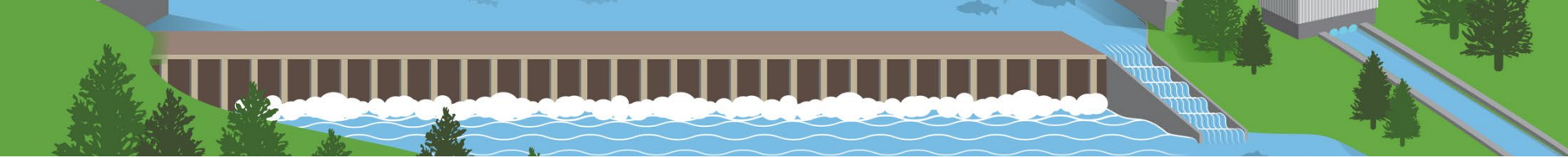


Activities



Team activities include:

- Engagement throughout the full academic year, including:
  - Developing and submitting challenge deliverables on time.
  - Supporting student engagement and education.
  - Conducting local outreach.
  - Fundraising.
  - Attending all-team calls and informational webinars.
- A multiday final event at an industry event in Spring 2025, which may include:
  - A kick-off meeting
  - Team presentations
  - Team expo/poster displays
  - Industry networking event
  - Awards ceremony.



How to Apply and Review of Criteria

To apply:

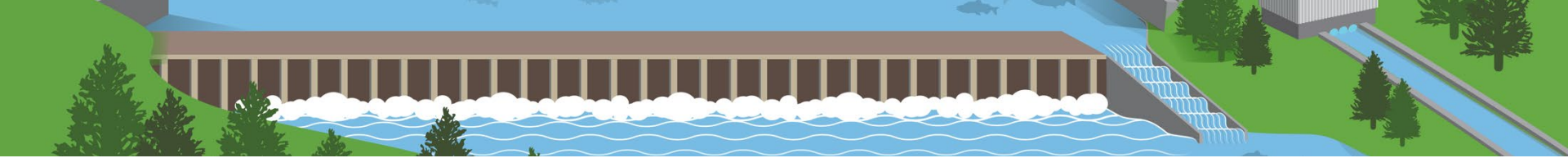
- Visit the competition on the American-Made website to learn more and apply: https://americanmadechallenges.org/challenges/hydropower-collegiate-competition/.
- Click “Follow the Challenge” and create or log into your account on HeroX to register to apply.
- Submit your application by **May 6, 2024**.

Note that the application process:

- Is not a heavy lift!
- Does not require a concept description and final team roster.
- Does not require engineering to apply!!!

Next steps:

- Start forming your team and working with your school to generate support.
- Reach out to water.competition@nrel.gov with questions or if you need support forming teams.



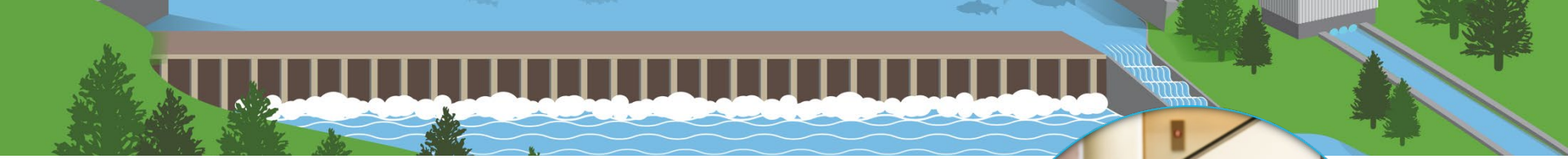
Application Review Criteria

To participate, interested teams must submit an application in PDF format 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 DOE.

Each application for the 2025 HCC can be a maximum of 1,500 words and include a response for each of the following sections:

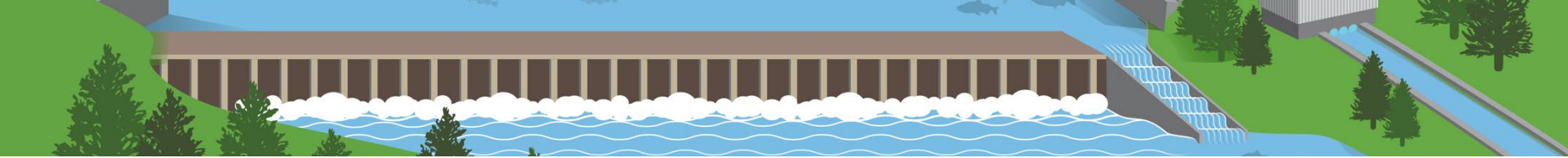
- Educational Objectives and Integration (35%)
- Organization and Project Planning (30%)
- Team Diversity and Inclusivity (25%)
- Institutional Support and Fundraising (10%).



Expectations from Teams

Participants are expected to:

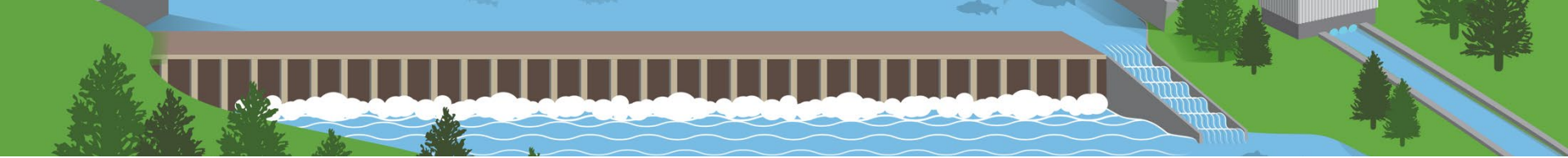
- Work in an interdisciplinary team.
- Apply concepts from coursework to solve real-world challenges and bring hydropower education into the classroom.
- Interact directly with industry experts.
- Engage with your community and spread the HCC message through outreach and local impact.
- Compete in the 2025 competition in a professional and collegial atmosphere.
- Take advantage of the educational opportunities provided.
- Acquire additional funds through fundraising or other means (if needed).
- Submit promotional content to NREL (videos, photos, etc.).



Commitment from the Organizers

The organizers agree to:

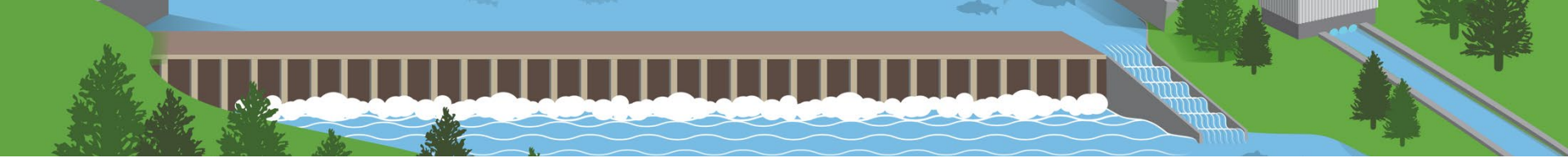
- Host the final competition at an industry event in spring 2025.
- Ensure fair and unbiased competition environment with expert judging.
- Provide prize funding as deliverables are met.
- Offer hydropower educational resources and networking opportunities with hydropower industry professionals.
- Invite teams to an alumni group following the final event.
- Facilitate opportunities to engage with community through required connections creation contest.
- Offer inclusion in NREL, Hydropower Foundation, and WPTO promotion of teams.



Advice from Other Collegiate Competitions

Alumni suggest you:

- Create opportunities for cross-disciplinary teams to work together.
- Create firm internal deliverables.
- Reach out to industry advisors for support.
- Start early and get everyone involved—bring any siloed teams together as early as possible.
- Decide on your travel team early—logistics, payment, paperwork takes time.
- Take advantage of the educational webinars and resources offered.
- Identify what is needed for the case study early on.
- Start collaborating with outside organizations as early as you can.
- Share your challenges on the all-team calls to get suggestions from other teams on how to solve them.
- Stay engaged.



What's Next

You should:

- Register for free on the HCC HeroX site to join the challenge and submit your application by May 6, 2024: https://www.herox.com/hydropower-collegiate-competition-2025.
- See competition updates, review past submissions, and communicate directly with organizers on the HeroX site.
- Reference the 2025 HCC Rules Document to learn about competition structure, submission deadlines, etc.: https://www.herox.com/hydropower-collegiate-competition-2025/resources
- Read the 2023 HCC team stories to get inspired: https://openei.org/wiki/Hydropower/Prizes_and_Competitions/Hydropower_Collegiate_Competition_(HCC).
- And remember: It is never too early to start looking for potential team mentors and sponsors!

Thank you!

https://americanmadechallenges.org/challenges/hydropower-collegiate-competition