MHK Environmental Permitting and Compliance Cost Reduction Strategies Webinar Meeting Summary

June 12, 2018 1:30 PM – 3:00 PM ET

Webinar Objectives

- Share detailed and accurate estimates of the environmental compliance costs associated with licensing and permitting MHK developments.
    - Gathered from industry and federal / state regulatory agencies
- Discuss how these respective costs contribute to LCOE and investment risk.
- Identify opportunities for cost reduction pathways.
- Provide cost comparisons of environmental studies for similarly categorized MHK projects (e.g. wave or tidal, commercial development or test deployment or test site, etc.) for both the permitting/licensing and monitoring/compliance phases.
- Discuss qualitative findings and lessons learned from other industries analysis, including implications for marine and hydrokinetic (MHK) projects.
- Gain feedback from participants on how to strengthen the project going forward.

Project Purpose and Overview

This three-year effort started in FY17 with the primary objective of detailing the environmental compliance costs and lessons learned from U.S. based MHK projects that have gone through the permitting and compliance process. The project goal is to find ways to improve the efficiency and effectiveness of the permitting and compliance process that reduce deployment uncertainties and associated risks/costs; ultimately encouraging investment in MHK projects. The project team is composed of Sandia National Laboratories, H. T. Harvey & Associates, Integral Consulting, and Kearns & West. Step one of the project process, collect data to determine permitting and compliance costs, was a focus during 2017, but is an ongoing process to ensure the project team is working with the most recent and accurate data as possible. Currently, the project team is focusing on step two of the project process, identify cost reduction pathways. Step three, develop cost reduction strategies, will follow during Fall 2018 and Winter 2019. Each step is envisioned as an iterative approach working with industry and regulators to best meet the project goal.

The data collected for MHK licensing and compliance activities includes costs associated with environmental studies, stakeholder outreach, background studies, mitigation and adaptive management measures, and decommissioning. Further, the team has captured qualitative lessons learned and recommendations/best practices from both industry and regulators. All data are aggregated to ensure confidentiality and protection of proprietary information as deemed necessary by the participating developers. The project team is working with industry and Federal/State regulatory agencies to obtain the data (both direct costs, as well as time and resources associated with permitting) and are looking to understand regional perspectives and varying experiences in the permitting/licensing process. Cost data and general information collection is ongoing and preliminary results presented during the webinar include a range of projects that are undergoing or have undergone the permitting/licensing and compliance process.

Updated Quantitative and Qualitative Findings Presented in the Webinar

To date, the project team has collected and is analyzing data from 17 projects around the United States, with an 18th coming up this year. Projects have been categorized by project type (test site, test deployment, or commercial deployment), project phase (completed, active, on hold, or cancelled), type of resource (wave, current, or tidal), geography (east vs west coast), grid connected or not, early project versus recent project, nearshore state waters versus Federal waters, permitting type (Federal Energy Regulatory Commission (FERC), United States Army Corps of Engineers (USACE), FERC/Bureau of Ocean Energy Management (BOEM), or state), and project stage (permitting/licensing vs monitoring/compliance). This categorization helps to understand the differences or similarities in costs in order to allow for proper comparison of projects. Data analysis, so far, has compared wave test deployments, wave test sites and commercial tidal deployments (permitting/licensing study costs and monitoring & compliance costs), as well as the timeline for project permitting and environmental studies. Planned analysis includes looking at outreach costs and permitting activity length.

Industry outreach, so far, has consisted of initial discussion of quantitative and qualitative project details, as well as follow up discussions on data gaps, comparability of data, and project/study timelines. If industry partnered with another organization, for example an academic institution, to conduct additional studies, those partners were contacted in order to obtain additional study costs that feed into overall project cost. Federal outreach has consisted of discussions with BOEM, FERC, the Department of Defense, the National Marine Fisheries Service (NMFS) , the U.S. Fish and Wildlife Service, and the U.S. Navy. State agencies from California, Maine, New York, Washington, and Oregon have also been contacted to discuss the regulatory process.

