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Title: Adaptive Meets Precautionary: Navigating Risk and Rules in Collaborative Marine Renewable Energy Permitting Processes

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Flaxen D. L. Conway

Despite its promise as a potentially beneficial new source of energy, the ocean-based renewable energy industry is still in its infancy, and like any new idea there are many unknowns with the potential to affect both people and our natural environments. A permit for marine renewable energy (MRE) must cut across many sectors of ocean management and serve many masters at once. The permitting process for MRE is where the social and the technical combine, using the best available science to meet the needs and legal requirements of each agency at the table in order to manage both short-term and long-term risk. This research analyzes examples of collaborative marine risk management in practice, when multiple government agencies must work together to identify and manage uncertainty and risk associated with permitting MRE projects in the United States. Two case study projects from Oregon and Maine are examined utilizing semi-structured qualitative interviews with process participants, analysis of relevant project documents, and participant observation of publicly available presentations, workshops, and conferences. This manuscript-style thesis approaches the concepts of risk, uncertainty, and the permitting process for MRE from three distinct angles: 1) characterize the varying perceptions of risk and uncertainty around the permitting table, and what role collaboration plays in the perception and management of risk; 2) evaluate barriers and opportunities in multi-party collaborative permitting arrangements and identify best management practices for future practitioners; and 3) investigate how regulatory perceptions of risk associated with MRE may be affected by the presence of an emergency that incapacitates the regional electrical grid, and how this relates to potential regulatory pathways for emergency MRE project concepts.

Adaptive Meets Precautionary: Navigating Risk and Rules in Collaborative Marine Renewable Energy Permitting Processes

by

Jeffrey D. Burright

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Major Professor, representing Marine Resource Management

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Dean of the College of Earth, Ocean, and Atmospheric Sciences

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Dean of the Graduate School

I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

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Jeffrey D. Burright, Author

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Chapter 1: Navigating Risk and Regulations in Marine Renewable Energy Permitting Processes

1. Introduction

So much depends on our choice of energy. Our nation's reliance on fossil fuels has influenced everything from global economics and geopolitical relationships to the wide-reaching effects of climate change and ocean acidification on environments, economies, and societies. For centuries, humanity has known that we can turn the motion of water into electricity, but since the 2000s a renewed interest has risen in technologies to harvest offshore winds, waves, and tidal currents as an alternative form of grid-capable energy. Proponents believe that these alternatives can provide a significant portion of the world's energy needs without relying on fuel or producing greenhouse gases. Resource assessments for wave, tidal, and offshore wind power potential claim that we could satisfy as much as 6% of current US power demand if the offshore environments were fully utilized for energy production (Previsic, 2009).

Despite its promise as a potentially beneficial new source of energy, the ocean-based renewable energy industry is still in its infancy, and like any new idea there are many unknowns with the potential to affect both people and our natural environments. It is important to understand how our system of government makes decisions about new and potentially risky uses of the ocean such as marine renewable energy (MRE), as the process reflects our relationship to our environment and an uncertain future.

If the ocean were merely an empty space, the decisions surrounding MRE permitting would be less controversial. The ocean is instead a "peopled seascape" and a living environment (Shackeroff et al., 2009; Pomeroy et al., 2014), within which MRE projects may represent use conflicts or other deleterious effects. Despite its expansive appearance, the ocean is trafficked by ships and animals in such a way that a stationary and permanent energy-producing device may cause interference or accident. The sea surface is also an extreme environment that tests everything we put on it against high winds, heavy seas, and corrosive salt spray. The place beneath the surface is a three-dimensional space that is always changing, host to a diverse array of marine life that is always on the move. Many of the species such as seals, whales, and several fish species are protected by law, while other species are of high economic importance to fishermen and communities. A successful ocean renewable energy permit has to navigate all the potential risks to these protected resources and uses.

During the past 50 years, the ocean has been protected by laws that restrict human activity unless it can be reasonably proven that our presence will be benign -- or in the language of the major ocean protection regulations that, “no significant impact,” “no significant adverse effect,” and “no take or harassment” will occur to marine mammals, other endangered marine species, or essential habitats for protected wildlife[1]. A new use such as MRE must follow these laws as well as those that govern safe navigation and use by the human fleets of ships and other seaborne equipment such as buoys, oil platforms, undersea cables, and other existing permitted human uses. Fishing gear and practices do not have an explicit law protecting their right to a place within the seascape, but socioeconomic effects of a proposed action must also be evaluated as part of the environmental impact assessment, so fishery users become a stakeholder in the ultimate decision. A permit for MRE must therefore cut across many sectors of ocean management and serve many masters at once.

The United States uses an agency-based system to execute its laws, which means in practical terms that any attempt to interact with these laws, for example via a permit application, must follow a human process with people in authority who will govern the outcome. Several local, State, and Federal government agencies are responsible for protecting and managing the busy ocean place, and together they provide a patchwork of management for the ocean. Each agency involved in the decision whether or not to allow MRE has its own process for consultation or permitting, which in past years energy companies have said made their overall process confusing, lengthy, and prohibitively costly (Dubbs, 2013). Agencies have responded by clarifying authorities, promoting early consultation, offering alternative permit process options, and publishing guidance on what information permits need to contain (FERC, 2008; Kraaz, 2015; Dept. of Interior and FERC, 2009).

The permitting process for MRE is where the social and the technical combine, using the best available science to meet the needs and legal requirements of each agency at the table in order to manage both short-term and long-term risk. The addition of new process options has trended toward greater integration of all the separate agency authorities into a “one stop shop” for the permit decision at hand in hopes that the process may be more efficient, more comprehensive, and less costly for all involved (Maine SP0545; OETF, 2009). This concept is in line with the Ecosystem-Based Management Framework (McLeod and Leslie, 2012), which emphasizes the need to consider holistically the connections within a coupled natural and human system, but it may be a new situation for some of the participants whose agencies may never

[1] Quoted language pertains to the National Environmental Policy Act, Magnusson-Stevents Fisheries Management and Conservation Act, Endangered Species Act, and Marine Mammal Protection Act, respectively.

have worked together on questions of MRE. How does each person around the table think about what is at risk? What does each consider to be the appropriate response to risks? How does the process of working together affect how the people see risk or how they respond? These questions are ripe for research.

Much has been written about the need for marine spatial planning, collaboration, ecosystem-based management, and adaptive management as administrative tools toward holistic management of the ocean space for multiple uses (Lubell, 2004; Levin and Lubchenco, 2008; Oram and Marriott, 2010). Emphasis has also been given to the importance of understanding the relationship between science and human values in decision-making. Many existing scholarly works and analyses have focused on the legal structures of the permitting process (Kraaz,2015; Pacific Energy Ventures, 2009;) or issues of economic, ecological, and social trade-offs associated with MRE (Allison et al., 2014; Boehlert and Gill, 2010; Bonar et al., 2015; Henkel et al., 2013; Jimenez et al., 2015; Papathanasopoulous et al., 2014; Pomeroy et al., 2014; Thaler and Lyons, 2014; Stafanovich and Chozas, 2010; Zydlewski et al., 2014), but there have been few explorations into the institutional and technical human processes that occur alongside and after a development project has successfully found a host community. This research will attempt to analyze examples of collaborative marine risk management in practice, when multiple government agencies must work together to identify and manage uncertainty and risk associated with permitting a proposed new use of ocean space.

1.1. Research Overview and Thesis Format

This manuscript-style thesis approaches the concepts of risk, uncertainty, and the permitting process for MRE in the United States from three distinct angles. This format is intended to facilitate potential publishing of separate but related research efforts in scholarly journals or as standalone reports.

The first chapter provides an overview of the MRE permitting process and risk management philosophies that have become important guiding concepts in marine governance. It also describes the research motivation, purpose, and desired outcomes.

The second chapter of this thesis is a manuscript, "Adaptive Meets Precautionary: Navigating Risk and Rules in Collaborative MRE Permitting Processes", that analyzes two MRE project case studies in order to characterize the varying perceptions of risk and uncertainty within the collaborative permitting process, and what role collaboration plays in the perception and management of risk. This research output will be submitted to journals such as "Marine Policy", "Ocean and Coastal Law and Policy" or MRE industry specific journals such as “International Journal of Marine Energy” or “Journal of Renewable and Sustainable Energy”.

The third chapter, “Best Management Practices for Collaborative Marine Renewable Energy Permitting Processes,” analyzes participant perspectives regarding the value of a collaborative MRE permitting approach relative to traditional permitting processes, and the barriers and opportunities for future practitioners of the collaborative approach. The purpose of this chapter is to identify and document best management practices for future practitioners of offshore energy regulatory approval processes.

The fourth chapter of the thesis, “Regulatory Perspectives on Marine Renewable Energy Permitting and Emergency Situations”, is another manuscript crafted from participating in a National Science Foundation Research Traineeship on the quantification and communication of risk and uncertainty in marine sciences. This chapter focuses on how regulatory perceptions of risk associated with MRE may be affected by the presence of an emergency, such as a winter storm that could damage the transmission grid and isolate coastal communities from the sources of electricity generated in other parts of the state. This chapter also evaluates potential regulatory pathways for a hypothetical emergency MRE solution deployed in response to a future blackout emergency.

The fifth chapter summarizes the findings of the previous chapters and integrates the separate research efforts toward implications for MRE development and ocean governance. This is followed by concluding remarks regarding how the human dimensions of the MRE permitting process reflect the many interests involved in MRE as a growing industry and shape the way that risks are managed now and in the future.

The remainder of this chapter provides a regulatory and theoretical context that frames the subsequent chapters. This contextual information is supplemented with additional theoretical frameworks in the subject-specific chapters.

2. Background

2.1. Documented Perceptions of the MRE Regulatory Process

In the mid-2000’s, an emerging interest in MRE development resulted in a “gold rush” of applications for preliminary FERC permits for offshore MRE projects in the United States (Conway et al., 2010). This alarmed many in coastal communities concerned about the risks and unanticipated effects of massive development, but more than ten years later only two small experimental projects have made it into the water. Several high-profile failures such as the Ocean Power Technologies Reedsport wave project in Oregon, the PGE WaveConnect project in California, the Cape Wind project in Massachusetts, and the Admiralty Inlet tidal project in Washington's Puget Sound highlighted the difficulties in obtaining regulatory approval and community acceptance for these projects while achieving economic viability for investors. From a total of 35 active FERC preliminary permits for marine hydrokinetic projects in 2011 (Colander and Monroe, 2011), by 2016, FERC counted six active preliminary permits projects, and as of October 2017 only three remain.

Many have acknowledged that navigation of the regulatory process for MRE is one of the most significant challenges to the development of the industry (Copping et al., 2016; Jansujwicz and Johnson, 2015; Leary and Esteban, 2009; Anderson et al., 2007; Bedard et al., 2007). The regulatory process for placing a MRE project in the ocean is recognized by those who have encountered it as "difficult and expensive" (Dubbs et al., 2013, p.5) or, "long, drawn out, challenging, and expensive, even for very small and pilot-scale deployments" (Copping et al., 2017, g). As summarized by Copping et al. (2016), "Time-consuming procedures — linked to uncertainty about project impacts and the need to consult with numerous stakeholders before reaching a permitting decision — appear to be the main obstacles to consenting of ocean energy projects (p. g)." A report from PNNL states that the environmental study phases of a project (both pre- and post-license) can cost between $2-24 million depending on the project type and scale and take several years, representing a significant portion of the total project cost (Copping and Geerlofs, 2011). Most of these costs are anticipated to occur as a result of long-term monitoring after a license has been obtained. When every cent per kilowatt-hour matters for convincing rate payers and policy makers that offshore energy makes economic sense, a lengthy and expensive permitting phase represents a significant hindrance to the growth of the young industry.

"The effort to innovate, refine, and demonstrate MRE technologies would be significantly easier if regulatory standards that determine the risk to public interests by MRE development were clearer," say the authors of a paper on marine renewables regulatory challenges (Dubbs et al., 2013). They assert that the main challenges to the growth of the industry are an unwillingness to offset potential environmental risks with potential environmental benefits, a lack of standardization for monitoring protocols intended to reduce uncertainty and identify impacts, and an unwillingness to consider lesser risks from small-scale pilot projects. These challenges present additional risk to MRE technology developers who must manage the risk of being so burdened by the regulatory process that their business cannot afford to survive.

The emerging debate over the conditions by which MRE will be allowed to exist offshore is consistent with the concept of a "green versus green" dilemma wherein, "climate mitigation efforts trigger renewable energy development, but then face substantial barriers from precautionary biodiversity protection instruments and practices" (Koppel, 2014, p 744). Proponents of marine renewables point to the positive effect that decreasing the reliance on fossil fuels will have on the environment and society, including a potential reduction in the harmful effects that climate change and ocean acidification are expected to exact on the ocean. At the same time, ocean preservation advocates and agencies responsible for protecting ocean resources may be unwilling to risk the health and resiliency of ocean places for the sake of a new human use.

