1.4.2.403 – Water Power STEM Workforce Development (Hydro)

THIS PEER REVIEW PRESENTATION WILL FOCUS ON HYDROPOWER ASPECTS OF THIS PROJECT AND COMPLEMENTS A MARINE ENERGY PRESENTATION PRESENTED DURING THE MARINE ENERGY PEER REVIEW

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Project Overview

Project Summary

- As interest in renewable energy grows, hydropower technologies will continue to play a robust and growing role in reaching our nation's clean energy objectives. With one-quarter of the domestic hydropower workforce retiring in the coming decade, the need to fill the workforce pipeline has never been more critical. The industry needs new talent to spur innovation and to support industry needs.
- WPTO efforts to address these needs include more programs, improved program accessibility, and an increased awareness of hydropower as a renewable energy career (secondary school, vocational and apprenticeship programs, and undergraduate curricula). There is much more work to be done.

Intended Outcomes

- An increased water power workforce pool that is competitive in the global marketplace and that incorporates multiple disciplines into strong diverse teams.
- Although not expected immediately, an increased number of new students and new hires (potentially moving from other sectors) employed in the hydropower industry.
- This project covers the breadth of the water power educational infrastructure, including hands-on activities, curricula development, engagement of industry and academia, networking, matchmaking, and more.

Project Information

Principal Investigator(s)

- Elise DeGeorge (hydropower focus) and Arielle Cardinal (marine energy focus)

Project Partners/Subs

- See Next Slide

Project Status

- Ongoing

Project Duration

- October 2018
- Project End Date tbd

Total Costed (FY19–FY21)

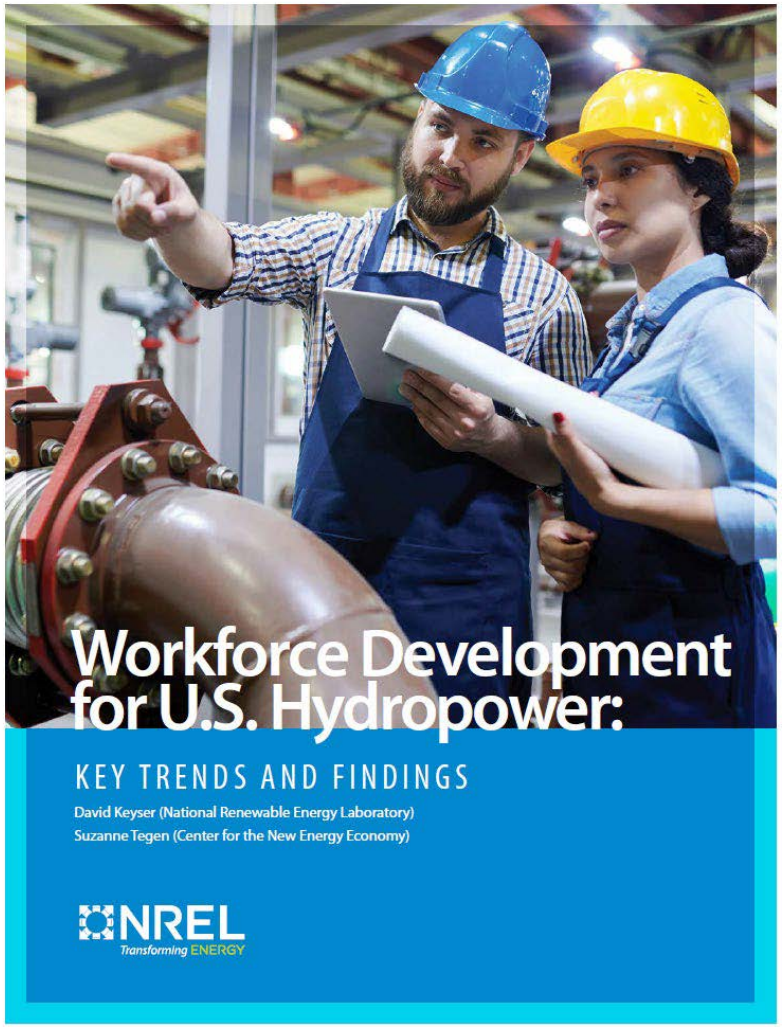
$2.8M (both marine energy and hydropower)
$698K for hydropower

Water Power STEM Team

Name	Organization	Expertise
Core Team and Subject Matter Experts	NREL	A strong core team leads distinct project aspects and a team of technical staff supports Water STEM by providing hydropower and marine energy specialized expertise where needed for content development and review.
Bree Mendlin/Linda Ciocci	Hydropower Foundation	Supports assessment of available content and information needs, helps facilitate Dialogue Series, and supports development of materials and/or curricula.
Rebecca Lamb/Mary Spruil	The NEED Project	National Energy Education Development (NEED) helps with materials development focused on secondary students and the general public and bringing the materials to classrooms.
Mike Arquin	KidWind	KidWind supports material dissemination and teach-the-teacher efforts.
Jules Smoke and Team	IKM Testing	IKM develops interactive digital renewable energy island display.
Katie Cubina and Laura Batt	Mystic Aquarium	Mystic Aquarium enhances museum displays and conduct community immersion activities through its Energy Engineers Program.
Parker Mullins, Chaun McQueen	Bonneville Environmental Foundation	Bonneville Environmental Foundation (BEF) augments STEM content dissemination and localizes messaging in both directions as the program's first Clean Energy Talent Hub.