The first quantitative analysis discussed in the webinar considered permitting of wave test deployments. Because wave test deployments are relatively short term, the costs are also relatively low in comparison to commercial deployments and test site development. Of particular interest, only noise studies were required and conducted as part of the licensing activities for wave test deployments. The next topic considered was the costs of environmental studies to permit the three U.S. commercial tidal deployments. The types of studies performed for each project depended on the technology deployed and site specifics biological species at the deployment location. Among all the environmental studies, fish and fisheries and noise studies had the highest pre-deployment costs. It should be noted that costs varied dramatically for some environmental studies. In some instances, this can be attributed to the need for an individual project to pioneer monitoring technologies and measurement methods to proceed through the licensing process.

The webinar continued with a look into the studies performed in support of permitting four U.S. wave test sites. The highest study costs are associated with fish and fisheries and marine habitat characterization. This may be associated with the size of the project footprint and distance offshore, which requires more effort to characterize and implement the site study plan. Next, the environmental study costs for all wave and tidal projects with like field studies were presented. This included seven wave and four tidal projects, where wave included test site and test deployment project types and tidal included commercial and test deployments. Study costs for tidal projects were generally more expensive than wave, which may be due to environmental risks and uncertainties being more of a concern for tidal projects. Further, the tidal projects presented are mostly all commercial deployments (3 out of 4), which likely also increased costs compared to the wave test sites and test deployments (there are no U.S. wave energy commercial deployments).

The ensuing quantitative analysis focused on costs of environmental studies done for monitoring and compliance purposes for the three wave and three tidal projects with such costs. It's important to note that wave and tidal projects did not always conduct the same environmental studies. In fact, only noise, adaptive management, and marine habitat had overlapping wave and tidal studies. Collision study costs, only incurred by the three tidal studies, showed the highest average and variability. The high variability in these costs was due in part to an outlier that had high research and development costs for development of pioneering study methods and technologies, which were necessary in order to obtain required permits. These costs were born by the developer, but also research conducted by labs and academia that should contribute to reduced costs in the future. Certain areas (e.g., recreation and avian) had low costs. When removing the outlier tidal project, the three highest costs for tidal projects were fish and fisheries, collision, and noise. The three highest environmental study costs for wave projects were electromagnetic fields (EMF), terrestrial, and marine habitat.

The final quantitative analysis focused on comparing permitting and licensing versus monitoring and compliance environmental study costs for all MHK projects. Analysis of nine wave and four tidal projects with qualifying costs indicated that permitting and licensing study costs are lower than for monitoring and compliance study costs. Collison study costs are high for monitoring and compliance of tidal projects due to the difficulty of working in high velocity tidal environments, a lack of understanding of collision risks, and the need to develop and test technology to accomplish study objectives. Some of the current high study costs associated with monitoring and compliance may help reduce monitoring costs for future projects. Removing the highest, outlier collision data point brings costs down for collision and makes fish and fisheries studies the highest monitoring and compliance cost on average.

The final graphic presented was a timeline depicting the environmental studies conducted for each project and project progression through the permitting and compliance process. The timeline data and graphic are still under development, but may allow for data gaps to be more easily identified and help understand costs differences between different projects. Because the projects span a range of stages in the environmental permitting and compliance process and are subject to differing interpretations of the regulations, some projects have generated more data than others over a longer time period. Assessing project costs based on the timeline does not necessarily translate to level of effort (e.g., boat time vs lab time vs pioneering technology), but the project team is working on ways to depict this within the timeline graphic. Comparing the timeline of studies is difficult because of the level of detail provided in available documentation, but the project team will work to fill gaps (e.g., specific cruise dates vs. a range for study duration, study costs where types of surveys are combined, and cost of ship vs. land-based studies).

Initial conclusions from quantitative analysis

Of the 17 MHK projects studies so far, they differ widely in their location, type of environment, project type, progression through the permitting and compliance process, etc. Further, there are only a few MHK projects deployed. All of this leads to a low sample size of "like" projects. Studies needed for permitting/licensing or for monitoring and compliance appear to translate into higher costs for early projects, but the results, lessons learned, and developments from early projects can help inform and decrease environmental uncertainties and risks for later projects. Initial conclusions include:

- Variability in study costs is strongly associated with project type, design, and siting, which determine what environmental impacts are a concern and what environmental studies are needed for permitting/licensing and monitoring and compliance.
    - There are a limited number of projects at the monitoring and compliance stage.

- There is a need to find ways to reduce the high costs of studies.
- Pioneering technologies and study methodologies increase individual project costs, but may reduce costs for later projects.
- Most projects involve developer and federal/state funding (13 out of 17 projects).
- Geographic location (East vs West) is hard to compare because of differing project phases and deployment types.

Qualitative Findings

The project team then reviewed the qualitative findings from the nascent MHK industry based on the State of the Science Report (prepared by the Pacific Northwest National Laboratory on behalf of DOE) as well as their own research. Essentially, some developers have limited experience or understanding of the environmental regulations and permitting due to little permitting precedence. Similarly, agencies have limited understanding of the technologies. Consequently, there is no straightforward pathway for simple technological deployments that would allow the industry to progress. In light of this, it is necessary to share knowledge and use findings from other locations and/or similar projects, especially those that provide solid resolutions to understanding the impacts of MHK technologies. As MHK is a new use of ocean space, important to minimize conflicts based on site selection and conduct early agency and stakeholder interaction. Monitoring at sea is expensive and challenging; therefore, it is vital to make the most of these efforts.

On the permitting side of this, there are no guidance documents that guide the MHK permitting process. The industry needs protocols on how data should be analyzed and on how MHK technologies should be managed. However, finding permitting documents is a tough task; this project team needs a source for these.

Scientific Findings (Monitoring Sound)

Progressing through the webinar, the project team discussed the actual scientific results of the studies mentioned above. First addressing underwater sound, the team established that the level of operational noise from individual marine renewable energy devices is unlikely to harm marine animals. However, studies do show that construction noise, especially pile driving, is very noisy and could potentially have adverse effects. More research is needed to cover the gaps and uncertainties. For example, there is a need for additional field investigations of “new” device types to characterize ambient noise prior to deployment, during calm conditions when device is non-operational, and accurate detection of sound generated from the device under a variety of physical regimes (tidal cycles, wave heights, etc.). The devices to study this, such as the hydrophone, are off the shelf; however, the methods and techniques in how this equipment is deployed is not standard (ex. where and how long to drift a noise monitoring array is variable). Thus, making it difficult to achieve these investigations and close these gaps.

There are technical guidelines for analyzing marine mammal thresholds for sound; however, laboratory and field studies are needed to elucidate response relationships pertaining to the response by organism to various amplitudes and frequencies of sound. This science is evolving. As of now, underwater sound studies range from $10,000 to $200,000; however, most have been short term and provide snapshots of ambient sound conditions. These snapshots can be used for tidal project acoustic studies, but wave studies will require a longer continuous deployment (e.g., months). Longer deployments are more costly due to data storage and power issues.

Post-licensing compliance and sound monitoring studies to date have shown that wave and tidal projects deployed in the U.S. and E.U. generally do not exceed the NMFS threshold for marine mammal harassment (120db). The NMFS guidelines are evolving because generally there is poor understanding of responses of marine animals to non-impulsive sounds. As these technologies improve, long term/continuous sound monitoring will result in huge amounts of data. Industry-wide standards for measuring sound from MHK devices will be very helpful.

Scientific Findings (Collisions)

The project team also discussed the likelihood of marine animal collisions with tidal project technologies. According to field studies done by University of Maine in Cobscook Bay, fish avoid or evade operating tidal turbines, thus exhibiting no evidence of strikes or collisions. There is, however, a caveat that events such as collisions or strikes are so rare that actual observations of strikes causing injury or death are unlikely to be detected. This is so because technology and methods to document interactions between marine mammals and tidal projects are not off the shelf. The project team discussed different technologies that could be used to determine the incidence of collisions, including hydroacoustics, acoustic cameras, and optical cameras. All three had at least a few drawbacks. Overall, the costs of collision monitoring studies are high because events are rare, and therefore a lot of data would need to be collected and analyzed. Future efforts should focus on using models to evaluate risk, as well as focused monitoring effects to improve models if confidence in the models is low.

Qualitative Findings from Other Industries Report

The project team reviewed other energy and marine industries (offshore oil and gas, offshore and onshore wind, onshore solar, and subsea power and data cables) for permitting and regulatory lessons learned in the marine space. The project team examined changes in levelized cost of electricity (LCOE) over time, permitting pathways, potential environmental effects and types of monitoring on other industries experiences, and factors contributing to easing environmental permitting. Discussions with regulatory agencies are underway. Lessons learned from other industries include:

- Use of existing baseline studies and effects analyses from analogous projects has proved beneficial.
- Apply permitting and regulatory solutions developed for other industries to MHK.
- Form partnerships among industry, agencies, and scientists, and conduct collaborative research to address important concerns and get answers to bigger questions. For example, consider collaborative research to address retiring risk where possible.
- Develop and implement guidance, protocols, and siting tools.
- Continue to hone technology and installation technologies.

Discussion

Towards the end of the webinar, participants were encouraged to ask questions and provide feedback. Each question was addressed by the webinar organizers and briefly discussed by attendees. Each question and the general discussion was recorded by notetakers. The group discussion highlights are summarized below.

Data and Studies

- The MHK devices are in an open water column and fish avoid them, meaning that collisions and strikes are much lower. However, migratory fish, such as Mackerel and Herrings, may be

exposed to these devices multiple times a year. So, while probability of strike may be low, they might be affected by the multiple encounters with the devices over their lifetime.
- In theory, there is a need to improve existing data to minimize redundancies. However, current studies aren't presenting a lot of redundancies, so there is still a need for more studies that will ultimately provide large amounts of data that can be used from here on out.
- The focus of these studies depends on the regulatory focus. What studies are of the greatest concern is subjective. This point requires more discussion.
- It is interesting that some of the developers whose studies were used in this webinar did not want to be identified. More transparency might be helpful.
- The project team will identify what the findings suggest about improving efficiency and discuss this with a broader audience to make sure that the concept and cost drives are right in order to move forward with the project.

Costs

- There is variability in project studies. Some have little to no studies, while other projects have expensive studies. Costs are driven by project type and specifics of the project. If a project has a lot of uncertainty, then costs are increased. Distance from shore increases costs due to longer cables needed and larger footprint.
- Tidal energy has not yet been proposed in Oregon, but members from the state were surprised that the up-front costs are so high. There is agreement that as devices become more familiar, studies will not have to do as much upfront assessment, thus driving down costs.

Other

- Regulators should communicate further between federal, state, and local agencies in order to improve efficiencies. This would create opportunities to learn from different experiences.
- Community feedback is vital.

Next Steps

The project team will continue to improve the quantitative analysis with data from state and federal permitting; outreach costs; state and federal funding contributions; separated costs for commercial deployments, test deployments, and test sites; and regional effects on costs (east vs west and north vs south). The project and environmental studies timeline will be updated to include new data and connections to costed studies which were not previously reported. A list of additional analysis planned is below.

Planned Analysis:

- State and federal permitting costs
- Outreach costs
- State and federal funding contributions
- Cost comparison of commercial and test deployments
- Regional effects on costs
- Project timeline data and analysis

Further, the team will identify additional U.S. MHK projects that have not been included in this study and will look to capture those costs and increase the overall project sample size. The project team will

also develop an updated discussion guide to support subsequent rounds of outreach during FY18 and continue to assess environmental compliance progression with other industries (regulatory agency discussions and refining lessons learned that can be applied to the MHK industry).

Meeting Participation

Name	Organization
Karen Gaidasz	NY State Department of Energy and Environmental Protection
Jonathan Hartman	Department of Energy
Delia Kelly	Oregon Department of Fish & Wildlife
Kristin Kerwin	Department of Energy
Jeff Murphy	National Marine Fisheries Service
Carrie Noonan	Department of Energy
Rebekah Padgett	Washington Dept. of Natural Resources
Jack Pan	
Roak Parker	Department of Energy
Steve Shephard	U.S. Fish & Wildlife Service
Patty Snow	Oregon Coastal Management Program
TOTAL PARTICIPANTS: 11	
Staff	
Zach Barr	Kearns & West
Craig Jones	Integral Consulting
Jorge Kalil	Kearns & West
Sharon Kramer	Harvey & Associates
Will Peplinski	Sandia National Laboratories
Jesse Roberts	Sandia National Laboratories
Erica Wales	Kearns & West
Anna West	Kearns & West
TOTAL STAFF: 8	