

water

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NHA Board Meeting

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Hydropower Funding & Congressional Direction for FY23

The agreement provides **not less than \$59,000,000** for Hydropower...

The agreement provides **up to \$10,000,000** for demonstration of a modular pumped storage project.

The agreement provides **up to \$35,000,000** to expand the HydroWIRES program.

The agreement provides **up to \$10,000,000** to continue industry-led research, development, demonstration, and deployment efforts of innovative technologies for fish passage and invasive fish species removal at hydropower facilities, as well as analysis of hydrologic climate science and water basin data to understand the impact of climate change on hydropower.

The agreement provides **up to \$5,000,000** for innovative analytics to optimize hydropower applications such as machine learning-based hydrologic forecasts and operations optimization technology advancement.

The agreement provides **up to \$15,000,000** for small hydropower innovation, testing, and initiatives, including industry-led competitive solicitations for advanced turbine demonstrations; improved environmental performance; standardized or modular project deployment applications; and advanced manufacturing and supply chain innovations.

The agreement provides **up to \$10,000,000** for design and engineering based on the outcome of the Department's ongoing scoping activities toward a network of hydropower testing facilities.

The agreement provides **up to \$5,000,000** for irrigation modernization demonstration and deployment activities including physical sites and digital tools that advance energy, water, environmental, community, and agricultural benefits.

The agreement provides **up to \$10,000,000** for the purposes of sections 242 and 243 of the Energy Policy Act of 2005 as being carried out by the Grid Deployment Office.

\$100M of prescriptive language

Minimum \$2.7M contribution to SBIR & TCF programs

~\$9M for EERE priorities and DOE corporate activities, including crosscutting EERE programs, all non-federal support staff, communications, workshops, conferences, merit reviews, peer reviews, etc.

After this, ~\$47.3M available to meet language.

Marine Energy Funding & Congressional Direction for FY23

The agreement provides **not less than \$120,000,000** for Marine Energy...

The agreement provides **not less than \$50,000,000** for industry-led competitive solicitations to increase energy capture, improve reliability, and to assess and monitor environmental effects of marine energy systems and components at a variety of scales, including full-scale prototypes.

The agreement provides **up to \$20,000,000** for continuation of foundational research activities led by universities and research institutions affiliated with the National Marine Energy Centers.

The agreement provides **up to \$10,000,000** for operations at the National Marine Energy Centers in order to accelerate the transition of marine energy technologies to market.

The agreement provides **not less than \$27,000,000** address infrastructure needs at marine energy technology testing sites, including general plant projects and planning activities for the staged development of an ocean current test facility and upgrades to facilities that provide cost effective open water access for prototype testing.

The agreement provides **up to \$5,000,000** for the development and construction of an open water, fully energetic, grid connected ocean current energy test facility, **not less than \$5,000,000** for general purpose plant projects, and **not less \$22,000,000** to complete construction of the grid connected wave energy test facility.

The agreement provides **not less than \$5,000,000** for the Department's Marine and Coastal Research Laboratory.

The agreement provides **up to \$8,000,000** for continuation of the Testing Expertise and Access for Marine Energy Research initiative.

The agreement provides **\$24,000,000** for the Powering the Blue Economy initiative. (no up to/not less than language)

\$176M of prescriptive language

Minimum \$5.5M contribution to SBIR & TCF programs

~\$12.8M for EERE priorities and DOE corporate activities, including crosscutting EERE programs, all non-federal support staff, communications, workshops, conferences, merit reviews, peer reviews, etc.

After this, ~\$101.7M available to meet language.

Infrastructure Law Funding for Water Power Programs at DOE

\$910 million for hydropower and marine energy programs under DOE.

Managed by the new Grid Deployment Office:

- \$753.6 million for hydropower incentive programs. These programs will incentivize hydropower facilities to improve efficiency, maintain dam safety, reduce environmental impacts, and ensure generators continue to provide clean electricity.

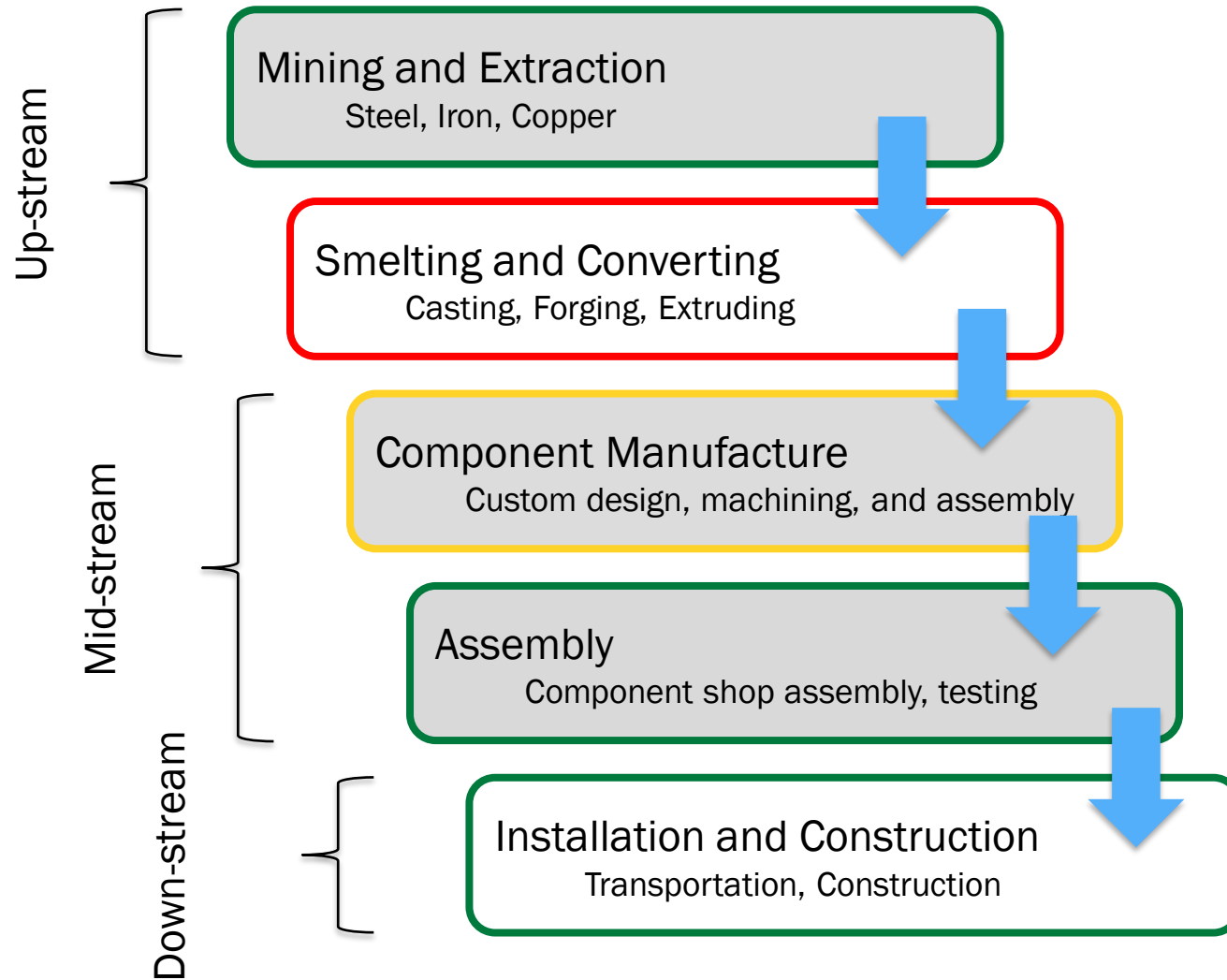
Managed by WPTO:

- \$10 million for a pumped storage demonstration project.
- \$36 million for various other hydropower research, development, deployment, and demonstration projects.
- \$110.4 million for marine energy research projects, of which \$40 million is to be directed toward the National Marine Energy Centers.

Recent WPTO Funding and Technical Assistance Announcements

Program	Type of Funding	Announcement Title	Open Date	Close Date	Funding Available	Funding Source
Marine Energy	Funding Opportunity Announcement	<u>DE-FOA-0002793: Marine Energy Systems Innovation at Sea</u>	9/29/22	3/2/23	\$10.3M	Annual Appropriations
Hydropower	Funding Opportunity Announcement	<u>DE-FOA-0002800: Funding Notice: Bipartisan Infrastructure Law: Stakeholder Insight into Hydropower R&D Issues</u>	10/19/22	11/18/22	\$4M	Infrastructure Law
Hydropower	Funding Opportunity Announcement	<u>DE-FOA-0002802: Funding Notice: Bipartisan Infrastructure Law: Pumped Storage Hydropower Wind and Solar Integration and System Reliability Initiative</u>	10/19/22	12/15/22	\$10M	Infrastructure Law
Hydropower	Funding Opportunity Announcement	<u>DE-FOA-0002801: Advancing Fish Passage and Protection Technologies</u>	10/31/22	3/27/23	\$4M	Annual Appropriations
Hydropower	NOTA	<u>HydroWIRES Technical Assistance Program</u>	11/9/22	3/10/23	N/A	Annual Appropriations
Hydropower & Marine Energy	SBIR/STTR	<u>SBIR/STTR Program FY23 Phase I Release 2</u>	12/12/2022	2/21/2023	~\$6.5M	Annual Appropriations
Marine Energy	Notice of Intent (for upcoming Funding Opportunity Announcement)	<u>U.S. Department of Energy Announces \$35 Million in Funding to Advance Tidal and River Current Energy Systems</u> Modification: <u>Proposed Funding Opportunity Expanded With \$10 Million to Support Community-Led Tidal and Current Energy Planning and Development</u>	N/A – coming soon	N/A	\$45M	Infrastructure Law
Marine Energy	Technical Support	<u>Request Technical Support from the Testing Expertise and Access for Marine Energy Research Program</u>	Rolling	Rolling	N/A	Annual Appropriations

Hydropower Manufacturing



Key Needs:

- **Castings and forgings above 10 tons** for large hydro and PSH runners
- **Generator windings above 100MW and large transformers**
- **Computer chips** for electronics & controls
- **A skilled workforce** for design, manufacture, assembly, and installation

Trends:

- Manufacturing for hydropower components is available domestically, but **foreign competition is more cost effective** (up to 2:1)
- **Quality control costs increase** as component manufacture moves west to east internationally

- **Red** indicates limited domestic capability
- **Yellow** indicates some domestic capability
- **Green** indicates domestic capability
- **Gray fill** indicates cost effective foreign competition

Hydropower Manufacturing

Recommendations from WPTO in coordination with the Office of the Secretary

Quantify the need for rehabilitation and new construction within the domestic hydropower fleet within the next 10 years

- Forthcoming ORNL U. S. Hydropower Market Report (see [2022 update](#) for latest info)
- Deloitte led Market and Hydropower Investment Assessment
- Industry engagement through conferences with roundtable event during Waterpower Week

Define the existing and required domestic hydropower manufacturing and workforce

- Ongoing efforts within the NREL lead [U.S. Hydropower Workforce: Challenges and Opportunities](#)
- Ongoing efforts to scope and implement advanced manufacturing for hydropower programs

Review incentives, policy, and technology investments to encourage domestic production

- Collaborate with GDO, LPO, and the OP to explore the implications of incentives and regulations.
- Assess Buy America Act (BAA) and the Build America and Buy America Act (BABAA) for federal procurements and federally provided dollars.

Hydropower Manufacturing

- Why manufacture in the U.S.?
 - More secure and resilient supply chains
 - High quality productions
 - Workforce development and increase institutional knowledge
 - Reduced transport and travel costs
 - Faster sourcing leads to reduced outage times
- Where is WPTO assessing industry needs?
 - February 22-23: NWA Conference
 - March 14-15: CEATI Hydro Conference
 - April 18: CEATI Webinar (Tentative)
 - May 1-3: NWA Owners
 - May 8-12: NWA Waterpower Week

Investing in Advanced Manufacturing and Materials (AMM) capabilities can address multiple challenges for new and existing hydropower

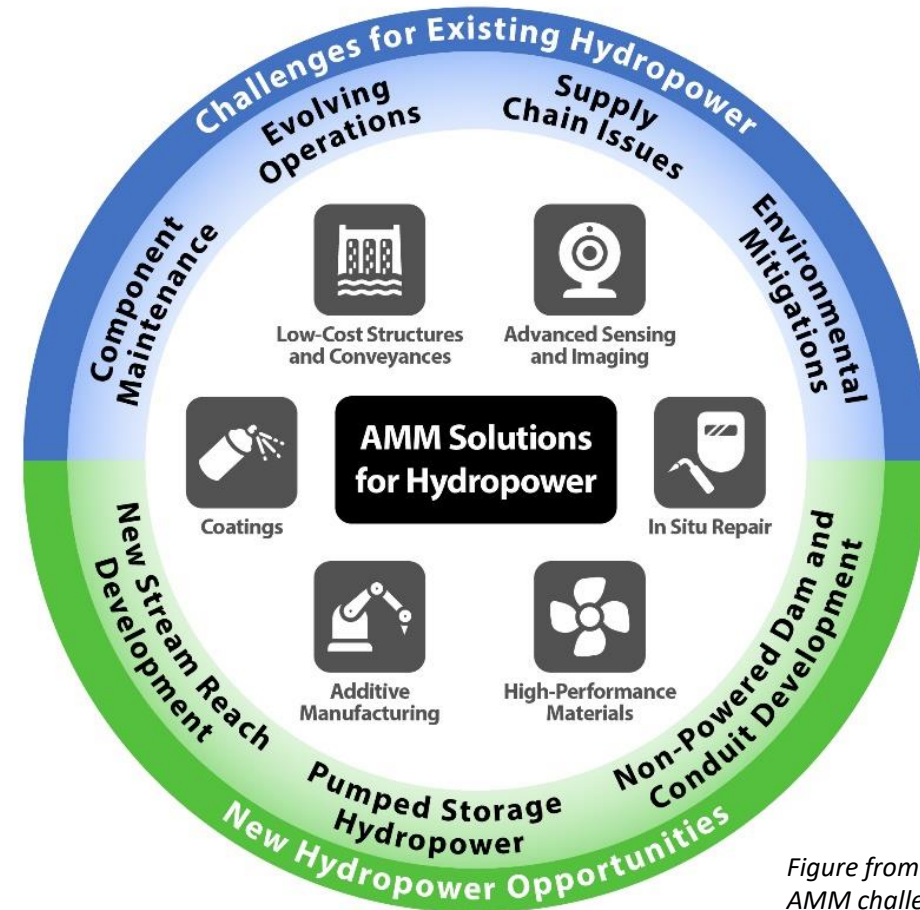





Figure from upcoming report on AMM challenges and opportunities in hydro by ORNL. To be released by mid-March.

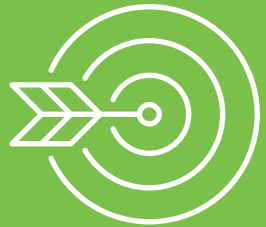
Elements of the Reimagined Hydropower Vision Roadmap

HYDROPOWER'S FUTURE	
	Flexible Operations
	Safe Dams
	Sustainable Approaches



ACTION AREAS	
	Advanced Technology
	Sustainable Development & Operations
	Improved Valuation
	Optimized Regulatory Processes
	Enhanced Collaboration, Education, & Outreach

Transition from the Roadmap Goals to Activities



Goals

Stewards: Visionaries

High-level end points
of where we want to be
by 2050

5.3 Workforce Development

The workforce is diverse and well-trained to meet industry needs



Activities






Stewards: Forums

Concrete **activities** to help
us measure, prioritize, and
achieve the goals for 2050

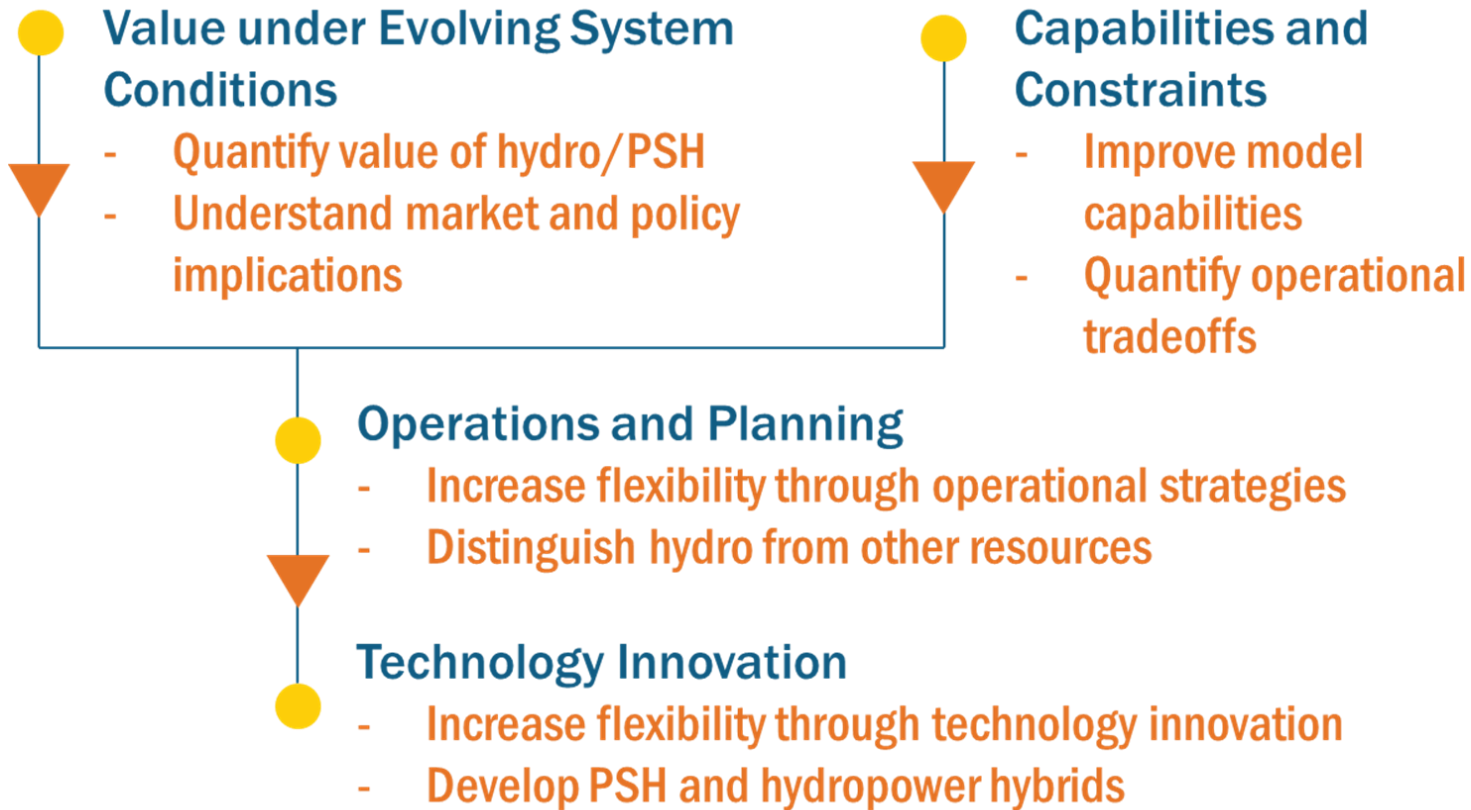
Example Activity for 5.3

Increase mentorship opportunities for those already working in the hydropower industry

Action Area Goals

 Advanced Technology	 Sustainable Dev & Ops	 Improved Valuation	 Optimized Reg Processes	 Enhanced Collab, Education & Outreach
Forum Lead: Kevin Stewart (ORNL)	Forum Lead: Kenneth Ham (PNNL)	Forum Leads: Stuart Cohen (NREL) & Todd Levin (ANL)	Forum Lead: Bo Saulsbury (PNNL)	Forum Lead: Lara Aston (PNNL)
WPTO Liaisons: Katie Jackson & Kyle DeSomber	WPTO Liaison: Dana McCoskey	WPTO Liaison: Sam Bockenbauer	WPTO Liaison: Tim Welch	WPTO Liaison: Allison Johnson
Innovative Approaches & Materials	Climate Resilience	Service Value Recognition	Process Understanding & Access	Renewable Recognition
Environmental Performance	Coordinated Operations	Service Compensation	Innovation Understanding & Access	Best Practices & Benchmarking
Validated Technology	Environmental Protection	Financing Support	Process Outcome Assessment	Workforce Development
Grid Integration & Resiliency	Safe & Secure Infrastructure			Resource Access & Sharing

HydroWIRES Research Areas and Recent Work



Recent activities:

- \$6M FOA for innovative PSH technologies
- \$10M FOA for studies to support PSH development
- \$4M technical assistance opportunity for PSH valuation and other topics
- PSH liner study
- PSH potential in Alaska study
- Environment-flexibility tradeoffs study
- International collaboration with the International Energy Agency and International Hydropower Association



A research initiative to understand, enable, and improve hydropower's contributions to reliability, resilience, and integration in a rapidly evolving electricity system.

HydroWIRES Outreach and Partnership Ideas

How can industry get greater insight into the research underway at DOE?

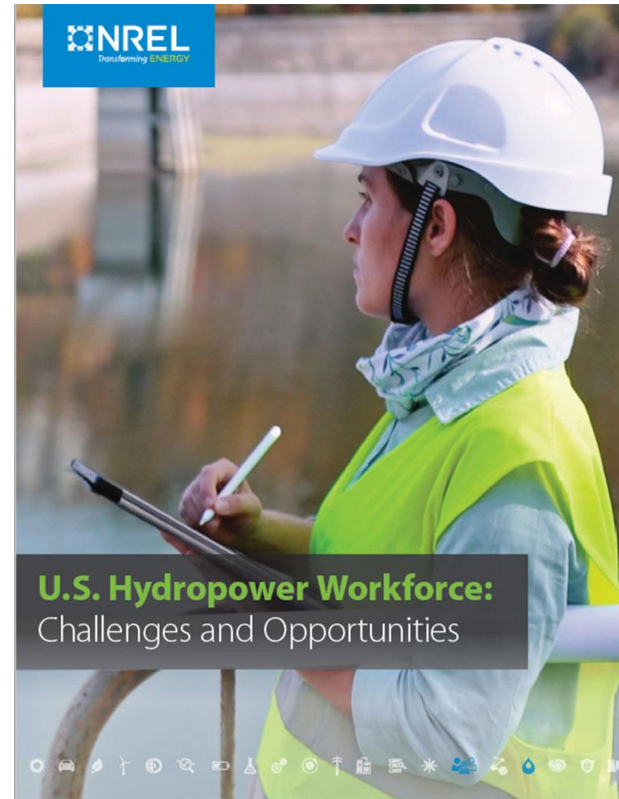
- "Developers' Corner" idea proposed by GE at our 2022 Peer Review – centralize links to the most important industry-facing DOE tools in a single place for ease of access by industry
- Focused, regular updates from DOE at industry events (e.g., NHA PSH Council)
- Propose research to DOE in appropriate areas of mutual interest (e.g., PSH Liner Study)
- Participate in peer reviews, merit reviews, and technical advisory groups
- Build relationships with DOE National Labs
- Take full advantage of newsletters, websites, webinars, and existing outreach efforts

Are there opportunities for industry to partner with DOE to highlight the results of HydroWIRES research (to RTOs, NERC, state PUCs, legislative leaders, FERC, etc.)?

- DOE research generally strives to balance all relevant perspectives, be national and/or holistic in scope, and be broadly applicable across the community.
- But, DOE tools and results should also be actionable and directly benefit end-users.
- We may be able to better frame and communicate DOE results for use by industry (and other parts of the hydropower community) to ensure uptake by decisionmakers.
- Examples include highlighting results for ISO proceedings, FERC technical workshops, or targeted PUC outreach.
- *(Side note: We've had similar discussions about how IEA Hydro research can be better framed to be useful to groups like the International Hydropower Association in their advocacy efforts)*

WPTO's Motivation for Investing in Workforce Development

- Approximately **26% of the hydropower workforce is age 55 and older** and will reach retirement age within the next decade.
- The need to quickly hire large numbers of 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.**
- An NREL-led curricula assessment and academic survey found **few hydro degree or training programs exist** yet institutions of higher learning reported see **growing demand from employers for students with hydropower education.**
- According to hydropower organizations who employ recent graduates, **new hires have limited to no knowledge of hydro or hands-on experience.**



U.S. Hydropower Workforce:
Challenges and Opportunities (2022)

Aging workforce



Few hydro degree or training programs



Perception among young people that hydro isn't exciting or innovative



WPTO's Key Workforce Development Activities

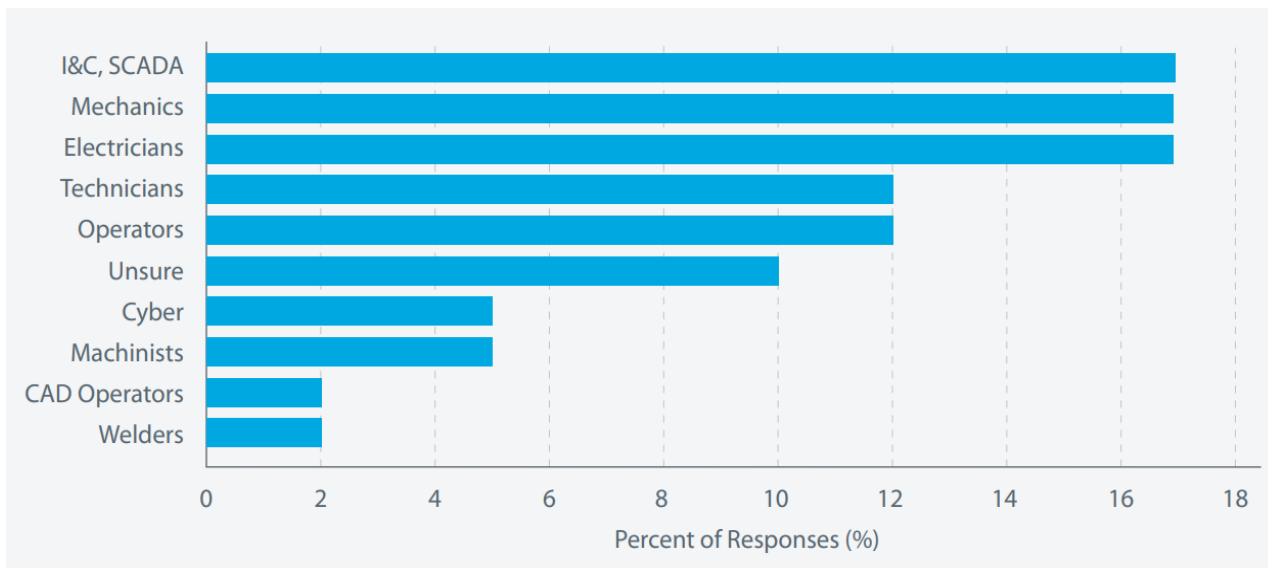


Mechanism	Target audiences	Reach/impact	Key Partners
Marine Energy Graduate Student Research Fellowship	<ul style="list-style-type: none"> Graduate students pursuing marine energy research 	A few but deeply	Oak Ridge Institute for Science and Education
Clean Energy Innovators Fellowship*	<ul style="list-style-type: none"> Recent graduates (Bachelor's, Master's, and Doctoral graduates) Early career energy professionals 	A few but deeply	Oak Ridge Institute for Science and Education
Marine Energy and Hydropower Collegiate Competitions	<ul style="list-style-type: none"> Undergrad students Community college students Trade school students Graduate students Professors and faculty 	~150 students and ~40 faculty advisors annually	NREL, Hydropower Foundation, NHA
Educational Curricula/Materials Development & Dissemination	<ul style="list-style-type: none"> K-12 students K-12 educators Post-secondary students Post-secondary educators 	Many via outreach partners and NREL's online STEM portals	NREL, Hydropower Foundation, NEED Project, IKM Testing, KidWind, Mystic Aquarium, Bonneville Environmental Foundation

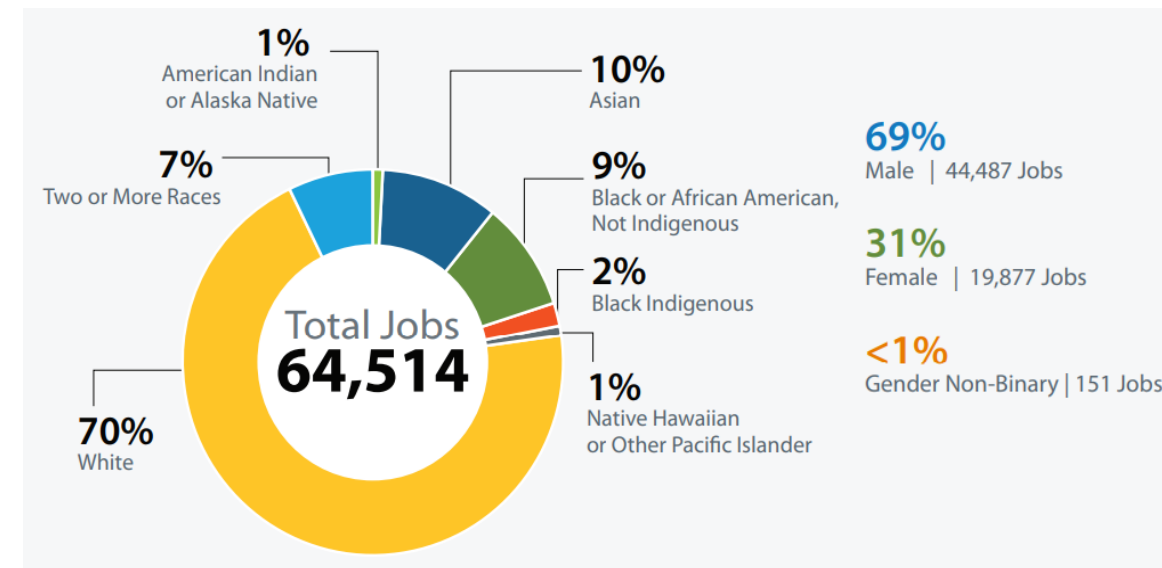
**EERE-wide pilot program*

Some Key Goals & Data to Inform Future Priorities

1. Support programs that **address industry's main challenges** regarding workforce recruitment or development.
2. Make an impact in terms of **scale and return on investment**.
3. Engage **populations underrepresented in the hydro workforce**, including new workforce entrants and/or existing professionals from adjacent sectors?
4. Attract **industry partnership, co-funding, and/or sponsorship** (to scale and ensure sustainability)?



Craft and trade jobs with the greatest hiring difficulty in hydropower.



U.S. hydropower industry demographics.

With More Resources, What Might We Do?



Launch New Programs

- Fellowships and internships
- Pre-apprenticeship experiences
- Curricula exchange programs
- Veterans training and placement programs

Scale Non-WPTO Programs

- Hiring for Hydro
- Hydro Think Tank
- Student research awards
- Travel and conference stipends for students and jobseekers

Continue Existing WPTO Programs

- Collegiate Competitions
- Educational Materials Development and Dissemination
- Workforce Analysis