2.2. Persistent Uncertainties in Marine Renewable Energy

In the United States, various efforts have been made to list and characterize persistent uncertainties that affect the approval of licenses for MRE. The Annex IV State of the Science 2016 (Copping et al., 2016) presents the following as key persistent uncertainties:

- Device interactions with wildlife, including avoidance, strike, entanglement, or collision;
- Acoustic effects to sensitive species
- Electromagnetic frequency effects to sensitive species
- Effects to sediment, nutrient, and contaminant transport in marine environments as energy is removed from the system;
- Effects to benthic habitats; and
- Cumulative effects of MRE devices at array scale (i.e., dozens or hundreds of devices in a given area)

These uncertainties and associated perceived risks may vary depending on the technology chosen and the ocean site selected.

A contributing factor to the persistence of these uncertainties, and the associated perceived risk they represent, is a lack of "definitive data" to characterize the likelihood and severity of potential effects. In response to these uncertainties, a growing body of literature is developing around the world that attempts to investigate and characterize the risks of MRE. The US Department of Energy is collecting this body of literature in an online repository called the TETHYS database (tethys.pnnl.gov), which currently hosts over 3,700 scientific papers related to MRE.

Another ongoing effort by the DOE National Renewable Energy Laboratory is based on the findings of a joint a series of industry/regulatory agency workshops that began in 2014 and continue to present day (Baring-Gould et al., 2016; Copping et al., 2017; Copping and Kramer, 2017). During these workshops, participants developed risk "dashboards" that represent the state of certainty and perceived risk for each major potential environmental impact associated with MRE and the subsequent level of investment that is warranted to address it. Additionally, these workshops identified potential avenues for monitoring or research to manage risk and uncertainty. Focus areas for identified potential impacts included acoustic output impacts, EMF emissions, physical interactions with devices, and project effects on the physical environment.

2.3. Relevant Risk Management Philosophies in Marine Governance

2.3.1. The Precautionary Principle

The marine management world is one of complicated choices with uncertain outcomes. The environment is constantly changing in cyclical timescale patterns. The life within migrates in search of favorable conditions, obeying no boundaries. Among this system, humans interact with the ocean, asking of it and cultivating it. In the past few decades, an emerging knowledge of the complex threats to the ocean resulting from human activities has led nations to search for simple wisdom to guide the rhetoric of their decisions. One dominant rhetorical guide in present-day ocean governance is known as the Precautionary Principle.

The concept of precaution has emerged as one of the most important alternative decision criterion for action under deep uncertainty (Lempert and Collins, 2007; O'Riordan & Jaeger, 1996). The precautionary principle or Precautionary Approach has been integrated into into international law and policy as a dominant paradigm of responsible governance. The widespread adoption of the precautionary principle has changed the way many regulatory entities exercise authority within their domains, sparking a continuing debate about the most morally and scientifically defensible way to manage risks in the face of complex systems and uncertain outcomes.

In 1971, the German phrase "Vorsorgeprinzip" (literally "precautionary principle") emerged in the German Program of Environmental Protection (O'Riordan and Cameron, 2013, p 31). Its introduction arrived after environmental catastrophes of the 1970s and 80s proved that society could not rely on science to foresee the environmental risks associated with human activities. To protect future generations, a preventative policy was needed to, “go beyond the scientific knowledge of a given moment” (Matthee and Vermersch, 2000, p 60). The precautionary principle was first explicitly stipulated by the Vienna Convention for the Protection of the Ozone Layer, adopted in 1985. From the German law, the foresight concept spread to the legal systems of other European countries, such as Denmark, Sweden and France, to address environmental issues, food safety, and public health (Andorno, 2004).

The UN World Charter for Nature (1982) contained statements that would later become essential elements of the precautionary principle, including “Activities which are likely to cause irreversible damage to nature shall be avoided," and “Activities which are likely to pose a significant risk to nature shall be preceded by an exhaustive examination; their proponents shall demonstrate that expected benefits outweigh potential damage to nature, and where potential adverse effects are not fully understood, the activities should not proceed.”

Declarations in 1987 and 1990 dedicated to protection of the North Sea also contained precursors such as, “Apply the precautionary principle, i.e. to take effective action to avoid potentially damaging impacts of substances that are persistent, toxic and liable to bioaccumulate even where there is a lack of full scientific certainty to prove a causal link between emissions and effects” (Harding and Fisher, 1999, p 31; Second North Sea Ministerial Declaration, 1987). This construction of precaution supported the idea that uncertainty about the likelihood of a risk stemming from a particular action can itself be sufficient justification to trigger a management response or prohibition of that action.

In 1992, Vorsorgeprinzip was formalized as the precautionary principle and defined in Principle 15 of the Declaration of the United Nations Conference on Environment and Development, commonly known as the Rio Declaration:

> In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. <u>Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation</u>.

After Rio, the precautionary principle spread into the legal and academic conversations of the decade. The underlined sentence was repeated word for word in The 1990 Bergen Declaration on Sustainable

Development, adopted by the European Commission for Europe (ECE) of the United Nations[2]; The 1992 Convention on Biological Diversity; The 1992 UN Framework Convention on Climate Change; and the Cartagena Protocol on Biosafety, signed in January 2000. The Rio Declaration has also become a commonly referenced basis for including precautionary concepts in international treaties and trade disputes.

A similarly worded phrase is also present in the 1998 legal decision to prevent the export of beef from the UK to other Member States amidst concerns about the spread of Mad Cow disease (Andorno 2004). The precautionary principle was also invoked in a 1995 International Court of Justice case on French nuclear testing, the guiding principles of the 1995 Agreement on Fish Stocks, and as the rationale for adding to the list of banned chemicals in Stockholm Convention on Persistent Organic Pollutants in 2004. In 2000, the Communication of the European Commission on the precautionary principle qualified it as a general principle of the European Union for human, animal, vegetable, and environmental health (Commission of the European Communities, 2000). Additionally, cases concerning the precautionary principle have appeared before international courts and tribunals, including the International Court of Justice, the International Tribunal for the Law of the Sea, the WTO Appellate Body, and the European Court of Human Rights.

In the United States, a commonly cited reference to the precautionary principle is the Wingspread Statement from the conference convened by the Science and Environmental Health Network in Racine, Wisconsin in 1998 (Wilson et al., 2006). The Wingspread Statement advocates an aggressive interpretation and has often been cited in challenges from environmental groups toward proposed actions. The statement reads:

> Therefore it is necessary to implement the precautionary principle: Where an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically. In this context the proponent of an activity, rather than the public bears the burden of proof.
>
> The process of applying the precautionary principle must be open, informed and democratic, and must include potentially affected parties. It must also involve an examination of the full range of alternatives, including no action.

[2]While the Bergen Declaration predates the Rio Declaration and contains the same language, the latter is credited as the origin of the precautionary principle in the modern environmental management context.

In the US, precautionary approaches have been embodied in the Clean Air Act, the Toxic Substances Control Act, and the Occupational Safety and Health Act, among others. Challenges to these acts in court have led to judicial support for agency adherence to precautionary measures (Ashford, 2006). Courts acknowledged that even in the case where the scientific basis for a threat to health or the environment is not compelling, regulators have the discretion to, "err on the side of caution," often without laying down a specific requirement to do so, although the directive to do so is often found in the enabling legislation of various regulatory regimes (Restrepo et al., 1998; US DOI, 2016).

The Precautionary Approach to Ocean Management

Francis et al. (2007, p 219) evaluated the precautionary approach to fisheries management and argue that the complexity of the ocean biological system is such that "fishery science will always be severely data-limited and uncertainty will always be high." They assert that, "Once fisheries are viewed from a holistic perspective, then ecosystem-based fisheries science necessarily becomes both risk-averse and adaptive" This same conclusion also arguably holds true for other human industries interacting with the ocean environment.

Agencies responsible for enforcing the Endangered Species Act (ESA) (USFWS and NOAA Fisheries) follow a precautionary approach when deciding whether to list or delist species to account for uncertainty about the population and survivability of the species in question (Prato 2005). When there is uncertainty about whether listing or delisting is in the best interest of the species, "precaution requires erring on the side of protecting a species even though it may not be in danger of extinction as opposed to not protecting a species and running the risk of it becoming extinct (Prato, 2005, p 809)".

The Marine Mammal Protection Act (MMPA) is similarly built with precaution as a guiding philosophy for management. Rizzardi (2014 p 213) argues that the precautionary principle, "lies at the very heart of the MMPA," referring to the 1971 debates in the House of Representatives over the legislation that,

> It seems elementary common sense to the Committee that legislation should be adopted to require we act conservatively – that no steps should be taken regarding these animals that might prove to be adverse or even irreversible in their effects until more is known (Rizzardi, 2014, p 213).

The general prohibition against taking of any kind supports the notion that the MMPA is a precautionary law that preemptively prohibits any action with a potential negative effect, even if the likelihood of a negative impact is uncertain.

A criticism of the integration of the precautionary principle into species protection laws is that it does not allow comparison of the benefits or costs of protecting versus not protecting the environment or a species unless the threat of extinction is very low. This feature of the precautionary principle makes it unacceptable to some groups, because as Van den Belt (2003, p 1124) points out, "Reversing the burden of proof would amount to substituting the maxim 'guilty until proven innocent' for the age-old legal principle 'innocent until proven guilty.'"

Ecosystem Based Management and the Precautionary Principle

Justifications for the use of the precautionary principle as a guiding principle in ecosystem-based management (EBM) appear to derive not only from a safeguard against losing that which is irreplaceable, but to acknowledging the inherent complexity of the ocean system.

A guide for EBM of the Oceans (McCleod and Leslie, 2012, p 331) states that the model of EBM emphasized in their manual, "focuses mainly on a precautionary approach to management, in which complexity and non-linearities in the behavior of the ecosystem necessitate preparation for and expectation of surprises in the system." They argue that a morally justifiable marine EBM management philosophy must honor the precautionary principle, whereby in cases of scientific uncertainty regarding the ramifications of particular actions, priority will be given to the environmental and human health without having to wait until the reality and seriousness of those adverse effects become fully documented scientifically. EBM acknowledges that changes to the ocean are increasingly non-linear, and a precautionary approach to management is to, "presume that alternate ecosystem States (including undesirable States) exist until data indicate otherwise and to manage with the expectation of surprise (McLeod and Leslie, 2012, p 342)."

At the statewide level, Oregon Planning Goal 19 governs the development of ocean resources. It favors an EBM approach and requires planning activities, "to take a precautionary approach to decisions about marine resources and uses when information is limited" (p 3). Oregon also engaged in a Territorial Sea Planning process for MRE projects in State waters in Part V of the Oregon Territorial Sea Plan. Part V of the plan States that, "Oregon prefers to develop renewable energy through a precautionary approach that supports the use of pilot projects and phased development in the initial stages of commercial development" (State of Oregon, 2013, p 1).

The Burden of Proof

One of the hallmark changes in risk management associated with the precautionary principle is a shift in the burden of proof toward the proponent of an action, rather than having it be incumbent on the government or an aggrieved party to prove that an activity or new product causes harm. Any new perturbations of the system are effectively guilty until proven innocent. This has proven understandably unpopular among entrepreneurs, industrialists, and innovators. Among conservationists, health and safety officials, and risk-averse natural resource managers this redirection of responsibility is credited with a greater ability to prevent indirect or irreparable loss (Van den Belt, 2003; Saunders, 2000).

In the strictest formulation of the precautionary principle, the shifting burden of proof requires proponents of an action to make their mistakes and learn the accompanying lessons before being allowed to spread into a vulnerable environment. Andorno (2004, p 19) reasons, “This change is justified because hazard creators are those who will benefit economically from the products or activities in question and therefore, society has the right to expect them to assume, at least in part, the costs of the risk assessment.” The greatest challenge to this approach is the fact that, “nothing can be proven un-dangerous,” and it is a heavy burden for a proponent of an activity or technology to provide definitive evidence that there is an absence of risk (Lomburg, 2014; Munthe, 2011). In this instance the precautionary principle often connects with traditional risk science, requiring hazard creators to establish the nature and extent of any potential risk relative to an agreed-upon acceptable level of safety.

<u>Conflicts and Criticism with the Precautionary Principle</u>

Since its debut in international law in the early 90s, opponents of the precautionary principle have argued that it, “has undermined the scientific process, can be used to mask economic protectionism, has stifled the advancement of science and technology, and lacks sufficient content to be an effective modality of risk management (Wilson et al., 2006, p 982).”

One of the most frustrated interpretations of the precautionary principle accuses it of having become “weaponized” in the EU regarding chemical safety:

> The vamped-up precautionary principle is inherently self-contradictory. Notice how it suggests that you should only do safe actions. But as nothing is entirely safe, you get a different outcome depending on the question you ask. If you’re lying under your bedcovers and ask: ‘Can I prove that it is safe to stay here?’, you would have to say no. Eventually you’re going to starve, which is clearly not safe. Both staying in and going to the store for food are forbidden by this interpretation of the precautionary principle (Lomburg, 2014).

Johnson, (2012, p 1) further cautions that, “Choosing the safest course of action may entail foregoing potential benefits afforded by riskier actions. Avoiding risk may lead to regret over missed opportunities, raising the prospect of being both safe and sorry.” The precautionary principle as enacted favors the precious – that which cannot be lost. It charges the leaders of today with a responsibility to, “give in matters of a certain magnitude – those with apocalyptic potential – greater weight to the prognosis of doom than to that of bliss” (Jonas, 1984, p 34).