Project Objectives: Relevance

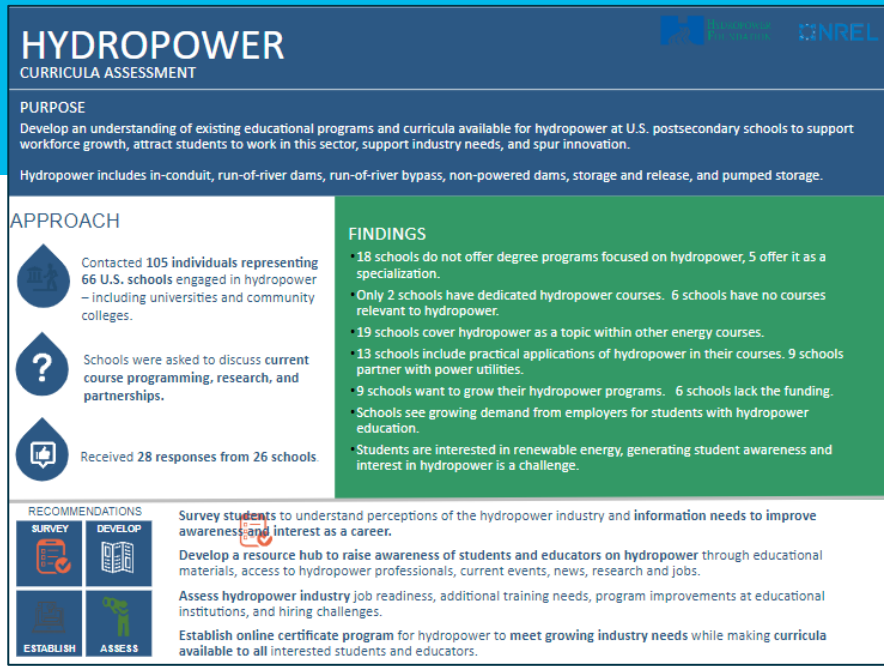
- To meet the workforce development challenge identified in WPTO's MYPP's Activity 5 – Data Access, Analytics and Workforce Development and the subsequent action to "support development of new educational resources where gaps currently exist, including curricula and training, to support an evolving hydropower workforce and increase awareness of hydropower opportunities," this project uses a multifaceted approach to knowledge transfer to address challenges described here and on the following page.
- Hydropower jobs—especially jobs operating and maintaining hydropower facilities—are typically in rural areas that lack economic development or private investment.
- The jobs provided by hydropower are critical to these communities. A trend in hydropower, as in other rural power plant jobs, is for multiple generations within families to work in the industry.

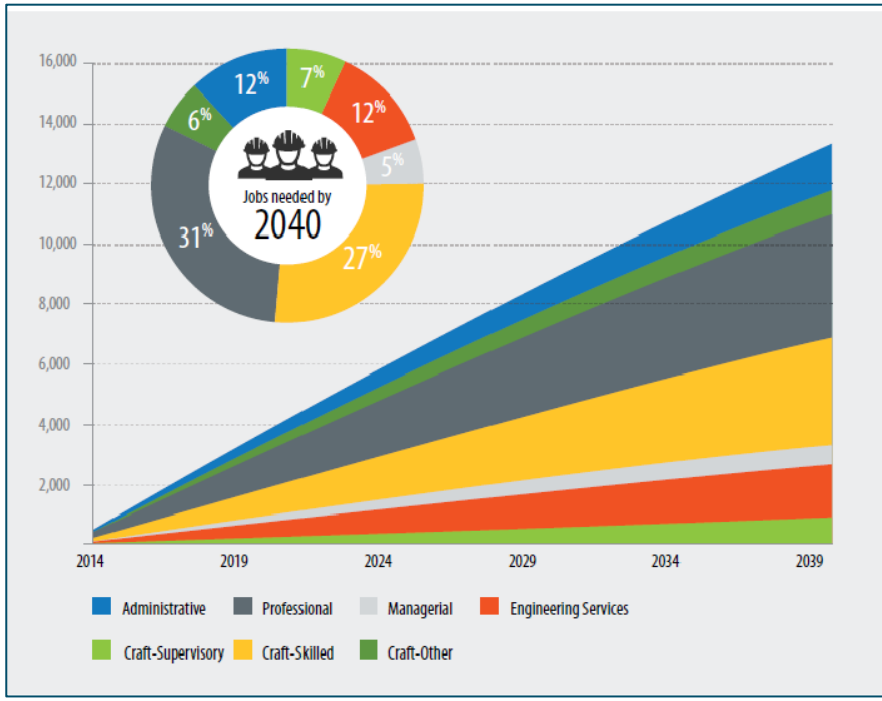


This report can be found at https://www.nrel.gov/docs/fy19osti/74313.pdf.

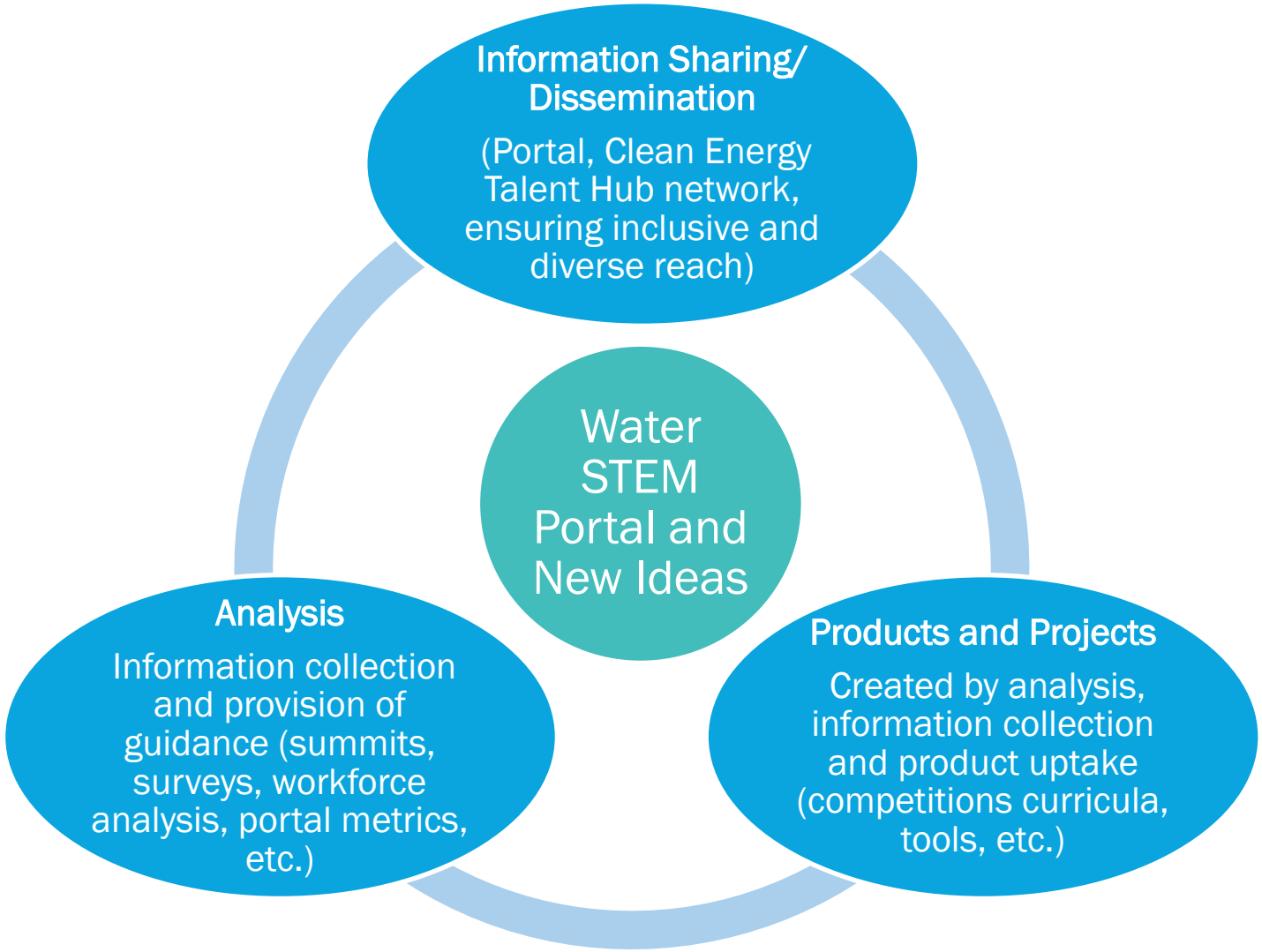
Project Objectives: Relevance

- Hydropower has an aging workforce - about one-quarter of the current workforce is already eligible for retirement or will be within the next decade.
  - Even without a growth in the overall number of hydropower jobs, a retiring workforce will drive hiring needs. We're already seeing these workforce challenges manifest in industry.
- Recruiting is challenged by the lack of hydropower-focused degree programs or training programs (see excerpt on curricula assessment, top right).
- While the need to replace at least a quarter of the workforce poses a huge challenge, it also presents a great opportunity to attract new and diverse talent—and help ensure the hydropower industry looks more like America as a whole.
- Rebranding hydropower will showcase the innovation and impact that working in this sector can provide.





Project Objectives: Three-Pronged Approach



Fundamentally, NREL's water power team uses the power of leveraging across multiple organizations (NEED curricula, KidWind, Energy Engineers, BEF, etc.) and other funded initiatives to ensure the broadest possible impact within the available WPTO budget.

Project Objectives: Expected Outputs and Intended Outcomes

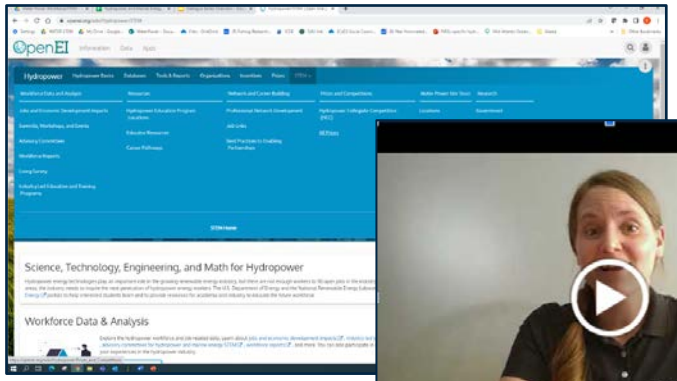
Outputs:

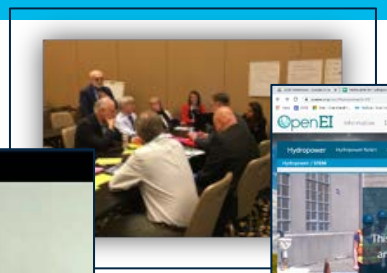
- Updates to hydropower Jobs and Economic Development Impact (JEDI) model and workforce analysis reports and dissemination of information collection mechanisms.
- Development, updates, and dissemination of STEM materials on the STEM for Hydropower Portal.
- Development of initial career competency maps.
- Development of materials that provide expanded details on hydropower workforce opportunities.
- Development of Hydropower Collegiate Competition (HCC) in partnership with industry.
- Continuation of dialogue "events" to occur quarterly either in person at industry conferences or virtual.
- Development of a Clean Energy Technology hub-and-spoke concept.
- Launch of Energy Equity program for water power education in after-school programs in disadvantaged communities across the nation.
- Development of interactive 3D island animation, Day-in-the-Life videos, curricula, teach-the-teacher programs and more sharing information and workforce opportunities.

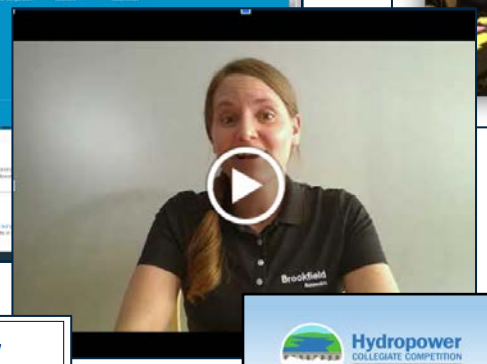
Outcomes:

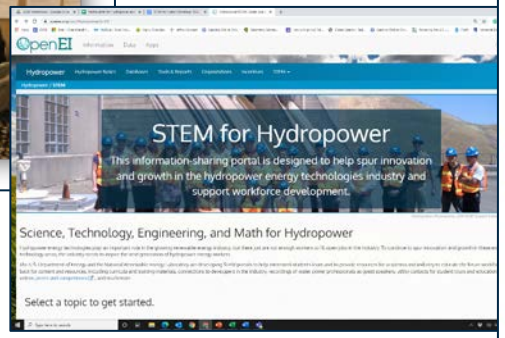
- A growing hydropower workforce that is competitive in the global marketplace and that incorporates multiple disciplines and has a diverse makeup.
- Increased number of new students and new hires employed in the hydropower industry.
- Utilization of hands-on activities, curricula, industry and academia engagement in STEM activities, and inclusion of hydropower in renewable energy STEM activities where it is currently not represented.
- Hydropower perceived as a game-changer in getting the nation to 100% clean energy.

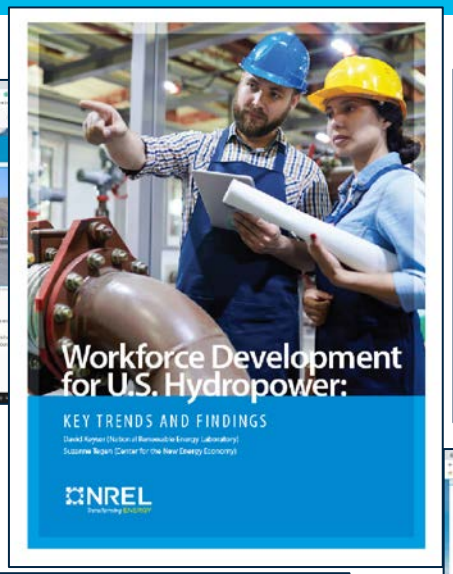
Sampling of Products and Reach

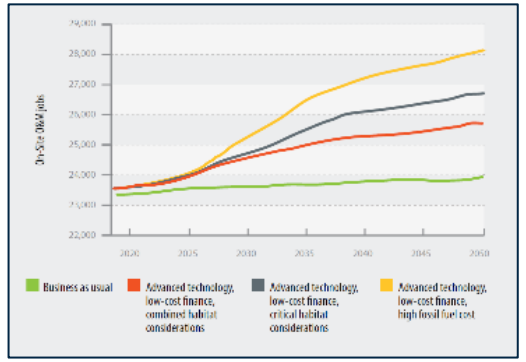


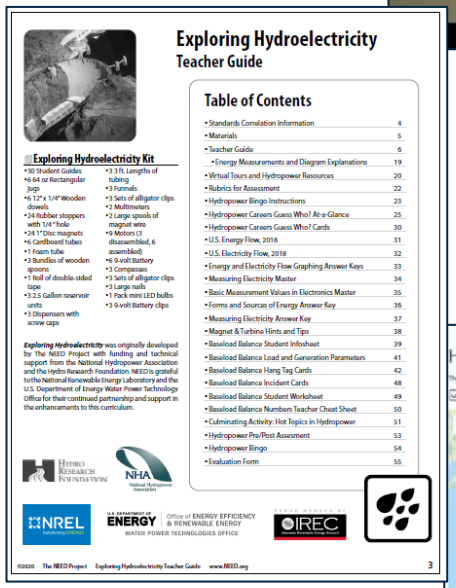


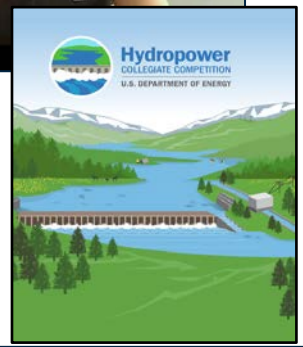


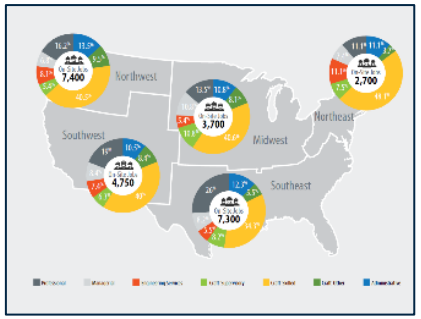


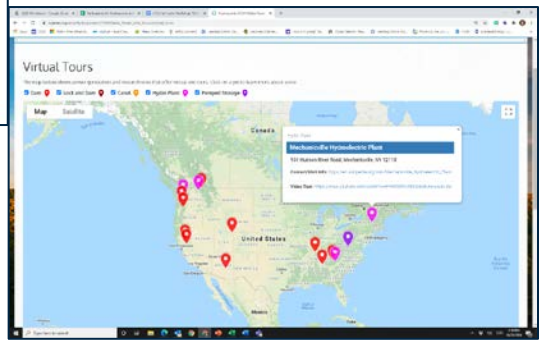


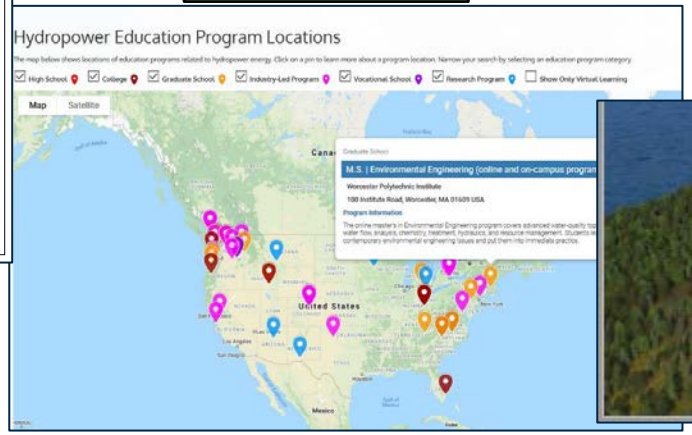












Hydropower STEM/Workforce Timeline

FY 2019

- Received initial project funding and began scoping with WPTO
- Launched water power workforce assessment, in partnership with the Hydro Foundation, through research, interviews, and surveys
- Completed initial assessment of curricula and provided recommendations to HQ
- Held stakeholder workforce/STEM information-gathering workshop at Water Power Week
- Published the Hydropower Workforce Analysis Report

FY 2020

- Received approval on 5-year roadmap and formalized partnerships with NOSB, KidWind, Oceans First Institute, and NEED to achieve project goals
- Launched the OpenEI STEM portals
- Shared student survey results with DOE and stakeholders
- Launched Best Practices to Enabling Partnerships.

FY 2021

- Launched bimonthly Hydro and ME Dialogue Series w/ 30+ attendees
- Launched JEDI and workforce reports pages on STEM portal, populated maps
- Finalized storyboard with IKM on island animation
- Added hydro education program locations and educator resources on portal
- Established HCC Steering Committee (Hydro Foundation, National Hydropower Association [NHA], industry partners)
- Completed industry survey analysis and disseminated results
- Finalized memorandum of understanding with BEF to serve as the first Clean Energy Talent Development Hub
- Hired intern to focus on expanding DEIB into the water STEM project
- Collaborated with the NEED Project to create a hydropower curriculum for primary, elementary, intermediate, and secondary students
- Published NHA Powerhouse articles: Attracting the Next Workforce Generation and Expanding the Hydro Workforce One Click at a Time
- Completed 2 hydropower Day-in-the-Life videos and posted to web portal
- Evaluated HCC survey and dialogue series feedback and submitted Go/No Go to DOE. Received approval to proceed with inaugural HCC.

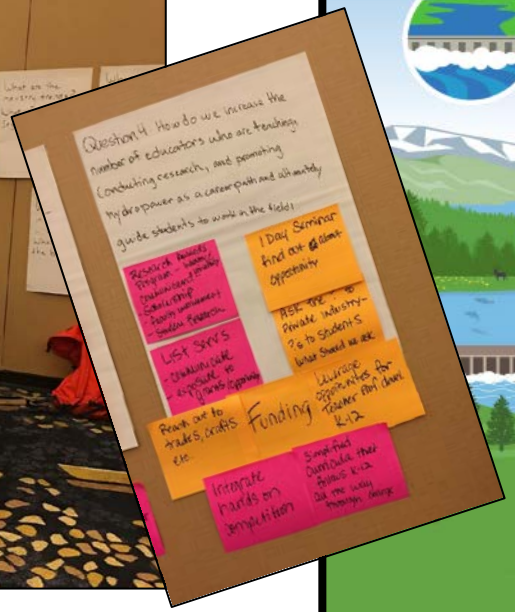
Project Budget

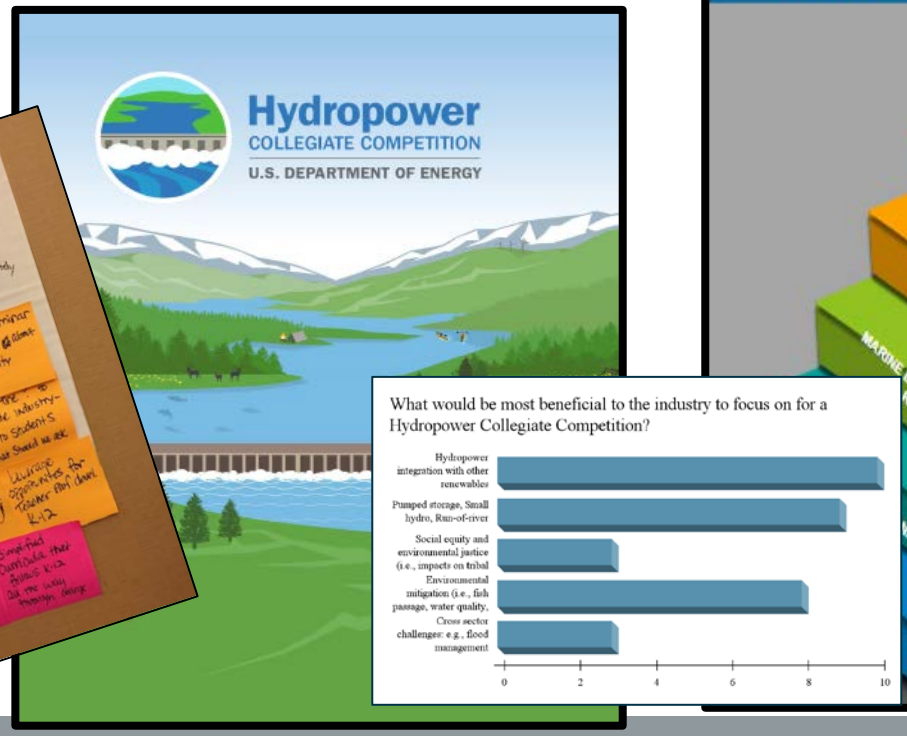
FY19	FY20	FY21	Total Actual Costs FY19–FY21
Costed	**Costed**	**Costed**	**Total Costed**
$574K	$953K	$1,266K	$2,793K
Hydro only: $143K	Hydro only: $238K	Hydro only: $317K	Hydro only: $698K

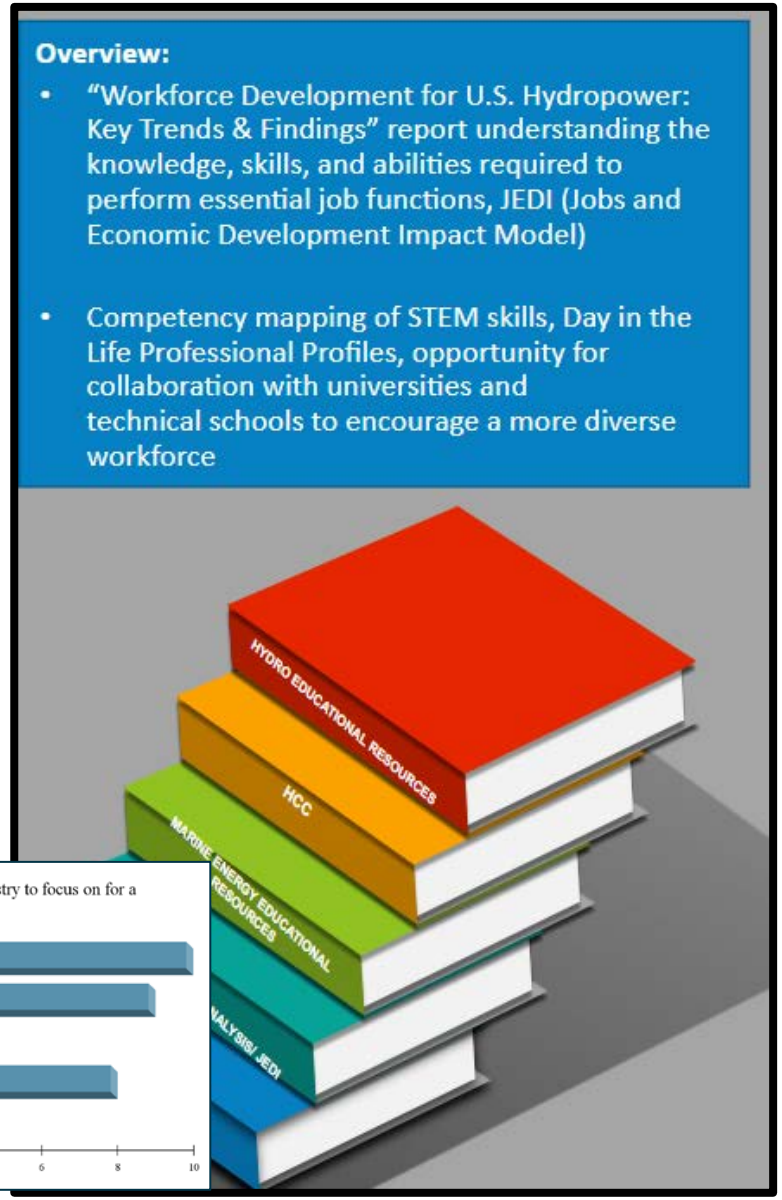
- There have been no variances against planned budget.
- Important to note that this budget covers both marine energy and hydropower activities – this presentation only covers hydropower activities.

End-User Engagement and Dissemination

- Engagement began with advisory committees and morphed into monthly dialogues toggling between marine energy and hydropower.
- Products and approaches, such as REDi Island and our new Hydropower Collegiate Competition are continually grounded in dialogues such as these, survey results, and portal activity.







Sampling of Water STEM Products Tailored to Different Audiences

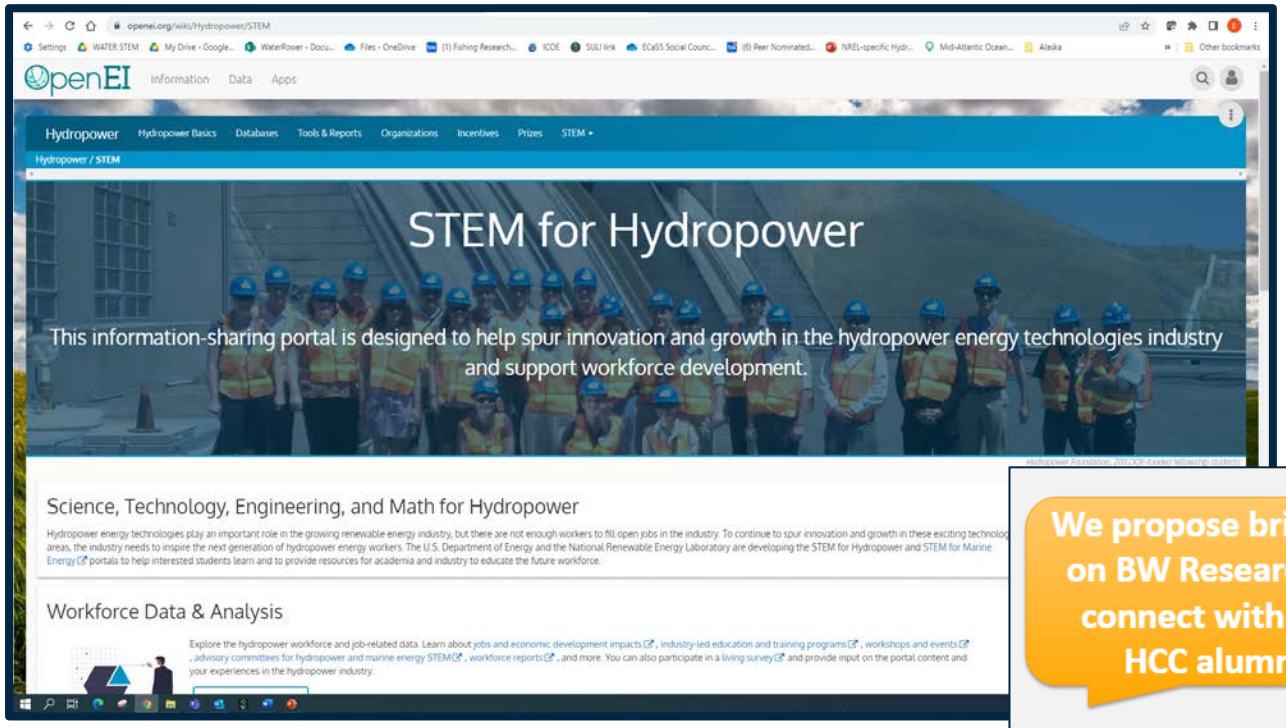
Mechanism	Target Audiences	Partners	Reach/ Impact
Online STEM Portals for Hydropower and Marine Energy	• K-12 students and educators • Post-secondary students/educators	• All Water STEM project partners, primarily Hydro Foundation, and interviewees for Day-in-the-Life videos	Many
REDi Island – a 3D Experience	• All ages – Middle/High School, College, Trades, General Public, more	• IKM and pull from national laboratory subject experts	Will be broad and deep
Clean Energy Talent Hub (CETH) Model including the Clean Energy Fellows Program	• Recent graduates (Bachelor's, Master's, and Doctoral graduates) • Early-career energy professionals • Tribal members	• Bonneville Environmental Foundation	CETH – broad and deep
Curricula, Teach-the-Teacher Training and Student Competitions	• Middle school/high school students • Student families • Industry judges and volunteers	• NEED • KidWind	Very broad and deep
Hydropower and Marine Energy Collegiate Competitions	• Undergrad and graduate students • Community college/trade school students • Professors and faculty • Industry employers and supporters	• Hydro Foundation • NHA • Industry	Hundreds of students/professors across many disciplines/employers
Energy Engineers After-School Program	• Middle school/high school students in disadvantaged communities	• Mystic Aquarium	Thousands of disadvantaged students/families

FY22 Events to Support End-User Engagement and Dissemination

Dialogue Workshop Session	FY funded	Date	Venue	Location	Description/Objective
Think Tank and associated workshop	FY22	Oct. 20, 2021	Clean Currents	Atlanta, GA	Hosted workshop alongside the Hydro Foundation's Think Tank Competition
Teach-the-teacher training	FY22	Oct. 20, 2021	Clean Currents	Atlanta, GA	NEED held teacher workshop and tour
Clean Energy Education & Workforce Alliance Workshop	FY22	Feb. 10, 2022	CEEWA	Virtual	Increase visibility and inclusion of water power in the renewable energy STEM and Career Technical Education (CTE) national network and discussions among partners nationwide
No workshop - see notes	FY22	Feb. 23–25, 2022	Northwest Hydroelectric Association (NWHA) Annual Meeting	Portland, OR	Amplified activities at a BEF-hosted booth
No workshop - see notes	FY22	April 5–7, 2022	Water Power Week	Washington DC	Sharing Water STEM collateral and promoting HCC and MECC
HCC Informational Webinar	FY22	April 13, 2022	Virtual	Virtual	Promote HCC and provide application and competition information to prospective teams

Performance: Accomplishments and Progress

- The most important technical accomplishment achieved over the life of the project has been the portal - the main repository of the DOE WPTO investment in hydropower workforce and STEM. This portal is designed to help spur innovation and growth in the hydropower energy technologies industry and support workforce development.



Metrics:

- OpenEI metrics for portal use being tracked.
- HCC metrics just beginning! 11 teams first year out! Developed with a 9-member industry advisory group
- Launching partnership with BW Research to support overarching project impact metric collection in FY22

We propose bringing on BW Research to connect with our HCC alumni

BW Research will send an online survey to students and recent graduates who participated in HCC:

- BW will handle student data and contact students
- NREL has partnered with this applied research firm for prior workforce analysis
- Students will receive an incentive for participation
- Online survey around 10-15 minutes

Future Work

- Complete career maps for both hydropower and marine energy including craft and trades with stakeholder input.
- Continue the quarterly engagements with stakeholders.
- **Continual focus on the portal as the core of the water power STEM program.**
- Enhance engagement with underrepresented communities (including rural communities, minorities, and veterans) and other stakeholders who may not traditionally see or be aware of water power as a viable career opportunity. This could be through expansion of CETH and/or development/expansion of a hydropower certification program or similar.
- Will expand upon DEI efforts with the help of summer internships.
- Complete second iteration of hydropower workforce plan along with updated Jobs and Economic Impact (JEDI) assessment.
- Complete a proposed plan for the continuance of Water Power STEM activities for FY24 through FY26 including assessment of certification program and growth of the CETH network including development of preplanning decision documents to determine applicability of certification program and CETH expansion concepts.
- Host inaugural Hydropower Collegiate Competition in May 2023. Lessons learned will be evaluated.
- Will formalize metrics tracking program in FY22 with BW Research and align with metrics tracking from project partners.