



Marine Energy and Hydropower STEM Summit Summary

Executive Summary

On April 1, 2019, the National Renewable Energy Laboratory, U.S. Department of Energy and the Hydropower Foundation, presented the 2019 Waterpower Workforce Summit. Industry professionals, university professors, young professionals, NGO's and industry stakeholders were in attendance. The purpose of the Summit was to collect information from industry and academia and gather information to lay the groundwork for the redevelopment of a vibrant hydropower workforce while developing STEM based educational materials and a better understanding of the workforce needs for marine energy technologies.

The Summit identified several challenges in the hydropower and marine energy industries. There is a gap in education and workforce development within the marine energy and hydropower industries. Marine energy is a relatively new industry and while there is student interest, there are few jobs to fill and a lack of funding to further the research necessary to increase employment opportunities. Hydropower is the oldest source of renewable energy, however, with that fact, comes an ancient mindset. Students don't find it as exciting as other renewables like wind and solar. The effort here is to change that mindset. This knowledge stems from both an assessment of U.S. hydropower and marine energy curricula and the Waterpower Workforce Summit recently held at Waterpower Week in Washington, D.C.

Background

The purpose behind holding the Marine Energy and Hydropower STEM Summit was to gather information to lay the groundwork for the redevelopment of a vibrant hydropower workforce while developing STEM based educational material and a better understanding of the workforce needs for marine energy technologies.

The overall objective of this work is to initiate programs that lay the groundwork for the redevelopment of a vibrant hydropower workforce while developing STEM based educational material and a better understanding of the workforce needs for marine energy technologies. To be successful, programs must be implemented throughout primary and secondary education (at schools and other locations of STEM engagement), as well as undergraduate and graduate programs in which hydropower and marine energy technologies are a component, and within communities with a high likelihood of individuals who could consider water power as a career option.

Key Recommendations from the Marine Energy Session

Education in Marine Energy

- Integrating Industry needs into marine energy curriculum

- Project based learning, internships and funding
- At the undergraduate level, students are getting foundational information and learning. Students should be allowed to learn several disciplines.
- Integrating marine energy technologies into academic programs and trades across all of the STEM disciplines will be important. Some ideas are as follows:
 - Incorporate into undergraduate education, e.g. two weeks on marine energy at the senior level, 3-6 month internship (NSF has intern opportunities)
 - Focus on education that can cross disciplines
 - DOE can address universities (e.g. workshops and seminars); in turn industry can participate in the classroom.
 - Faculty to build strong coordination with an industry partner.
 - Universities are set-up well for teams. DOE can specify team environment within their FOAs.
 - Provide funding.
- Expanding the educational informational resources to match what is available for other energy sectors that are more successful in pulling in students.
 - There is a lack of jobs and curricula for marine energy, but there needs to be jobs for these students to enter the workforce. If there are jobs, the industry and government entities should be attending the career fairs at the universities.
 - Make the curricula transferable, not just marine engineering, policy and others. Much of the technology, is fundamentally similar, and we should piggy back off the success of wind power to help penetrate the market.
 - Hands on projects and obtaining interest beginning in elementary and middle school. Matt Sanders stated that their organization is working with K-12, sharing the various job opportunities, environmental regulation, showing the larger expanse of jobs, wave energy trust developed a course that has been taught at the Oregon Technology Trust, if there is marine energy in the news, the course enrollment does increase (Matt has shared his syllabus)
 - DOE can encourage universities to pursue opportunities with energy companies.
 - Foster cloud based resources and materials for teachers to bring into the classroom.

Workforce Development

- Lack of research funding and job opportunities were identified as key challenges for the marine energy sector.
 - Need more internships at companies working in marine industry.
 - To show people the marine energy industry is developing, need more activity with prototype development or energy (excitement) around industry.
 - Dedicated funding that is coordinated with the length of time required based on the degree program (i.e. funding tied to how long it takes to train a student).

- What should be done to prepare students, educators, and workers for a future “Blue Economy” workforce that supports power at sea and resilient coastal communities?
 - Develop Partnerships - Leveraging offshore wind networks to enhance marine energy.
 - Increase Student Interest - There needs to be case studies on what workforce opportunities would exist in the future blue economy (real world examples).
 - Clarify Job Opportunities - To show people the marine energy industry is developing, need more activity with prototype development or energy (excitement) around industry.
 - Provide workforce development for all skills - It’s also important to develop researchers and visionaries in marine energy, not just fill workforce gaps or currently identified needs. Multi-skilled workers are more beneficial to the industry. Research funding supports graduate students mostly, difficult to support students with funding go/ no-go points. Would be helpful to fund more undergraduate students with broader skill sets and interests. Design skills for marine energy are also challenging to find.
 - Raise Awareness - Hands on activities are key for students in elementary, middle, and high school. Make connections with what students like to do in the water (i.e. surfing, diving, etc.) to create awareness.
- How can U.S. marine energy market growth be incentivized?
 - Connections - Could partner with the International Network on Offshore Renewable Energy (INORE) to help increase outreach in the U.S.
 - Need to increase outreach between companies and collaboration between universities and companies.
 - *National focus, not just coastal areas* - To meet the jobs in the marine energy future, we must engage students across the county and promote unique experiences and job opportunities in ocean and marine environments.
 - Importance of engaging vocational schools across the country, such as the schools teaching wind technicians for land-based wind. Also need to engage vocational schools and their counselors in addressing workforce gap for crafts and trades.
 - *Scaling marine industry*- It can be challenging to scale-up research to production, economics is important.
 - Marine energy relies on other industries to produce parts (e.g. hydraulics, mechanical, electrical, fabrication). It will take a lot of research to develop marine energy and expand to an industrial size; this will take lots of effort to increase the scale.

Key Recommendations from the Hydropower Session

Education in Hydropower

- How can hydropower technologies be integrated into academic programs, crafts, trades and professional services across multiple STEM disciplines?

- An electrician is an electrician, a machinist is a machinist, so it comes down to how they are introduced to the hydropower sector. Hydropower is not communicated to the general community. This needs to change.
- Hydro doesn't need to be introduced alone, it should have its place in the clean renewable portfolio. There is much opportunity in different areas for employment. Be general, but let students know the wide range of experience and skills needed. Energy is not a simple, but rather a complex system.
- Introduce hydropower in elementary school through hands on projects - Tie a solar panel to a pump, to raise water, the water falls down and turns on a light. This is just one simple example to communicate hydropower to the public and young kids. Implement these competitions, so they learn how it is integrated into education. Some K-12 schools, didn't necessarily compete but would purchase the kits and use in their own classrooms. It's about putting the interest into the young children's' minds.
- Easy to use off-the-shelf curriculum, using big picture topics. Renewable Energy Course, wind, solar, hydropower and then wave and tidal energy devices. It is the image of hydropower and not a specific topic area, there is not a specific hydropower program or course. Integration with economics is very important, we are not used to looking at economics as an engineer. If you bring this up with students they get very interested.
- Partners in the industry to transfer knowledge to the classroom. Try to initiate collaboration with industry and universities. Industry professionals need to be speaking to schools.
- How can we make sure industry needs are accounted for in hydropower curriculum (e.g. industry engagement)
 - Emphasize why hydropower is fun
 - Educating the educators to make sure this is on the radar of the students. Penn State has energy days, they bring faculty, students and industry in and promote a broad topic area in renewable energy, as interest grows in certain area.
 - Make hydropower projects available to teachers to use in class.
 - Host visiting seminars and etc., I'm going to go do a mechanical engineering fluids class, but it is a much larger multidisciplinary technology sector.
- Ideas on what gaps exist in curriculum for waterpower-based career paths (e.g. courses in hydraulics, power generation, etc)
 - The technology is old and developed, but show how it is improving each year. Look at the powerhouse, this has been in operation since 1940s but a lot of new technology has been updated. There is tremendous innovation in the electronics and upstart procedures and brainpower going into these fields. Seeing new opportunities in pumped storage hydro would gain interest.
 - The compensation packages in this industry should be communicated.

- Communicate how the grid has a demand, a one day seminar for the public to provide an opportunity to learn about the grid.

- How do we increase the number of educators who are teaching, conducting research, and promoting hydropower as a career path and ultimately guide students to work in the field?
 - Hydropower Foundation's Research Awards Program - planted ideas and provided scholarships. It let students know about the field of hydropower and engaged the faculty. The faculty acknowledged that there was a need and brought the need to the forefront for potential research dollars. It leveraged to something even more. It allowed the engagement between industry and academia.
 - Find list serves of universities and improve communication. Offer grants and scholarships similar to what DOE has done for solar and wind. Help to bring some standardized courses to provide the education needed in universities.
 - If you have faculty doing research, it is easy to generate curriculum but if there is no cash flow it will be difficult.
 - Require teachers to complete some professional development training, including hands on activities and tours of the laboratories. The teachers can then go back and host a spin off lecture for young students.
 - Reaching out to local trades unions and craftsmen, the military has done a great job training female technicians, reach out to more sectors.