2.3.2. Adaptive Management and Monitoring Regimes

The concept of adaptive management is a risk management approach that has been described as walking “hand in hand” with the precautionary principle (Francis et al., 2007). It is predicated on the basic premise that, “if human understanding of nature is imperfect, then human interactions with nature [e.g., listing or delisting species] should be experimental” (Lee 1993, p 53). Proponents of adaptive management assert that ecosystem based management of fisheries should incorporate scientific trial and error, with extensive monitoring regimes to investigate the effects of the management decision and plan the next iteration (Morrison-Saunders et al. 2007; Stankey, 2003). “As originally proposed by Holling (1978) and refined by Lee (1993), adaptive management treats economic uses of nature as experiments so that we may learn efficiently from experience” (Francis et al., 2007, p. 220).

Adaptive Management is not without its weaknesses, and its relationship with the precautionary principle is complicated despite the fact that both approaches seek to increase understanding of a system and decrease the amount of uncertainty associated with a proposed action. One article observes, “There is a natural tension between adaptive management and the precautionary principle. Adaptive management requires a degree of risk taking as policies are implemented as experiments with uncertain outcomes, and advocates of precaution are wary of actions that may entail unforeseen results” (Johnson, 2012, p 9).

Kallis et al. (2009) points out an “interesting contradiction in the logic of AM” that potentially puts it at odds with the precautionary principle. He echoes the reasoning of Owen (2009) who observed that, “while AM recognizes the inherent uncontrollability of complex socio-ecosystems, the objectives of experimentation are ultimately to improve our capacity to understand and better control the system” (Kallis et al., 2009, p 641). The alternative perspective under a precautionary approach would therefore be to “limit human intervention on ecosystems given the limitations of our understanding” (641).

According to Council on Environmental Quality (CEQ) regulations regarding the completion of NEPA reviews, adaptive management practices may be included in an Environmental Assessment or

Environmental Impact Statement to assist a project with meeting its environmental obligations, particularly where long-term impacts are uncertain and future monitoring might change later implementation decisions. 43 C.F.R. §§-46.310, 46.415 (2012).

As described by MRE scholars (Masterson, 2014; Jansujwicz, 2013; Oram and Marriott, 2010), adaptive management has emerged as an effective framework for managing risk and uncertainty within MRE permitting projects. In a study of the Ocean Renewable Power Company tidal energy project in Maine (which is also a case study in this research), Jansujwicz (2013) found that, "there was also widespread recognition that the only way to determine the feasibility and effects of hydrokinetic projects was to "learn by doing'" (263). With many interests and authorities involved in the permitting process, adaptive management as a framework also requires that, "the adaptive manager be an able negotiator as much as a visionary scientist" (Jansujwicz, 2013, p3; Lee 1993, p 80).

2.4. Requirements and Authorities of an MRE Permit

In order to gain permission to be installed in the ocean, a MRE project must obtain a number of permits and licenses from various Federal, State, and local government entities. It must also demonstrate that it adheres to all applicable environmental protection and human safety regulations, both during installation and throughout the life of operation. The Federal Regulatory Energy Commission (FERC) is the lead Federal agency for the licensing of marine hydrokinetic (MHK) projects (i.e., wave and tidal energy capture technologies) in the United States. Non-Federal projects fall within FERC's jurisdiction when they are located in navigable waters of the United States and are connected to an interstate electrical grid.

Masterson (2014) organized the framework for environmental review of MRE projects into three major areas: (1) the Federal Power Act, (2) the National Environmental Policy Act (NEPA), and (3) targeted environmental statutes such as the Endangered Species Act (ESA) and the Coastal Zone Management Act (CZMA). Pacific Energy Ventures (2009) summarizes the major laws that integrate with the MRE permitting decision. Each legal authority associated with the MRE permitting process is accompanied by an enacting agency whose staff interpret and execute their authorities within the process. For the purposes of this chapter, agency authorities will be described according to their roles within the FERC licensing process: lead, cooperating, or consulting agencies.

As the licensing of an MRE project constitutes a major Federal action, FERC is also the lead agency for the purposes of the administrative and environmental evaluation requirements of the National

Environmental Policy Act (NEPA). The Bureau of Ocean Energy Management (BOEM) has lead authority over resources on the outer continental shelf, and as a result of a Memorandum of Understanding signed with FERC in 2009 they have authority over the issuance of seafloor leases and rights-of-way for MHK projects.

Cooperating agencies are those that will be issuing their own approvals for aspects of the project, such as the use of navigable waters, and therefore are also subject to NEPA. At the Federal level they include the Department of Energy (DOE), US Army Corps of Engineers (USACE), and the US Coast Guard (USCG). For the PMEC-SETS project in Oregon, BOEM also elected to participate as a cooperating agency for the NEPA process rather than as a co-lead, presumably to reduce potential process-related conflicts.

Consulting agencies are those with whom FERC must consult before issuing a license per the Federal Power Act (16 U.S.C. 792 et seq.) and the Fish and Wildlife Coordination Act of 1934. They include the National Oceanic and Atmospheric Administration (NOAA), the US Fish and Wildlife Service (USFWS), and relevant State authorities, and they provide input to the FERC license in the form of official comments regarding the consistency of the proposed action with regulations under their responsibility (e.g., essential fish habitat under the Magnusson Stevens Act (MSA) administered by NOAA or Endangered Species protection under the Endangered Species Act administered by NOAA and the USFWS). Consultations also evaluate the adequacy of the environmental information, provided by the applicant and incorporated in the NEPA environmental analysis, to ensure that the environmental impacts from the project are sufficiently understood. Masterson (2014) notes that, while environmental review is required under the FPA, “such analysis is completed pursuant to the guidelines of key Federal environmental statutes rather than under the FPA itself, thus impacting the type of environmental analysis that occurs” (p.10).

Following consultation, FERC has the authority to request that the applicant perform additional studies or to include conditions in an approved license such as monitoring or mitigation activities. Some consulting agencies also have conditioning authority for a FERC license under the FPA. For example, the agency responsible for making a Federal Consistency determination under the CZMA in each State (e.g., DLCD in Oregon and the State Planning Office in Maine) can set mandatory conditions on the license to ensure that the MRE project is consistent with State ocean management plans.

Outside of the FERC licensing process, separate agency-specific approvals may include incidental take permits under the ESA or MMPA, a removal/fill permit under the authority of the USACE for the use of anchors and moorings, or private navigation aid permits under the USCG and USACE (33 CFR 66 §66.01; 33 CFR 322). Additionally, transmission cables that cross through State waters (up to 3 nautical miles offshore) must obtain seafloor leases and rights-of-way from the authorized agency (Department of State Lands in Oregon and Department of Conservation in Maine, for example). Once a cable comes ashore, the associated grid interconnection infrastructure must comply with State and local plans and ordinances, as well as any State or Federal regulations pertaining to the protection of terrestrial species and environments. Since 2013, projects in the State of Oregon are also required to adhere to the standards set in Part V of the Oregon Territorial Sea Plan and provide proof of decommissioning financial assurance (SB 606; ORS 274.879).

2.5. FERC Licensing Process Options

There are currently three "process tracks" for full licenses (30-50 year duration): the Traditional Licensing Process (TLP); the Integrated Licensing Process (ILP); and the Alternative Licensing Process (ALP).

The basic parts of a FERC licensing process are:

- Submission of a Notice of Intent to initiate a licensing process and application for a preliminary application, which reserves a location for an applicant while the licensing process is ongoing.
- A public scoping process under NEPA.
- A pre-filing consultation process with resource agencies, which includes completion of environmental studies to support development of an environmental analysis under NEPA.
- Submission by the applicant of a Draft License Application, containing all relevant project information including environmental studies.
- Evaluation of project impacts by FERC, via generation of an Environmental Impact Statement or Environmental Analysis pursuant to the National Environmental Policy Act.
- Other Federal and State regulatory reviews, pursuant to such authorities as, among others, Sections 4(e), 10(j), and 18 of the Federal Power Act, Section 401 of the Clean Water Act, Section 7 of the Endangered Species Act, and Section 106 of the National Historic Preservation Act [appendix A of ALP final has the full list of applicable regs]
- Based on the environmental review and consultation with other agencies, FERC may request additional information or studies from the applicant.
- Approval of a FERC license, OR a negotiation process toward the filing of an agreement of an Offer of Settlement with FERC.

The three process “tracks” represent varying routes by which an applicant may navigate these essential steps in the licensing process.

Figure 1 shows a representation of the FERC licensing processes and highlights the components that differentiate them.

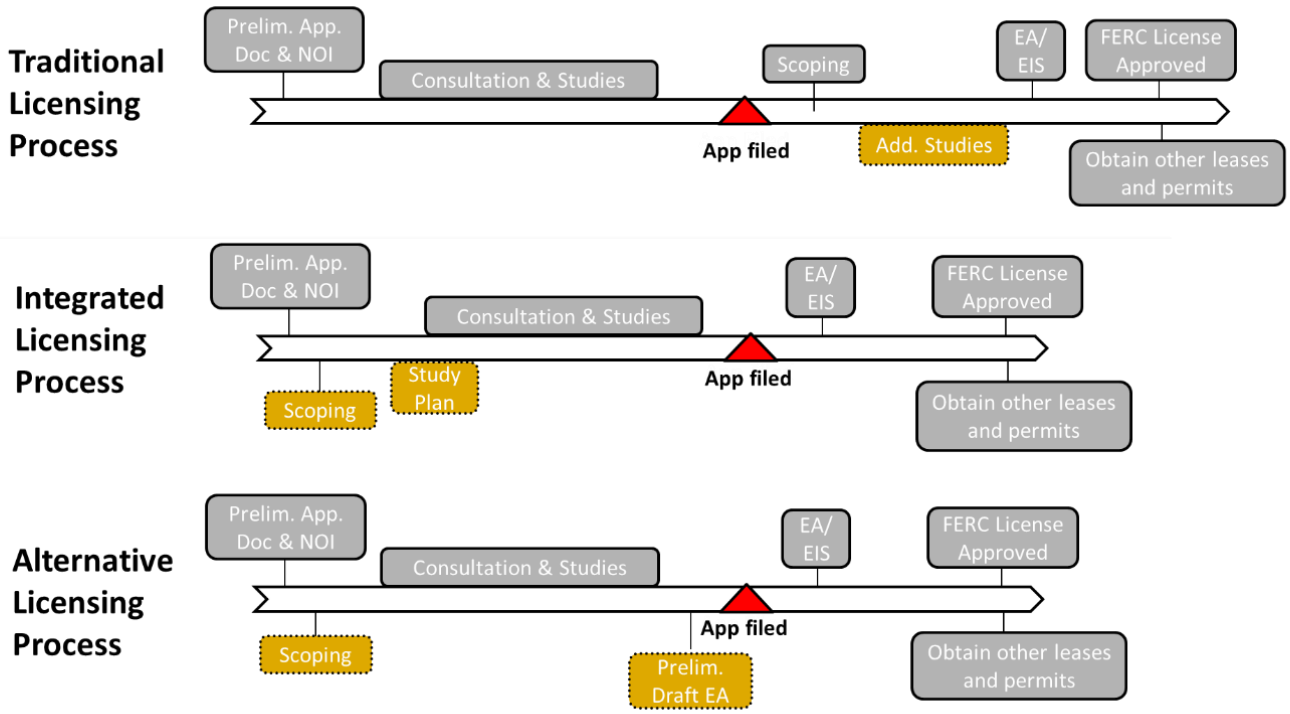

Figure 1. FERC License Process Tracks (adapted from Carter, 2015)

The TLP was the first process option under the FPA, and it is expected to take at least five years to complete (Gaffney, 2008). The traditional process provides that the formal proceeding before FERC does not begin until the application is filed, and FERC staff generally does not participate in prefiling consultation. After the application is filed, the Federal agencies with responsibilities under the Federal Power Act and other statutes, the States, Indian tribes, and other participants have opportunities to request additional studies and provide comments and recommendations. Although emphasizing extensive prefiling consultation, the traditional process has come to be viewed as “adversarial and applicant-driven.” (Swiger and Grant, 2004, p 1) Moreover, the initiation of National Environmental Policy Act (NEPA) scoping often provides a “second bite” opportunity for resource agencies to raise new issues and expand the record (Swiger and Grant, 2004).

The ALP first emerged in 1997 and in its initiating regulation is explicitly designed to be a collaborative process under the expectation that,

> Early resolution of issues can result in less time and expense for the participants than the longer traditional process. . . A collaborative process affords all participants an opportunity to reconcile different interests and concerns. This process encourages participants to be flexible and creative in attaining their objectives (Interagency Task Force on Improving Hydroelectric Licensing Processes, 2000, p iv).

An applicant may use the alternative process, "if it can demonstrate that a consensus exists among the applicant, resource agencies, Indian tribes, and citizen groups that the alternative procedures are appropriate under the circumstances." (Swiger and Grant, 2004, p 1)

The ALP allows pre-filing consultation and environmental review procedures to proceed concurrently. The ALP also allows the permit applicant to prepare their own preliminary draft environmental assessment prior to filing the formal license application with FERC. By allowing the applicant to draft the first environmental review, they become the de facto convener of the collaborative pre-filing consultation process because they must gather input from the agencies and accurately reflect the outcomes of the collaboration in the documents. Additionally, by having the Preliminary Draft Environmental Analysis occur prior to filing of the license application, theoretically the post-filing consultation between FERC and the relevant agencies would be streamlined because there are "no surprises" in the environmental analysis (Interagency Task Force on Improving Hydroelectric Licensing Processes, 2000, p 18).

The ALP requires development of a communications protocol, which includes a charter for a Collaborative Working Group (CWG) of participating agencies. In Oregon, the CWG communications protocol includes governing rules for a consensus-based process of information sharing to create "CWG Products" that will be incorporated into the application filing. Consensus agreements are not legally binding but assume a good faith intent by all agencies to act consistent with the agreement within their respective authorities.

Another key feature of the ALP is that FERC has a more active role in the collaborative process. Under the TLP and ILP, FERC *ex parte* rules do not permit Federal resource agencies with mandatory conditioning authority to be both cooperating agencies under NEPA (meaning they have access to informal communications with FERC) and intervenors for purposes of challenging a FERC license. FERC ultimately concluded that, "Precedent indicates that allowing Federal agencies to serve both as cooperators and intervenors in the same case would violate the [Administrative Procedures Act].” (Swiger and Grant, 2004, p 2)

Because the ALP is designed as a collaborative process, dispute resolution is expected to occur informally within the collaborative process rather than via the formal FERC process. The FERC Order instituting the ALP stated, “We proposed to leave the existing, non-mandatory and non-binding dispute resolution procedures applicable to the ALP in place because mandatory, binding dispute resolution appears to be incompatible with the collaborative nature of the ALP.” (FERC Order 2002). ALP participants may request formal dispute resolution under FERC, but a resource agency may object to formal dispute resolution regarding subject matter of its statutory obligations (Interagency Task Force on Improving Hydroelectric Licensing Processes, 2000).

The ILP is the newest of the processes, emerging in 2003, and is currently the default process for new license applicants (Swiger and Grant, 2004). It combines the multi-agency integration components of the ALP with the schedules and formal dispute resolution process of the TLP, but it must adhere to the ex parte requirements of FERC under the Administrative Procedures Act (APA), which prevents informal communications between FERC and cooperating agencies in the development of the Environmental Impact Statement (EIS) under NEPA. The ILP requires completion of a FERC approved study plan in consultation with resource agencies during the pre-filing consultation stage and encourages informal resolution of disputes associated with the determination of necessary studies, although formal dispute resolution under FERC is an option under the ILP. The ILP also contains process schedules and deadlines that, if missed, lead to cessation of the licensing process (Interagency Task Force on Improving Hydroelectric Licensing Processes, 2000). Based on interviews with permitting process participants during this research, it was clarified that the ILP was originally envisioned to streamline the re-licensing of an existing project, such as a hydroelectric dam, where many aspects of the project and its environmental effects have been more clearly defined over time.

Alongside these process options, FERC added the option in 2008 to apply for a 5-year Pilot Process for projects that are experimental in nature. The pilot licensing process was developed following the “Verdant Orders” in which, “the [FERC] interpreted the Federal Power Act in a flexible manner that allowed an experimental deployment without a license.”[3] The Pilot License path was envisioned to follow the ILP track. Applicable pilot projects are: “short-term; can be quickly modified, shut-down, or removed

[3] https://www.ferc.gov/industries/hydropower/gen-info/licensing/hydrokinetics/pdf/white_paper.pdf

if significant, unforeseen risks to public safety or adverse environmental impacts occur; are not located in areas designated as sensitive by the Commission; and are removed, with the site restored, before the end of the license term" (FERC, 2008, p 5). When issuing the pilot process, FERC stated that,

> "[The] Staff's goal is to provide expedited procedures through which a Commission decision can be rendered in as few as six months after the filing of the application. The procedures will be oriented toward the characteristics of small, pilot projects with short license terms. They will emphasize post-license monitoring with the possibility of modifying, shutting down, or removing a device that presents an unforeseen risk to public safety or environmental resources. (FERC, 2008, p 4)"

In order to satisfy requirements of a pilot license, the applicant will need "sufficient information to describe site conditions and identify potential project issues." FERC notes that such information will need to be gathered as part of the process if not already available. The pilot license application must also propose a monitoring plan to identify potential environmental effects that result from project operation.

3. Research Purpose and Expected Outcomes

Because the permitting and risk governance process for MRE has been recognized as a significant influence on the growth of the industry, and because it resembles many aspects of EBM, there is value in better understanding this multi-sector socio-technical process and the risk perceptions of its participants. Additionally, it may be valuable to understand how processes that feature collaboration might affect the quality of interconnection between the different sectors of government that play a part in the permitting decision. Potential benefits of this research may include:

- identification of approaches to risk and uncertainty management that are acceptable to regulatory agencies and other communities of interest;
- an increased awareness of ocean management principles relating to risk and uncertainty management for new uses of the ocean;
- consideration of new scientific findings or investigation or monitoring methods that have reduced perceived risk in the examined MRE permitting processes;
- identification of best management practices and process innovations that may increase the efficiency of the MRE permitting process; and
- more effective interagency and interpersonal interactions in future permitting processes based on an increased understanding of lessons learned during past collaborations.

Ultimately, the hope is toward more effective governance of the ocean and improved communication between MRE applicants and those who govern ocean risk.

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Chapter 2: Adaptive Meets Precautionary – Collaboration and Risk Perception in MRE Permitting Processes

Abstract

Despite its promise as a potentially beneficial new source of energy, the ocean-based renewable energy industry is still in its infancy, and like any new idea there are many unknowns with the potential to affect both people and our natural environments. A permit for marine renewable energy (MRE) must cut across many sectors of ocean management and serve many masters at once. The permitting process for MRE is where the social and the technical combine, using the best available science to meet the needs and legal requirements of each agency at the table in order to manage both short-term and long-term risk. This research analyzes examples of collaborative marine risk management in practice, when multiple government agencies must work together to identify and manage uncertainty and risk associated with permitting MRE projects in the United States. Two case study projects from Oregon and Maine are examined based on semi-structured qualitative interviews with process participants, analysis of relevant project documents, and participant observation of publicly available presentations, workshops, and conferences. This research provides a characterization of the varying perceptions of risk and uncertainty within the collaborative permitting process, and assesses the role collaboration in the permitting process plays in the perception and management of risk.

1. Introduction

Despite its promise as a potentially beneficial new source of energy, the ocean-based renewable energy industry is still in its infancy, and like any new idea there are many unknowns with the potential to affect both people and our natural environments. It is important to understand how our system of government makes decisions about new and potentially risky uses of the ocean such as marine renewable energy (MRE), as the process reflects our relationship to our environment and an uncertain future.

During the past 50 years, the ocean has been protected by laws that restrict human activity unless it can be reasonably proven that our presence will not pose an adverse effect on protected marine species and critical marine and shoreside terrestrial habitat environments. A new use such as MRE must also comply with laws governing safe navigation and use by fleets of ships and other seaborne equipment such as buoys, oil platforms, undersea cables, and other existing permitted human uses. Fishing gear and practices do not have an explicit law protecting their right to a place within the seascape, but socioeconomic effects of a proposed action must also be evaluated as part of the environmental impact assessment, so these users become a stakeholder in the ultimate decision. A permit for MRE must therefore cut across many sectors of ocean management and serve many masters at once.

Each agency involved in the decision whether and how to allow MRE has its own process for consultation or permitting, which in past years energy companies have said made their overall process confusing, lengthy, and prohibitively costly (Dubbs, 2013). According to the 2016 Annex IV State of the Science for Marine Renewable Energy, “The consenting process is still regarded as a barrier for the sector to scale up and become cost-competitive with other forms of electricity generation.” As summarized by Copping et al. (2016, g), “Time-consuming procedures — linked to uncertainty about project impacts and the need to consult with numerous stakeholders before reaching a permitting decision — appear to be the main obstacles to consenting of ocean energy projects.”

Much has been written about the need for marine spatial planning, collaboration, ecosystem-based management, and adaptive management as administrative tools toward holistic management of the ocean space for multiple uses (Lubell, 2004; Levin and Lubchenco, 2008; Oram and Marriott, 2010). Emphasis has also been given to the importance of understanding the relationship between science and human values in decision-making. This research analyzes examples of collaborative marine risk management in practice, when multiple government agencies must work together to identify and manage uncertainty and risk associated with permitting hydrokinetic MRE projects in the United States.

The purpose of this research is to document and understand the human, technical, and institutional factors at play within the collaborative risk governance arena of the MRE permitting process. It is hoped that the findings of this research may improve the effectiveness and efficiency of these processes in the future and promote an improved understanding of how risks to ocean users and associated communities are managed within the agency-based governance structure of the United States. With this increased knowledge, stakeholders may be better positioned to ensure that their values and concerns are being appropriately upheld within the process and/or identify appropriate ways to participate in the process and have their values and concerns addressed.

2. Methods

~~This section describes the design and methodology of this sociological research effort. A record of research methods allows reproducibility of results.~~ The research presented here was performed between September 2015 and September 2017 and consisted primarily of qualitative semi-structured interviews, supplemented by an analysis of relevant documents. It is a mixed-methods qualitative case study involving two MRE projects in the United States that utilized a self-described collaborative approach to the licensing and permitting process. Case studies are defined by Yin as, "an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used (Yin, 1984, p. 23)." A case study approach was selected because: 1) a permitting process for an individual MRE project is a phenomenon involving a distinct population of participants within a specific context; 2) similarities or differences between cases may reveal significant themes; and 3) the research focuses on in-depth qualitative interviews soliciting individual perceptions, which are compared against perceptions from other participants in that case and across cases.

2.1. Research Question

Given the gaps in the research described above, this research asks the following research question: "In the context of MRE projects, what is the interrelationship between collaboration in multi-agency permitting processes and the perception and management of uncertainty and risk?" Within this research question are related inquiries regarding how participants in MRE permitting processes perceive uncertainty and risk and how they perceive the collaborative process in which they participated.

2.2. Case Study Selection

An initial list of potential case study projects was developed based on secondary document and Internet-based research, including the marine hydrokinetic projects listed on the FERC Hydrokinetic Projects tracking website[4] (FERC 2017). This list was then narrowed based on the project's ability to meet the following selection criteria:

- The project must involve the licensure and/or permitting of a MRE project;
- The permitting process must have incorporated formal or informal collaboration between multiple regulatory agencies;
- The permitting process must have explicitly addressed uncertainties and risk management;

[4] http://www.ferc.gov/industries/hydropower/gen-info/licensing/hydrokinetics.asp

- The selection of projects will be limited to the United States, to control for variations in institutional structures and underlying regulations in other countries. Non-project-specific comparisons may be drawn as appropriate from secondary literature regarding EU permitting processes.
- Successful acquisition of a permit was not a requirement for selection.

The final list of case studies to undergo direct participant interviews was ultimately limited to two projects: the Pacific Marine Energy Center-South Energy Test Site (PMEC-SETS), planned for offshore Newport, Oregon; and the Ocean Renewable Power Company (ORPC) Cobscook Bay tidal energy pilot project near Eastport, Maine. This decision was made for the following reasons:

- Time constraints in the research schedule, coupled with the number of participants in a given MRE permitting process, limited the ability to capture a broad range of participant perspectives from more than two projects during the available research period.
- The chosen case studies are still actively ongoing, which improved the ability to locate current process participants with fresh recollections of interactions.
- A case study for an offshore wind project (the Block Island Wind Farm project in Rhode Island) was considered for inclusion but ultimately dismissed because it operates under a different process framework led by BOEM and would complicate an analysis of the decision-making structure of the process.
- The chosen case studies provided greater opportunity for in-person interviews given a lack of travel funding and the proximity of these process participants to Oregon and planned travel to Maine during the research period.

2.3. Study Population

For each of the selected case study projects, an initial list of potential interview participants was generated purposively (Palinkas et al., 2015; Creswell, 2007) from permitting process-related documentation such as mailing lists, official correspondence, and permit application documents. This list was supplemented by snowball sampling (Creswell, 2014) based on recommendations from interview participants regarding other relevant perspectives to gather. Interviews were gathered opportunistically from the list of potential participants within the time constraints of this research effort, with preference given toward agencies with lead permit approval authority or consultation authority for environmental protection laws.

Eligible participants were limited to people with direct experience interacting in multi-party permitting process meetings, however due to staff turnover among government agencies and MRE developers, not all interviewees were participants throughout the entirety of their respective multi-year collaborative permitting processes.

For this research, a total of 16 participants were interviewed directly. Input from an additional seven participants was also obtained from participant observation of publicly available presentations, workshops, and conferences.

Limitations of the study

It should be noted that not all organizations associated with the MRE licensing and permitting decisions for their respective projects were able to be interviewed. As a result, this research should not be considered a comprehensive representation of all process participant perspectives. Furthermore, while multiple people with differing specific responsibilities from a given agency or organization may have been involved in the permitting process, interviews were limited to one person per agency or organization per project. In cases where multiple potential interview participants were identified for a particular entity, the decision regarding who to recruit for this research was based on guidance from other process participants or from recommendations by management level personnel at the entity in question. Perspectives not gathered as part of this research included tribes, local government (i.e., city or county personnel), nongovernmental organizations, or economic stakeholders such as the fishing community. Some of the interview participants referred to these types of stakeholders and will be discussed later.

2.4. Qualitative Interview Methods

A multi-method approach (Creswell, 2014; Ingles, 2007) was utilized to collect both primary and secondary data from the two case study MRE projects. Research participants engaged in semi-structured interviews (Creswell, 2007), conducted by the researcher, with open-ended questions focused on the themes of this research topic: perceptions of uncertainty and risk, perceptions on collaboration, and perspectives regarding the permitting process itself.. The methodological approach followed selected tenets of grounded theory, such as inductive reasoning, a focus on process, and an emergent style of investigation and knowledge pursuit (Glaser and Strauss 1967; Strauss and Corbin 1990; Auerbach & Silverstein, 2003).

Interviews were conducted in person or via telephone and typically lasted for 1-2 hours. Interviews were audio recorded and transcribed verbatim to ensure consistency and open-coding analysis (McLellan, MacQueen, and Neidig, 2003). In-person interview locations were chosen by the participant and often took place in private offices or conference rooms, while phone interviews most commonly took place with the participant in their workspace. To attain full transparency and secure consent, the researcher began each interview with a full explanation of the project's goals and intentions and obtained consent for capturing the audio content of the interview. This is consistent with the requirements of the Institutional Review Board, and interviewees were assured that the information they provided would be kept confidential to the extent permitted by law. Others may know that they had participated in the research, but nothing they said would be directly attributed to them or their organization. Interviewees were informed of their rights as participants in human subject research and were asked to sign a written informed consent document or provide verbal consent prior to their interviews.

A set of semi-structured interview questions was formulated by the research team to initiate and guide interviews (Appendix B). Participants directed the dialog, often lending insight into tangential but important issues in the process. The questions for the semi-structured interviews were focused on one of three general topic areas: perspectives on collaboration within the permitting process; perceptions of uncertainty and risk associated with the MRE permit decision; and elements of the authorities and structure of the MRE permitting process itself that may have affected process outcomes.

The semi-structured interviews are supplemented by textual analysis of publicly available documents pertaining to the selected case studies, including relevant laws, directives, and guidance from agencies, permit application documents, working group charters, interagency correspondence, and Memoranda of Understanding between agencies. These documents provided additional insights into the permitting process structure, the roles of the participants around the table, and the dominant risks that were managed within the process.

2.5. Data Analysis

Collected data were coded and analyzed using a modified grounded theory qualitative analysis, with support from the software program MAXQDA12 (Auerbach & Silverstein, 2003; Strauss & Corbin, 1990). The grounded theory approach to data analysis utilizes an inductive-coding framework to extract repeating ideas and themes from data (Miles, Huberman, & Saldana, 2014) and identify emergent themes, patterns, and relationships among participants in the MRE permitting process.

The coding process includes two rounds of analysis that extract repeating ideas, then generalize themes. The first round of coding classified text along general thematic categories (e.g., roles within the process, authorities, risk perceptions, uncertainty, collaboration experiences). The second round of coding expands upon the codes to include more detailed aspects of the text themes. This aided in determining if there were any underlying themes that were initially missed in the first round of coding. The final round of coding consolidated and organized the codes relative to the theoretical framework of the research. This refines the themes and produces the final narratives behind each theme.

In the early stages of the coding process, inter-coder reliability was practiced. Two other social science researchers on the research team independently coded a sub-set of transcriptions, and these results were compared to the original analysis to ensure emerging themes were similar across researchers. This process increased validity and reliability of data analysis (Auerbach & Silverstein, 2003; Bernard, 2011; Miles et al., 2014; Robson, 2011; Ryan and Bernard, 2003; Strauss & Corbin, 1990).

2.6. Ethics

Standard Institutional Review Board (IRB) verification protocol was followed, and acceptance was granted for the participation of human subjects in this study. Due to the demographic configuration of participants, this study did not interview any vulnerable populations. Prior to data collection, ethical training was required to ensure the appropriate consent, confidentiality, and data collection and storage parameters were followed.

In accordance with IRB protocol, participant consent was required for the audio recording of all interviews. The goals and intentions of the study were explained in full, and an opportunity to ask questions was given to every participant before pre-approved IRB consent form was distributed (Appendices B). All interviews were voluntary, and participants had the right to decline recording. Participants also had the right to remove their interview consent freely at any time.

3. Case Study Context

3.1. PMEC-SETS Wave Energy Test Facility, Oregon

The Pacific coast of North America possesses an enormous amount of kinetic wave energy which, if converted into electricity using a collection device, has the potential to offer a substantial renewable energy resource that could replace other greenhouse gas-producing energy sources. The wave energy industry is still in its infancy, however, and its potential is hindered by a lack of direct experience testing new device designs in the marine environment.

To address this challenge, in 2013 the Northwest National Marine Renewable Energy Center (NNMREC) at Oregon State University embarked on an effort to license and construct a wave energy test facility off the coast of Oregon (known as the Pacific Marine Energy Center - South Energy Test Site or PMEC-SETS), which would offer a preapproved venue for inventors to test their devices with a minimum of regulatory barriers. As currently envisioned, PMEC-SETS would consist of four grid-connected test berths, each with a capability to test up to five wave energy conversion devices, located approximately six miles offshore southwest of Newport, Oregon.

Following a successful public siting process (Goodwin, 2015), OSU requested to follow the Alternative Licensing Process toward a full FERC license. Prior to official approval to use the ALP, the license applicant (OSU as represented by NNMREC) formed a Collaborative Workgroup (CWG) as the venue for permitting discussions and developed a Communications Protocol pursuant to 18 CFR Section 4.34(i)(3). The CWG was comprised of, "the agencies and stakeholders who began coordinating with NNMREC-OSU in early 2013, as well as representatives of other State and Federal agencies, local government, Native American tribes, and commercial fishing, conservation and recreation interests" (NNMREC, 2012). The stated purpose of the CWG during the application pre-filing consultation phase of the ALP is to:

- Identify issues, concerns, goals, statutory responsibilities, and information needs relating to the proposed project.
- Identify and share any relevant information and data that can be used to inform the development and assessment of the proposed project.
- Identify and assess any potential gaps in the available information and suggesting ways to gather such information, including how it will be collected and how it will be used.
- With the facilitator's assistance, establish priorities, deadlines and critical paths essential for progress and achievement of desired outcomes in an efficient, effective manner.

A draft Communications Protocol (NNMREC, 2013) was distributed to the CWG by the applicant in November 2013. The protocol establishes the ground rules for the information sharing and decision-making to occur during the pre-filing consultation, including a conflict resolution process. After a process of consultation and refinement, in March 2014 a total of 20 entities representing the CWG unanimously motioned their support for the Communications Protocol for the purposes of carrying out the ALP.

The CWG pre-filing consultation process is still ongoing as of 2017, with submittal of the Draft License Application to FERC expected toward the end of the year. The final permit application for the SETS is currently behind the planned schedule due to the need for unforeseen additional studies that emerged from the process. As such, the value of the experimental collaborative regulatory approach is not yet clearly understood. The findings of this research represent a snapshot of an ongoing process and should be considered in the context of the time when it was performed.

3.2. ORPC Cobscook Bay Tidal Project, Maine

In 2006, Ocean Renewable Power Company (ORPC) submitted an application to FERC for a License to construct a tidal turbine array in Cobscook Bay (CB) within the Bay of Fundy, offshore of Eastport, Maine. FERC became the lead agency for an Integrated Licensing Process involving the developer and State and Federal agencies with jurisdiction over the decision whether to permit placement of the device. ORPC received the preliminary permit from FERC in July 2007. This original project was large in scope, with 100 to 150 generation devices planned for Cobscook Bay.

In June 2008 ORPC changed course and formally requested to use the recently unveiled FERC Pilot License Process for a smaller testing project in Cobscook Bay. Environmental studies associated with the earlier effort were continued in support of the new process. In 2009, the State of Maine and FERC also signed an MOU outlining their collaborative approach to State and Federal regulatory consistency, with a goal of ensuring sustainable development of tidal energy resources and the commercialization of new technologies. Agencies from Maine's Departments of Conservation, Environmental Protection, Inland Fisheries and Wildlife, and Marine Resources, State Planning Office, and the Governor's Office of Energy Independence and Security and FERC came to together to create a coordinated process to review tidal energy projects with the pilot license process. Maine's Department of Environmental Protection was designated as the lead agency for Maine (ORPC, 2012).

In July 2010 ORPC submitted a preliminary permit application to FERC for the CB pilot project. FERC issued a second preliminary permit in January 2011. In September 2011, ORPC submitted its pilot license application to FERC. FERC developed an Environmental Analysis under NEPA based on the information submitted by ORPC, which resulted in a Finding of No Significant Impact in January 2012, and the developer received a pilot license in September 2012.

One of the provisions in the FERC license was that within three months of license issuance, the applicant would be required to develop an adaptive management plan (AMP) to guide ongoing monitoring and environmental effects evaluation activities. Basing their approach on the collaborative nature of the 2009 MOU between FERC and the State of Maine, ORPC drafted an AMP in 2012 in consultation with the USFWS, National Marine Fisheries Service, Coast Guard, Maine Department of Environmental Protection, and Maine Department of Marine Resources. The Adaptive Management Team (AMT) formed out of the Adaptive Management Plan and is composed of ORPC, NOAA NMFS, USFWS, USCG, USACE, Maine DEP, Maine DMR, and technical advisors. The AMT is responsible for evaluating environmental monitoring data and recommending license modifications where appropriate.

In the 2012 ORPC Adaptive Management Plan (ORPC, 2012, p 7), adaptive management is defined as, “a collaborative, consultative process among ORPC management, State and Federal agencies, and stakeholders that monitors and reviews the results of policies, Project actions and environmental data, and integrates this new learning into policy and management actions, adapting as necessary.” Collaboration is embedded within the definition of AM in the plan, with an emphasis on co-learning. The plan continues, “In this approach, policy and management actions are viewed as scientific experiments that are conducted among scientists, managers, and other stakeholders on key policy decisions.”

ORPC’s experimental tidal turbine was installed in Cobscook Bay in 2013. A failure of the power takeoff system caused ORPC to remove the turbine in 2014. ORPC is now planning to initiate another pilot project in a nearby location, Western Passage, which is expected to have more favorable energy generation potential. This second project will require a new FERC Pilot Project license.

4. Background on the FERC Licensing Process

The United States uses an agency-based system to execute its laws, which means in practical terms that any attempt to interact with these laws, such as via an MRE permit application, must follow a human process with people in authority who will govern the outcome. Several local, State, and Federal government agencies are responsible for protecting and managing the busy ocean place, and together they provide a patchwork of management for the ocean. The permitting process for MRE is where the social and the technical combine, using the best available science to meet the needs and legal requirements of each agency at the table in order to manage both short-term and long term risk.

4.1. Requirements and Authorities for a FERC MRE License

In order to gain permission to be installed in the ocean, an MRE project must obtain a number of permits and licenses from various Federal, State, and local government entities. It must also demonstrate that it adheres to all applicable environmental protection and human safety regulations, both during installation and throughout the life of operation. The Federal Regulatory Energy Commission is the lead Federal agency for the licensing of marine hydrokinetic (MHK) projects (i.e., wave and tidal energy capture technologies) in the United States. Non-Federal projects fall within FERC's jurisdiction when they are located in navigable waters of the United States and are connected to an interstate electrical grid.

Masterson (2014) organized the framework for environmental review of MRE projects into three major areas: 1) the Federal Power Act, 2) the National Environmental Policy Act (NEPA), and 3) targeted environmental statutes such as the Endangered Species Act (ESA) and the Coastal Zone Management Act (CZMA). Pacific Energy Ventures (2012) summarizes the major laws that integrate with the MRE permitting decision. Each legal authority associated with the MRE permitting process is accompanied by an enacting agency whose staff interpret and execute their authorities within the process. For the purposes of this chapter, agency authorities will be described according to their roles within the FERC licensing process: lead, cooperating, or consulting agencies.

The Federal Energy Regulatory Commission (FERC), as the lead agency for licensing MHK under the FPA, makes approval decisions regarding issuance of a license to construct and operate a project. Such an approval may be augmented based on conditions or recommendations from other State and Federal agencies per the requirements of the Federal Power Act. Additionally, as the licensing of an MRE project constitutes a major Federal action, FERC is also the lead agency for the purposes of the administrative and environmental evaluation requirements of the National Environmental Policy Act (NEPA). The Bureau of Ocean Energy Management (BOEM) has lead authority over resources on the outer continental shelf, and as a result of a Memorandum of Understanding signed with FERC in 2009 (DOI and FERC, 2009) they have authority over the issuance of seafloor leases and rights-of-way for MHK projects.

Cooperating agencies are those that will be issuing their own approvals for aspects of the project, such as the use of navigable waters, and therefore are also subject to NEPA. At the Federal level they include the Department of Energy (DOE), US Army Corps of Engineers (USACE), and the US Coast Guard (USCG). For the PMEC-SETS project in Oregon, BOEM also elected to participate as a cooperating agency for the NEPA process rather than as a co-lead, presumably to reduce potential process-related conflicts.

Consulting agencies are those with whom FERC must consult before issuing a license per the Federal Power Act (16 U.S.C. 792 et seq.) and the Fish and Wildlife Coordination Act of 1934. They include the National Oceanic and Atmospheric Administration (NOAA), the US Fish and Wildlife Service (USFWS), and relevant State authorities, and they provide input to the FERC license in the form of official comments regarding the consistency of the proposed action with regulations under their responsibility (e.g., essential fish habitat under the Magnusson Stevens Act (MSA) administered by NOAA or Endangered Species protection under the Endangered Species Act administered by NOAA and the USFWS). Consultations also evaluate the adequacy of the environmental information, provided by the applicant and incorporated in the NEPA environmental analysis, to ensure that the environmental impacts from the project are sufficiently understood. Masterson (2014) notes that, while environmental review is required under the FPA, "such analysis is completed pursuant to the guidelines of key Federal environmental statutes rather than under the FPA itself, thus impacting the type of environmental analysis that occurs" (p.10).

Following consultation, FERC has the authority to request that the applicant perform additional studies or to include conditions in an approved license such as monitoring or mitigation activities. Some consulting agencies also have conditioning authority for a FERC license under the FPA. For example, the agency responsible for making a Federal Consistency determination under the CZMA in each State (e.g., DLCD in Oregon and the State Planning Office in Maine) can set mandatory conditions on the license to ensure that the MRE project is consistent with State ocean management plans.

Outside of the FERC licensing process, separate agency-specific approvals may include incidental take permits under the ESA or MMPA, a removal/fill permit under the authority of the USACE for the use of anchors and moorings, or private navigation aid permits under the USCG and USACE (33 CFR 66 §66.01; 33 CFR 322). Additionally, transmission cables that cross through State waters (up to 3 nautical miles offshore) must obtain seafloor leases and rights-of-way from the authorized agency (Department of State Lands in Oregon and Department of Conservation in Maine, for example). Once a cable comes ashore, the associated grid interconnection infrastructure must comply with State and local plans and ordinances, as well as any State or Federal regulations pertaining to the protection of terrestrial species and environments. Since 2013, projects in the State of Oregon are also required to adhere to the standards set in Part V of the Oregon Territorial Sea Plan and provide proof of decommissioning financial assurance (SB 606; ORS 274.879).

4.2. FERC Licensing Process Options

There are currently three "process tracks" for full licenses (30-year duration): the traditional licensing process (TLP); the Integrated Licensing Process (ILP); and the Alternative Licensing Process (ALP)[5]. Figure 2 shows a representation of the FERC licensing processes and highlights the components that differentiate them.

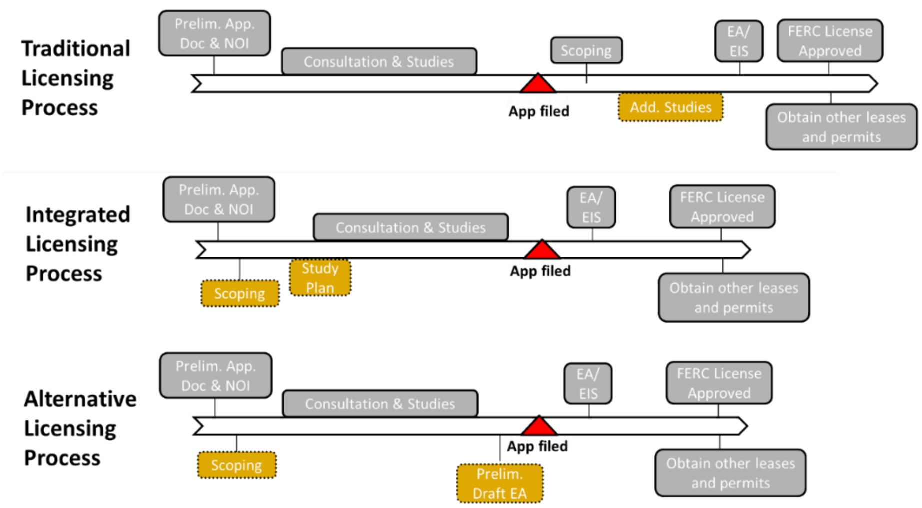

Figure 2. FERC License Process Tracks (adapted from Carter, 2015)

The TLP was the first process option under the FPA, and it is expected to take at least five years to complete (Gaffney, 2008). The traditional process provides that the formal proceeding before FERC does not begin until the application is filed, and FERC staff generally do not participate in prefiling consultation. After the application is filed, the Federal agencies with responsibilities under the Federal Power Act and other statutes, the States, Indian tribes, and other participants have opportunities to request additional studies and provide comments and recommendations. Although emphasizing extensive prefiling consultation, the traditional process has come to be viewed as "adversarial and applicant-driven." (Swiger and Grant, 2004, p 1) Moreover, the initiation of National Environmental Policy Act (NEPA) scoping often provides a "second bite" opportunity for resource agencies to raise new issues and expand the record (Swiger and Grant, 2004).

The ALP first emerged in 1997 and in its initiating regulation is explicitly designed to be a collaborative process under the expectation that,

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[5] https://www.ferc.gov/industries/hydropower/gen-info/licensing/licen-pro.asp

> Early resolution of issues can result in less time and expense for the participants than the longer traditional process. . . A collaborative process affords all participants an opportunity to reconcile different interests and concerns. This process encourages participants to be flexible and creative in attaining their objectives (Interagency Task Force on Improving Hydroelectric Licensing Processes, 2000, p 2).

An applicant may use the alternative process, “if it can demonstrate that a consensus exists among the applicant, resource agencies, Indian tribes, and citizen groups that the alternative procedures are appropriate under the circumstances.” (Swiger and Grant, 2004, p 1)

The ALP allows pre-filing consultation and environmental review procedures to proceed concurrently. The ALP also allows the permit applicant to prepare their own preliminary draft environmental assessment prior to filing the formal license application with FERC. By allowing the applicant to draft the first environmental review, they become the de facto convener of the collaborative pre-filing consultation process because they must gather input from the agencies and accurately reflect the outcomes of the collaboration in the documents. Additionally, by having the Preliminary Draft Environmental Analysis occur prior to filing of the license application, theoretically the post-filing consultation between FERC and the relevant agencies would be streamlined because there are “no surprises” in the environmental analysis (Interagency Task Force on Improving Hydroelectric Licensing Processes, 2000, p 18).

The ALP requires development of a communications protocol, which includes a charter for a Collaborative Working Group (CWG) of participating agencies. In Oregon, the CWG communications protocol includes governing rules for a consensus-based process of information sharing to create “CWG Products” that will be incorporated into the application filing. Consensus agreements are not legally binding but assume a good faith intent by all agencies to act consistent with the agreement within their respective authorities.

Another key feature of the ALP is that FERC has a more active role in the collaborative process. Under the TLP and ILP, FERC *ex parte* rules do not permit Federal resource agencies with mandatory conditioning authority to be both cooperating agencies under NEPA (meaning they have access to informal communications with FERC) and intervenors for purposes of challenging a FERC license. FERC ultimately concluded that “precedent indicates that allowing Federal agencies to serve both as cooperators and intervenors in the same case would violate the [Administrative Procedures Act].” (Swiger and Grant, 2004, p 2)

Because the ALP is designed as a collaborative process, dispute resolution is expected to occur informally within the collaborative process rather than via the formal FERC process. The FERC Order instituting the ALP Stated, "We proposed to leave the existing, non-mandatory and non-binding dispute resolution procedures applicable to the ALP in place because mandatory, binding dispute resolution appears to be incompatible with the collaborative nature of the ALP." (FERC Order 2002). ALP participants may request formal dispute resolution under FERC, but a resource agency may object to formal dispute resolution regarding subject matter of its statutory obligations (Interagency Task Force on Improving Hydroelectric Licensing Processes, 2000).

The ILP is the newest of the processes, emerging in 2003, and is currently the default process for new license applicants (Swiger and Grant, 2004). It combines the multi-agency integration components of the ALP with the schedules and formal dispute resolution process of the TLP, but it must adhere to the ex parte requirements of FERC under the Administrative Procedures Act (APA), which prevents informal communications between FERC and cooperating agencies in the development of the Environmental Impact Statement (EIS) under NEPA. The ILP requires completion of a FERC approved study plan in consultation with resource agencies during the pre-filing consultation stage and encourages informal resolution of disputes associated with the determination of necessary studies, although formal dispute resolution under FERC is an option under the ILP. The ILP also contains process schedules and deadlines that, if missed, lead to cessation of the licensing process (Interagency Task Force, 2000). Based on conversations with permitting process participants, it was clarified that the ILP was originally envisioned to streamline the re-licensing of an existing project, such as a hydroelectric dam, where many aspects of the project and its environmental effects have been more clearly defined over time (Pers. Comm.).

Alongside these process options, FERC added the option in 2011 to apply for a 5-year Pilot Process for projects that are experimental in nature. The pilot licensing process was developed following the "Verdant Orders" in which, "the [FERC] interpreted the Federal Power Act in a flexible manner that allowed an experimental deployment without a license" (FERC, 2008). The Pilot License path was envisioned to follow the ILP track.

Applicable pilot projects are: "short-term; can be quickly modified, shut-down, or removed if significant, unforeseen risks to public safety or adverse environmental impacts occur; are not located in areas designated as sensitive by the Commission; and are removed, with the site restored, before the end of the license term" (FERC, 2008, p 5). When issuing the pilot process, FERC Stated that "[The] Staff's goal is to provide expedited procedures through which a Commission decision can be rendered in as few as six months after the filing of the application. The procedures will be oriented toward the characteristics of small, pilot projects with short license terms. They will emphasize post-license monitoring with the possibility of modifying, shutting down, or removing a device that presents an unforeseen risk to public safety or environmental resources. (FERC, 2008)" In order to satisfy requirements of a pilot license, the applicant will need "sufficient information to describe site conditions and identify potential project issues." FERC notes that such information will need to be gathered as part of the process if not already available. The pilot license application must also propose a monitoring plan to identify potential environmental effects that result from project operation.

4.3. The Collaborative Action Arena

Under collaborative FERC processes (the ILP and ALP in different forms), three distinct action arenas for interagency and applicant interaction exist during the life of a project. The first is the pre-filing consultation and studies phase, of which the Oregon CWG stands as an example. During this phase, issues are identified and addressed to the extent possible before filing the license application to FERC. Once the application is filed, a second action arena forms, during which FERC solicits formal recommendations from the relevant State and Federal agencies per the FPA and FWCA. During this phase, communication appears to proceed via letters containing comment on a NEPA environmental analysis. The NEPA process also includes a public comment portion during which members of the public and NGOs may submit comments to FERC. Comments submitted to FERC are then considered, and FERC has the option to request more information from the applicant to address consultation concerns, or FERC can impose conditions on the license. If additional studies are required, an extended period of formal issue resolution may occur. At the end of the second action arena, FERC either issues or denies a license.

If the examples of Oregon and Maine are any indication, then the issuance of a license will initiate the start of a third collaborative action arena: adaptive management. Like the pre-filing arena under the ALP, the applicant is required to develop a charter for an Adaptive Management Team, whose purpose is to review monitoring information and make recommendations for any warranted modifications to the license. The Maine project is currently four years into an adaptive management process.

4.4. Precautionary and Adaptive Risk Management

The concept of precaution has emerged as one of the most important alternative decision criterion for action under deep uncertainty (Lempert and Collins, 2007; O'Riordan & Jaeger, 1996). The precautionary principle (precautionary principle) or Precautionary Approach has been integrated into in international law and policy as a dominant paradigm of responsible governance. It has been incorporated into many laws and guidance surrounding marine management, including the Endangered Species Act, the Marine Mammal Protection Act, Statewide planning goals, and marine Ecosystem-Based Management as described in the National Ocean Policy Implementation Plan (National Ocean Council, 2013).

One of the hallmark changes in risk management associated with the precautionary principle is a shift in the burden of proof toward the proponent of an action, rather than having it be incumbent on the government or an aggrieved party to prove that an activity or new product causes harm (Raffensperger, 1999; Somsen, 2007). In the strictest formulation of the precautionary principle, the shifting burden of proof requires proponents of an action to make their mistakes and learn the accompanying lessons before being allowed to spread into a vulnerable environment. Andorno (2004) reasons, “This change is justified because hazard creators are those who will benefit economically from the products or activities in question and therefore, society has the right to expect them to assume, at least in part, the costs of the risk assessment (19)”.

Adaptive management is a concept of risk management has been described as walking “hand in hand” with the precautionary principle (Francis et al., 2007). It is predicated on the basic premise that “if human understanding of nature is imperfect, then human interactions with nature [e.g., listing or delisting species] should be experimental” (Lee 1993). Proponents of Adaptive Management assert that proposed actions should incorporate scientific trial and error, with extensive monitoring regimes to investigate the effects of the management decision and plan the next iteration (Morrison-Saunders et al. 2007; Stankey, 2003). “As originally proposed by Holling (1978) and refined by Lee (1993), adaptive management treats economic uses of nature as experiments so that we may learn efficiently from experience.”

As described by MRE scholars (Masterson, 2014; Jansujwicz, 2013; Oram and Marriott, 2010), Adaptive Management has emerged as an effective framework for managing risk and uncertainty within MRE permitting projects. In a study of the Ocean Renewable Power Company tidal energy project in Maine (which is also a case study in this research), Jansujwicz (2013) found that, ‘there was also widespread recognition that the only way to determine the feasibility and effects of hydrokinetic projects was to “learn by doing.’” With many interests and authorities involved in the permitting process, adaptive management as a framework also requires that, “the adaptive manager be an able negotiator as much as a visionary scientist” (Jansujwicz, 2013, p 3; Lee 1993, p 80).

5. Theoretical Frameworks

To supplement the grounded theoretical approach, the data from the interviews and document analysis were organized and analyzed consistent with the Institutional Analysis and Development (IAD) Framework (Ostrom, 1997). While the IAD framework provided the overall structure for inquiry, this research topic will draw upon the existing literature surrounding psychometric and cultural risk perception (Slovic, 1987) and theories regarding collaborative governance. These supplemental lenses provide further specific context regarding the interrelationship between collaboration, risk perception, and risk management.

5.1. Institutional Analysis and Development (IAD) Framework

The IAD framework provides a structured process for isolating and analyzing important variables that influence institutional design, institutional performance, and institutional change within collective action arrangements (Ostrom, 2011; Andersson, 2006). It has also been identified as an effective framework to, "better understand the institutional arrangements used to implement ecosystem-based management programs" (Imperial, 1999).

Institutions are defined within the IAD Framework as a set of prescriptions and constraints that humans use to organize all forms of repetitive and structured interactions (Ostrom, 2011). These prescriptions can include rules, norms, and shared strategies (Crawford and Ostrom 1995). Institutions are further delineated as being formal or informal; the former characterized as rules-in-form and the latter as rules-in-use.

The analytical focus of the IAD is on an "action arena", where social choices and decisions take place. In the case of this research, the action arena refers to the venue for multi-party pre-application filing consultation under the FERC licensing process. Three broad categories of variables are identified as influencing the action arena: institutions or rules that govern the action arena, the characteristics of the community or collective unit of interest, and the attributes of the physical environment within which the community acts (Ostrom 2005).

5.2. Risk Perception

One of the primary models for risk perception is that of Slovic (1987). Slovic applies a "psychometric paradigm" (Starr, 1968) to risk perception that attempts to quantify perceived risk using psychophysical scaling and multivariate analysis. This quantitative approach measures risk along two axes: familiarity and dread. Familiarity could refer to a person’s state of knowledge about a given risk or the ubiquity of that risk factor in their daily lives. Dread may refer to the degree of a person’s perceived negative consequences if the risky event were to occur. Using this model, Slovic measured the perceived risks of many people and displayed them in a single chart (Figure 3). As familiarity decreases and dread increases, the likelihood of public outrage about the existence of the risk increases.

As Slovic (2015) has pointed out,

> The measurement of risk is inherently subjective. For example, the nuclear engineer's probabilistic risk estimate for a nuclear accident and the toxicologist's quantitative estimate of a chemical's carcinogenic risk are both based on theoretical models, whose structure is subjective and assumption-laden, and whose inputs are dependent on judgment at every stage of the assessment process.

Fischhoff et al. (1978) noted in passing that, across different hazards, perceived risk declined as perceived benefit increased. They also found that the characteristic most highly correlated with perceived risk was the degree to which a hazard evoked feelings of dread.

An additional factor in risk perception, known as the affect heuristic (Finucane et al., 2000; Slovic et al., 2002), was first identified by Alhakami and Slovic (1994) based on an observation that people’s feelings about the perceived risk and benefit of a risky behavior or event depended on whether or not the risky element is “liked” by the perceiver. Subject matter experts have been observed to view risks more from a quantitative perspective synonymous with probability of harm or expected mortality.” (Slovic, 2015; p.1)

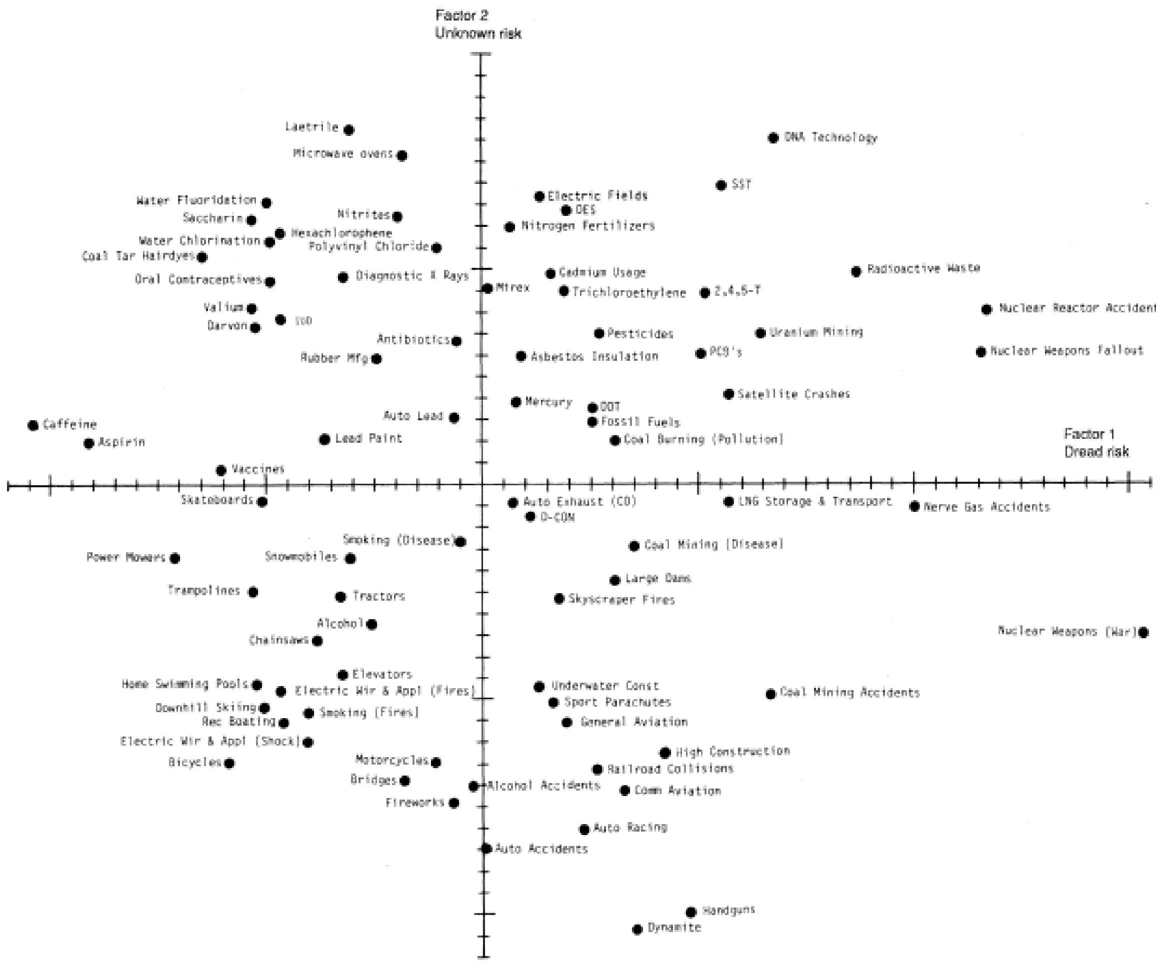

Figure 3. Location of hazards on factors familiarity and dread (reproduced from Slovic, 1987)

While the research before you now is qualitative in nature and therefore did not solicit quantitative measurements of participants' perceptions of risk along these axes, the Slovic model still has value as a structure upon which to evaluate the perceived risks described by research participants.

5.3. Collaboration Theory

Collaborative governance has been defined broadly as, "the processes and structures of public policy decision making and management that engage people constructively across the boundaries of public agencies, levels of government, and/or the public, private and civic spheres in order to carry out a public purpose that could not otherwise be accomplished." (Emerson and Nabachi, 2012, p 721) By this definition, the permitting process for MRE qualifies as a collaborative governance arrangement because the decision requires integration of requirements from multiple spheres and sectors of government.

Applied to natural resource management issues, Lubell, 2004 remarks:

> The hallmark of collaborative institutions is an attempt to encourage consensus and cooperation among the multiple actors with some political, economic, or administrative stake in policy outcomes. Collaborative institutions emerged from dissatisfaction with the adversarial, command-and-control style of governance embodied by conventional environmental policies, which have left many environmental problems unresolved while at the same time inflaming large amounts of costly legal and administrative conflict (Fiorino, 1999; Kagan, 1999) (p 1).

Lowndes (1998) surmises that, "Multi-agency partnerships arise from the search by public bodies for integration within an increasingly fragmented organizational landscape." Ocean management, with its many sectors of sometimes overlapping authority over migratory resources within a fluid and highly changeable three-dimensional landscape, is one such landscape. Kallis (2009) goes so far as to say that, "Collaborative, adaptive governance based on interagency integration and stakeholder participation is the new paradigm for managing environmental problems (Lemos and Agrawal, 2006; Folke et al., 2005)."

Kallis et al (2009) summarizes the findings of Innes and Booher (1999) and Bryson et al. (2006), who identified several important procedural attributes for effective collaboration such as:

> The presence of shared practical tasks; initial agreements; a reliance on self-organization rather than an externally imposed structure; the use of high-quality, agreed upon information sources; proceeding with agreements when there is overwhelming support; external legitimacy of the process; resources and commitment to equalize power differences between participants; continuous trust-building activities, and genuine engagement in productive dialogue (Kallis et al. 2009, p 637).

The extent to which these features apply to MRE permitting processes may correlate to levels of success.

Lubell (2004) acknowledges that the research and management communities remain uncertain regarding the effectiveness of collaboration arrangements to solve, "many of the pathologies of adversarial policy (John, 1994; Marsh and Lallas, 1995; Weber, 1998) (p 549)." The most searing criticism he notes is that,

> Others argue that collaborative institutions are at best a passing administrative fad, and at worst guilty of all talk and no action; i.e., the collaborative process leads to favorable changes in attitudes and social relationships, without the subsequent behavioral changes in levels of cooperation that are necessary to improve environmental outcomes (Kenney, 2000a,b) (Lubell, 2004, p 549).

Given the growing ubiquity of collaboration and the persistent uncertainty regarding its effectiveness at achieving its designed outcomes, the decision to employ collaborative process within the context of MRE permitting is itself a risk to proposed project schedules and overall outcomes. Therefore, its use remains a potential variable when diagnosing factors contributing to the success or failure of a new MRE project.

6. Study Results

6.1. Risk Perception

6.1.1. Types of Risk

When making decisions regarding MRE permitting, participants in the collaborative process described multiple different types of risk they encountered. Most discussed were environmental risks associated with protected species, habitats, and human uses. The identified risks within this category were predominantly aligned with the risks described in the Annex IV State of the Science 2016 report for MRE (Copping et al., 2016). New risks identified in the Oregon project included pinniped haulout onto devices, potential effects from MRE devices acting as Fish Attraction Devices (FADs), artificial reef effects, and some species-specific concerns such as potential harm to green sturgeon if the presence of a device changed normal migration or feeding behavior.

Participants from the resource protection agencies focused predominantly on risks that pertained to their authorities and responsibilities. For example, a person whose agency is responsible for protecting endangered species would emphasize the potential risks to those species caused by uncertain interactions with a device in the water. For some interviewees, potential risks were perceived to result from human reactions to environmental changes. For example, while the nesting of marine birds on an offshore device may not itself pose harm to a species, it could introduce a situation in the future where a developer would seek permission to forcibly remove those species as nuisances.

Applicants and their staff tended to describe a holistic list of perceived risks that spanned all regulatory perspectives, but they also acknowledged risks associated with lengthy or expensive environmental studies affecting the economic viability of their projects. For license applicants, the risks also expanded beyond environmental impacts to include operational risks to devices and maintenance crews at sea or financial risks associated with a prolonged licensing process or requirements for cost-prohibitive environmental investigation and monitoring regimes.

One respondent described the risks associated with ongoing monitoring this way:

> *Ultimately all this environmental monitoring that's going on and every single piece that's in it have to be paid for. Those costs are going to be passed on to whoever is using the facility. If those costs get too high then economically it just won't work.*

The addition of trained observers to maintenance trips was perceived to increase the complexity of vessel logistics and may even require commissioning of larger vessels and crews than originally envisioned, adding costs.

In addition to risks to species and environments, agency participants described a risk associated with legal challenges to their decisions, based on failure to observe proper process under NEPA or a decision that is perceived to not meet protectiveness standards, or litigation if an unwanted event were to occur. Several interviewees echoed similar sentiments to the one below:

> *It's almost a mantra: what's the risk? We have to assess our risk. We're constantly evaluating what is the risk of a challenge to our action . . . How can we manage risk of conflict with the people that we're regulating, the industries that we're regulating, and are there ways of mitigating that risk so that we come to a better resolution and a better working relationship?*

Risks to protected resources affect not only those resources, but the agencies charged with protecting them. One respondent explained,

> *Risk when you talk about it means something different to everybody. If it's the people around that table and they're mostly government people, it's filtered through whatever standard it is that they're applying under their regulatory program, their plan, policy. The attorney general's office looks at it from a legalistic perspective. What's the risk legally to the state by allowing something?*

A similar perceived risk related to who would bear the ultimate liability should a project fail to be decommissioned properly or significant adverse effects to humans or the environment present themselves over time. One respondent related that, "*As I navigate this I'm constantly having to reassure my folks that, 'At the end of the day FERC is the lead agency and most of the liability is on them,' and people are like, 'Are you sure?' and I'm like, 'No I'm never sure! Nobody is ever sure*.'"

Some risks related to the licensing process itself. This was especially true in Oregon, where the perception was that the applicant chose the ALP as a method to address regulatory issues before the draft license application was submitted to FERC, in hopes that the formal process that followed would be faster and less surprising to all parties. One of the risks associated with the traditional licensing process is that FERC may require additional studies to be performed based on the recommendations from consulting agencies under the FPA. The expected benefit of the ALP was that the applicant and agencies would resolve potential risk-related issues early in the process in an informal setting. The same was true in the Maine example, where one respondent noted, "*The guidance [from FERC] was, 'If you have concurrence from the Adaptive Management team, we'll basically sign off on it.' That bolsters your case*."

However, participants noted that following a collaborative process carries its own risks. For one, the lack of a formal process schedule means that the pre-filing consultation phase is open-ended and can continue indefinitely, and it has proven true that the four-year-long process in Oregon exceeded all participants' expectations. One respondent described, "*If the collaborative group effort requires that everybody is happy and everybody agrees entirely, then any one of those people for whatever reason can stop it, and they did*."

A lengthy process introduces additional risks to both applicant and agency resources, as well as the risk that agreements and understandings reached during collaboration may not be remembered by the time the license application reaches the agencies for review. Combined, these perceived risks emphasize that the decision to collaborate is itself a gamble.

> *I'm concerned about the risk of how much money it costs and how much time it costs, people not remembering what we've talked about, and that we'll go and figure something out and then the next time somebody sees it again they start drilling down again. . . It's memory because they're busy people, they've got lots of different projects they're working on, and if we talked about it two years ago they might have forgotten that we said this or that and they agreed to it.*

Also mentioned were perceived personal risks, especially concerning the professional reputations of subject matter experts upon whose recommendations the agency-specific recommendations to FERC and the subsequent licensing decision may rely. Additionally, personal risks may be present when process participants are asked to make decisions that may pose risks to their respective institutions, and that this may be an uncomfortable situation for some.

> *[There's risk of an] admonition that, 'If you let that happen, the first time a whale impales itself on that, we're all going to stare at you.' Really? . . . 'So and so flipped on that. Oh they're a bad person. They don't love whales anymore.'*

Some of the participants, both on the agency and the applicant side, were of the perception that MRE is treated, "harder than other marine industries." Some of the industries mentioned included oil and gas, ocean science infrastructure such as surface buoys and subsea observatories, aids to navigation, or shipping. No single consensus reasoning emerged for why this perceived situation was present. Some speculated that the current era of ocean science-based management was more mature than in the past and therefore more complex. Perhaps MRE as a new industry in this era represented a "first opportunity" to reach for authority over human activities that have been historically accepted and conduct a modern review. Others wondered if the perceived profit motivation or financial risk associated with developers colored the approach to risk. Some reasoned that the scrutiny is justified, and multiple interviewees mentioned the proliferation of dams in the United States as a cautionary tale about unanticipated and lasting impacts to ecosystems. Some believed that regional differences in regulatory cultures were a significant factor, and nearly half of the participants talked about the importance of personalities and the individual risk attitudes of the participants at the table, either as a result of or in spite of their institutional culture. Some simply considered the differences between risk perceptions to be the result of an emerging industry with uncertain effects.

6.1.2. Uncertainty and Risk Perception

Every participant recognized the presence of uncertainties that affected the permitting process. A few interviewees made a connection between the perceived risks associated with MRE are a function of uncertainty about the likelihood and severity of effects, rather than actual data verifying that such a risk is present. One respondent reflected, *"I would be really surprised if anybody ever tried to permit a project that from the first discussion had as much perceived uncertainty as this one did from the vantage point of the regulatory agencies and what gets brought to them*." Another remarked, "*It's helpful to have a body of literature. In the industry it's 'best available science,' and one of the challenges in the MHK industry is there isn't any*." The difficulty this poses when managing MRE risks was summarized with the recognition that, "*We don't know everything about everything under every condition all the time. Of course not! So what do we do*?"

Seventeen of the 23 participants mentioned that MRE is a "new," "novel," or "unknown technology" as reasons for the high perceived degree of uncertainty and associated perception of potential risks. A few also mentioned the novelty of the permitting process as well with statements such as, "this has never been done before." In the face of this uncertainty, many of the agency participants relied on a precautionary approach to risk such that, as one described, "*We want to err on the side of the species*." Another described the relationship between uncertainty and precaution this way:

> *We just had no information on what to expect, so we were taking a very precautionary approach. We wanted to understand what we were in for because our mandates are to protect and conserve the resources, and if we don't have information we don't know how to do that.*

This perceived uncertainty was commonly countered by project proponents from both applicants and agencies with sentiments similar to the one below:

> *While offshore renewable energy on a whole is new, so many pieces of it aren't new. Putting a buoy out in the ocean: not new. Having a cable in the ocean: not new. So a really interesting question is how does the perceived risk of this just balloon so much when the individual aspects of it have a lot of previous examples?*

All environmental risks described by participants, unsurprisingly, had a component of uncertainty either regarding the likelihood of a negative effect or the severity of that effect on the species or environment of concern. It was noted that regulatory agencies have the difficult task of managing an environment that, due to its complexity on spatial and temporal scales, they are not able to fully understand. As such, this compounds the uncertainty associated with introducing a new perturbation to that environment.

The environmental uncertainties described by participants may be broadly categorized as technology-specific, place- or time-specific, or receptor-specific. A technology-specific uncertainty can relate to the performance of technologies in the ocean environment (e.g., extreme event survivability), how a device interacts with wildlife, how much sound is produced by devices, or the extent of EMF field propagation from devices and transmission infrastructure. Most of these types of remaining uncertainty can be best addressed by direct measurement and observation once a device is in the water. One of the major uncertainties for the Oregon project was that, because the SETS project is envisioned as a pre-permitted test facility, it is impossible to predict with certainty what specific devices would be installed at the site over the 30 years of license operation.

When characterizing risks, uncertainty over time and space seemed to be significant contributors to perceived risk associated with potential environmental effects. Place- or time-specific uncertainties are associated with the presence or absence of sensitive species and habitats relative to the project area. As one respondent put it, "*In terms of tidal power it's going to be like real estate, location is everything*." These uncertainties will dictate whether a more focused risk/uncertainty management action is needed, because if no endangered species are present in the project area, it is reasonable to expect that risks to those species from device interactions are not applicable. However, one respondent noted that, "I*f we* *have no data to document the actual presence of the species in the area but we suspect they might be there, our regulatory authority requires us to assume that they're there*."

In Maine, interviewees expressed a degree of comfort, if not certainty, that species such as protected bird species or marine mammals were not present in the project area, and therefore risks associated with those authorities had less of an effect on the permitting process. The participants interviewed seemed to share a perception that the location of the ORPC pilot project in Cobscook Bay was not highly trafficked by sensitive or protected species such as marine mammals or endangered birds. This perception seemed to influence the perceptions of risk among the group, and in some cases it led participants to become less active in the pre-filing consultation process because they believed their concerns to be adequately addressed. Similarly, participants noted that CB was not highly utilized for fishing, which reduced some perceived concerns about human use space conflicts. The primary spatial and temporal risks and uncertainties in Cobscook Bay related to protection of Atlantic Salmon migrations and consideration of vessel traffic patterns associated with fishing.

Some participants noted however that if ORPC moves its device to an area around the corner (Western Passage), it is expected that different species will be present. The minke whale specifically was mentioned as a potential risk concern, with several participants citing reported sightings of the species in the area, as well as potentially diving birds and greater fishery activity. The expected increase in affected receptors was similarly expected to lead to greater requirements for environmental characterization and monitoring than was required for the Cobscook Bay location. The discussion of information needs for Western Passage had not yet occurred, but it was reported that ORPC was planning to include additional time to the pre-consultation phase of the FERC process to accommodate additional discussion with the regulatory agencies.

Based on the responses in both Maine and Oregon, it appeared that the spatial resolution required to characterize a project area is on one hand fine-scale and on another hand potentially broad in scale. In Oregon, spatial and temporal variation affected such concerns as whale migration routes relative to the project location, the expected presence or absence of sea lions or seabirds in the project area, and even the feasibility and timing of monitoring activities given that the Pacific Northwest ocean can be very dangerous for boats to transit during certain times of year. Emphasis was also placed on the need for information specific to the defined 2-square-mile project area. For example, information from the nearby PMEC North Energy Test Site, located approximately 10 miles from the proposed PMEC-SETS site, had limited usefulness for alleviating uncertainties. The same was true of information from participants who had experience in other Pacific States or from data that had come from other projects outside the US such as in Europe.

Receptor-specific uncertainties generally relate either to a species' behavioral response to the presence of a device or the severities of biological effects that may occur if a negative interaction were to occur. These uncertainties become significant only if a species of concern is established to be present in the vicinity of the proposed project, so in some cases they may be circumvented if it can be proven that a species is not expected to be present. Some agencies do not conceive of receptor-specific risks as focused on single species or populations, however, but instead regard more complex effects on the interconnected web of species in an ecoregion. As one respondent explained,

> *It's not that simple. It's a change, and we are not talking about one species here. You're talking about an entire community. Hundreds of species, some of which will be negatively impacted, some of which will be positively impacted probably. . . really it's just the whole community change. . . It's an uncertainty because we don't know who's going to be the winners and the losers and whether or not the overall outcome is positive or negative.*

6.1.3. Defining Unacceptable Risk

Perhaps the most difficult question for most of the participants to answer related to how an acceptable or unacceptable risk or impact may be defined and measured. It is worthwhile to showcase the diversity in perspectives around the table surrounding the question of how to define unacceptable risks, excerpted below:

> *That's sort of a research thing from my perspective. Risk in these projects is what are the chances you're going to harm or kill a critter by the project, and that's related again to the uncertainty, as you really don't know.*
>
> ---
>
> *Others can contemplate it in different ways, but for the regulator or the government person, they always perceive it in terms of the words on the page of the regulation, the standard that's in place, the policy that's in place, so they're fixated on that.*
>
> ---
>
> *Triggers are sometimes hard to identify in whether they are meaningful or not, and that's typically a problem from the get-go, but if the parties can't agree on a trigger, once the application gets filed the applicant provides the reason why they selected a particular trigger, then the agencies have an opportunity to get their argument in, and then FERC would make their decision . . . based on everybody's argument and the information as provided.*
>
> ---
>
> *I do believe that there should be a reasonable level of risk that we should be okay with accepting and I don't feel like that exists . . . I think that's a harder sell for some people to swallow.*
>
> ---
>
> *Our goal is to achieve not more than minimal impact, so an impact is acceptable but not more than minimal, and that's very fuzzy. What's minimal?*

[Our standards] all turn on the [phrase] 'No unreasonable impact,' . . . Where do you draw that line?

When we seek information and recommend or require studies to be done, or have studies to be done, we take it into perspective of the size of the project.

We have a water quality standard, and we also have a standard for no unreasonable impact to fisheries or wildlife, but that grabs everything. Marine mammals, fish, birds, water quality, chemistry as well as biological criteria that go along with that.

Our interest has less to do with the fact that it's putting anything at risk that we know of. It's an uncertainty because we don't know who's going to be the winners and the losers and whether or not the overall outcome is positive or negative.

[We can] get some information, but what are you going to do with that? Everything else we do, there's a mitigation measure.

I mean we didn't have conversations like, 'Oh it's 50 fish or 100 fish' or something like that. It's more like, 'We'll know it when we see it,' you know? And it's got to be kind of the consensus of the folks around the room that there is, and it's got to be an unreasonable impact in order for us to say you got to get this thing out of here.

His view is there is EMF and it's kind of like, 'Yeah, but it's not going to affect the animals, and we actually don't care if there's EMF, and the resource agencies don't care if there's EMF. It's just if it's having an effect.'

We want to get more to the point of understanding what is the threshold for acceptability. We never really got to that point in the with the Cobscook Bay project. There was never a big concern where the regulators said 'No', but we think there might be a different kind of threshold in Western Passage. We're not quite sure. We need to explore what that really means, so hopefully we can get more to this kind of risk question.

They came up with kind of their criteria. I can never remember the words [used] but it was like some kind of 'definite, 'imminent, and serious'. It had to be a true threat, a known serious threat or something like that for them to commit any resources in monitoring.

Just because an individual or a population would respond to the presence of a device doesn't mean it's actually a negative effect. