Using Adaptive Management to Resolve Uncertainties for Wave and Tidal Energy Projects

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AS THE NATION clamors for new renewable energy sources, hydrokinetic technologies—including wave, current, tidal, and in-stream energy technologies—offer promising additions to the grid. Placing new technologies in ocean and tidal environments, which contain vast, sometimes sensitive resources but are, surprisingly, relatively unstudied, presents a challenge to agencies and developers alike as the industry strives to move through initial project-permitting stages in an efficient but environmentally responsible manner.

"Adaptive management" approaches can allow projects to be permitted and installed while providing agencies and other stakeholders the opportunity to verify their anticipated impacts. Moreover, where actual impacts exceed expectations, an adaptive management approach allows agencies to address such impacts consistent with existing regulatory standards intended to protect marine resources.

Adaptive management is not a new concept; whether called "adaptive management" or not, the practice of studying something and making changes to address identified problems is a logical concept that we naturally apply in many permitting schemes. As applied to initial ocean and tidal energy projects, however, the particular challenge is that adaptive management schemes may need to contain fewer specific contingency plans—fewer "if X, then Y" scenarios—than agencies, in particular, may be used to having. This article considers that challenge and describes an approach to adaptive management intended address those concerns.

As the hydrokinetics industry moves from demonstration projects to commercial build-out, the knowledge gained in initial project stages will help mitigate the uncertainty that exists today. Ultimately, as agencies and other stakeholders better understand the positive and negative impacts of placing hydrokinetic devices in marine environments, adaptive management plans should evolve from open-ended processes toward more prescriptive, contingency-based plans. And just as agencies and other stakeholders gain more certainty, this trend toward more specific contingency planning will provide the necessary certainty to support long-term investments in this industry.

This article attempts to define adaptive management for our purposes. It then discusses the components of adaptive management that are necessary to make such schemes viable for initial ocean and tidal energy projects, including that such schemes be project-specific, adopted at the developer's election, and guided by standards articulated in laws that already exist to protect ocean and tidal resources. Finally, this article confirms that adaptive management is allowable under the National Environmental Policy Act (NEPA), and describes how analyses under NEPA should address such schemes.

WHAT IS ADAPTIVE MANAGEMENT?

Adaptive management has been variously defined as "a systematic approach for improving resource management by learning from outcomes" (Williams et al., 2009, p. 1); "[a]n iterative approach to managing ecosystems, where the methods of achieving the desired objectives are unknown or uncertain" (California Coastal Commission, 1995); and a process for "evaluating the performance of new management approaches and changing practices over time as experience is gained" (West Coast Environmental Law glossary at: http://www.bcwatersheds.org/issues/urban/sbg/glossary).These definitions share several common themes: adaptive management is an iterative process used by resource managers to improve management processes over time when environmental impacts are uncertain.

True adaptive management can be differentiated from contingency planning even though both deal with high levels of uncertainty. Contingencies (i.e., predicted impacts and planned responses to those impacts) give managers little control over how to react to environmental impacts because the response to such impacts is already dictated. True adaptive management is open-ended, omitting contingency plans in favor of added control over the response when an impact is realized.

For our purposes here, an adaptive management scheme, program, or plan can include elements of both. As the first ocean and tidal energy projects are undertaken, adaptive management plans will not likely include many contingencies because the uncertainties are high—project managers just do not know what may turn out to be problematic, if anything, in various aquatic environments. However, as we learn more about project effects and as the industry begins to address any unacceptable impacts, adaptive management plans should shrink to address only those areas over which uncertainty still exists, and contingency planning should be used to reduce the risk profile of new projects for developers and investors.

lands, environmental quality, water resources, parks and recreation, and the states' coastal zone management plans. Citizens groups include commercial and recreational fishers, surfers, and nonprofit environmental organizations, to name a few. With such a breadth of interests at the table, structuring an adaptive management plan may seem like a daunting task, but it does not have to be one.

As Figure 1 shows, the first step in making adaptive management a viable option for project planners is to create a baseline understanding among all stakeholders about how the process should proceed. Ultimately, stakeholders will more easily embrace a process that has widely accepted procedural guidelines. Much has been said on structuring adaptive management programs for hydrokinetics already, but five major issues deserve special attention: (1) Should adaptive management plans be mandated

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STRUCTURING ADAPTIVE MANAGEMENT FOR HYDROKINETIC PROJECTS

The diversity of stakeholder groups with an interest in hydrokinetic projects cannot be underestimated. Federal agencies include, but are not limited to, National Marine Fisheries Service (NMFS), US Fish & Wildlife Service (USFWS), US Coast Guard, Federal Energy Regulatory Commission (FERC), and Minerals Management Service. State agencies include those responsible for fish and wildlife, state

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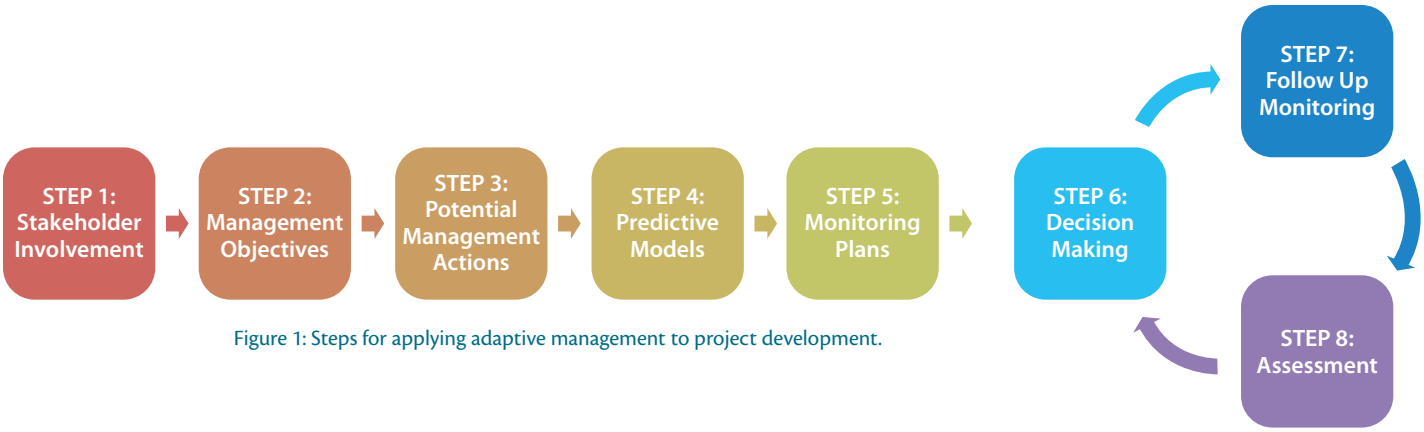

Figure 1: Steps for applying adaptive management to project development.

by the agencies or should they be voluntary? (2) Should an adaptive management process be set for the entire industry, or should plans be project-specific? (3) What standards should guide the adaptive management of a project over time? (4) How does dispute resolution work in this context? We address each of these questions in sequence.

ADAPTIVE MANAGEMENT MUST BE A VOLUNTARY ENDEAVOR

Adaptive management planning should be employed at the election of project developers rather than mandated by a particular agency. Collaborative processes work best when all participants engage of their own volition. FERC and other agencies will undoubtedly make any proposed adaptive management plan an enforceable condition of a project's hydropower license and other permits, but proper implementation of adaptive management requires ownership and trust—something best gained by allowing a developer to develop and champion an adaptive management plan particular to the specific project.

More importantly, making adaptive management mandatory may stifle development if the uncertain impacts of some projects make them too financially risky for investors. Some developers may choose to address unknown environmental impacts with an open-ended adaptive management program, which is not without risk, but which, if the project is ultimately benign, is unlikely to require significant expenditures over time. Other developers may forgo the uncertainty inherent in adaptive management in favor of having more onerous conditions placed on their licenses and permits at the outset, anticipating problems and addressing them whether or not they become reality, rather than using the adaptive management framework to study and respond to environmental stressors over time. For them, acquiring financing may depend on a known risk profile for the project. If agencies mandate adaptive management, those developers who would exchange stricter conditions up front for more certainty in their mitigation requirements may have to abandon projects for lack of investors.

ADAPTIVE MANAGEMENT PLANS MUST BE PROJECT-SPECIFIC

Considering the variety of technologies and locations in which ocean and tidal hydrokinetic projects can be sited, a single, one-size-fits-all template for adaptive management is difficult to imagine or justify. This industry encompasses turbines, buoys, oscillating water columns, and more, with proposed projects on the Atlantic and Pacific coasts, in Alaska and Hawai'i, in ocean waters, on coastal jetties, and in the Gulf Stream. Even if the question were limited to whether plans for these projects should be designed around contingencies or whether they should be truly open-ended adaptive management plans, the answer is complicated.

From a practical standpoint, neither the government, nor academic institutions, nor industry has enough environmental baseline data to understand all of the issues related to these projects. Moreover, developers will have different appetites for risk. Some developers may accept the risks associated with a truly open-ended adaptive management

plan. For them, open commitments to address unknown post-deployment impacts will be acceptable. Others may prefer up-front contingency planning even if it results in stricter license or permit conditions. As the industry matures over the next decade and more becomes known about how different devices impact the aquatic ecosystems they are placed in, it may be possible to work toward a more uniform—and certain—process. For now, however, stakeholders should be free to design adaptive management programs that fit a particular project's scope and location and address its environmental impacts as best understood by the stakeholders.

AGENCIES' STATUTORY AND REGULATORY MANDATES MUST GUIDE ADAPTIVE MANAGEMENT

Because there are so many unknowns in adaptive management planning for hydrokinetics, the temptation exists to explore every possible avenue for mitigating every effect that a hydrokinetic project may be perceived to have on the environment. For that reason, we need to think carefully about when to stop chasing rabbits down rabbit holes—that is, when we can say that a developer has indeed fulfilled its obligation to protect the environment from project impacts. The underlying problem is that different stakeholders will want to manage to different outcomes. For hydrokinetics, an agency's desire to manage for minimum impacts can be in conflict with a developer's need to manage for maximum power output.

The key to balancing these diverging needs in developing an adaptive management plan is to manage to the *existing statutory and regulatory standards* that Congress and our state legislatures have enacted. Using existing legal standards—which in turn translate to biological standards—has many advantages. From the perspective of agencies and other stakeholders, using such standards means that they are not "giving up" any existing authority; they are not agreeing to allow developers to have impacts greater than what is allowable under the law. And from the perspective of developers, they are not agreeing to do more than the law would otherwise require. More generally, using legal standards that have already been well defined (and sometimes well litigated) helps ensure a common understanding of the terms and intent to which the project is being managed. Finally, as described in further detail below, using these legal standards will be helpful in the event of a dispute over whether a change in project operations or structures is necessary in light of new information. Agencies and developers should agree that they each retain their rights and authorities under relevant laws to impose or oppose, respectively, new measures at a project.

DISPUTE RESOLUTION AND AGENCY AUTHORITY

When an adaptive management plan is put in place, a developer's interaction with the permitting agency has only just begun. Stakeholder engagement throughout the iterative processes of follow-up monitoring, assessment, and decision making is essential to successful project management over the long term. During the iterative process, disputes may arise, and an adaptive management plan should specify how the parties will resolve those conflicts. The dispute resolution process should identify how and when parties may trigger the process, what happens if a dispute cannot be resolved in a mutually agreeable manner, and deadlines for action. These deadlines ensure both a timely response to the environmental stressor and a predictable process for the public, agency staff, developers, and other stakeholders.

Dispute resolution provisions in an adaptive management plan do not preempt the authority of any state or federal agency to take an action that it would have been authorized to take absent that plan. Although all parties to the plan should attempt to use the process set forth as a primary method for handling the uncertainties inherent in these projects, the plan is not the only means for inducing change in project management. This is an important point: all parties that agree to participate in an adaptive management plan benefit from the collaboration that results, but no agency has its authority threatened by participating. If a significant change in conditions or the revelation of new data leads to disagreement among stakeholders about what action should be taken, agencies may act on their own.

For example, FERC has ongoing oversight authority throughout the life of a hydropower license. "Reopeners" in the license may allow FERC to take actions to protect fish and wildlife resources that do not require consent of all parties to the adaptive management plan. Should dispute resolution fail to address a stakeholder's concern, therefore, the stakeholder may petition FERC to impose new measures under a hydropower license to address a newly discovered harm. Similarly, NMFS or

USFWS may "reinitiate" consultation under Section 7 of the Endangered Species Act if they believe a change in conditions brings their earlier analysis into question for a particular species. And just as agencies and stakeholders retain whatever authority they may have under the law, so too do developers, who retain their right to question or oppose the imposition of new measures under a license or permit.

ADAPTIVE MANAGEMENT AND NEPA

Adaptive management provides a means for proceeding with agency permitting processes in the face of uncertainty. At first blush, such uncertainty may seem like an insurmountable barrier to the information requirements imposed on agencies conducting environmental analyses under NEPA. Section 102 of NEPA (42 U.S.C. § 4332) requires agencies to prepare an Environmental Impact Statement (EIS) for any "major federal actions significantly affecting the quality of the human environment." If issuance of a permit or license for a hydrokinetic project (e.g., a Clean Water Act § 404 permit or a FERC hydropower license) is deemed by the federal agency to be a major federal action under the statute, then the lead permitting agency—generally FERC in the case of hydrokinetic projects developed in state waters—will be required to determine whether a wave or tidal energy project presents sufficient potential impacts to warrant an EIS. (See 40 C.F.R. § 1503.1.)

So, what information must an EIS include? Section 102 of NEPA is specific: an EIS must include a discussion of "any adverse environmental effects which cannot be avoided" should the license or permit be issued. An EIS must also include alternatives to the proposed action. This seemingly onerous language is not the death knell one might expect it to be for adaptive-management planning. Although the EIS must include a discussion of everything that is known at the time the agency issues its Record of Decision, both the Council on Environmental Quality (CEQ) and the courts have stated that *perfect* information is not required. An EIS can survive judicial scrutiny even if the information used to prepare it was incomplete or data identified as relevant to the agency's decision were unavailable at the time.

FOR AN EIS, PERFECT INFORMATION IS NOT NECESSARY

A lead agency may proceed with a permitting or licensing process in the face of imperfect information so long as it discloses what relevant information was incomplete or unavailable—and there will be plenty of unknowns in the early years of hydrokinetic project development. When faced with imperfect information, CEQ has identified four points that an agency must set out in its EIS. The agency must include (1) a statement that information is incomplete or unavailable, (2) a statement of how the missing information is relevant to evaluating reasonably foreseeable environmental impacts, (3) a summary of existing credible scientific evidence, and (4) the agency's evaluation of reasonably foreseeable environmental impacts based on theoretical approaches or generally accepted scientific research methods. (See 40 C.F.R. § 1502.22[b].) So long as the agency addresses each point, a well-designed, adaptive management plan selected from among other alternatives in the EIS can satisfy the information requirements of NEPA.

In addition to CEQ, courts have supported the notion that agencies do not need to have all of the answers in order to approve a project and meet NEPA's analytic and public notice requirements. As early as 1978, in *Alaska v. Andrus*, 580 F.2d 465, 473, the DC Court of Appeals recognized that "agencies may not be precluded from proceeding with particular projects merely because the environmental effects of that project remain to some extent speculative. NEPA simply does not specify the quantum of information that must be in the hands of a decision maker…" And more recently, in *The Lands Council v. McNair*, 537 F.3d 981, 1001 (2008), the Ninth Circuit Court of Appeals noted that "none of NEPA's

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statutory provisions or regulations requires [an agency] to affirmatively present every uncertainty in its EIS."

Instead of requiring an unbounded study of hypotheticals, courts require that agencies disclose the limits of what is known. Examples of such disclosures can include frank discussions of scientific uncertainty and any shortcomings in the methodology used to make final decisions. This is not to say that unforeseen environmental effects revealed later (i.e., when a project becomes operational) will be ignored. Agencies still must prepare supplemental EISs if significant new circumstances or data arise that were not described in the original EIS. (See 40 C.F.R. § 1502.9.) To minimize the necessity of supplemental documents, however, agencies can and should describe in their EISs a reasonably broad range of potential impacts.

This is all good news for project proponents and federal agencies alike. Because perfect information is not required in an EIS, agencies can issue licenses and permits so long as the unknowns are identified and vetted with the public. Even more important for this discussion is that adaptive management programs are an ideal way to tackle those uncertainties. Well-designed adaptive management alternatives in an EIS can be written to allow flexibility for managers as data is collected through ongoing monitoring and assessment efforts.

CONCLUDING REMARKS

Adaptive management is not a new concept, but, as applied to wave and tidal energy projects, it will require creativity and bold leadership by agencies and developers alike. For initial projects, adaptive management will be a critical tool to get projects in the water, and may require more flexibility on the part of agencies and developers than either is used to providing. As we learn more, however, all stakeholders, including developers and investors, will gain more certainty as we move from open-ended adaptive regimes to contingency planning. Recognizing the important role of adaptive management in this young industry is a key step in moving it forward in an efficient and environmentally responsible manner.

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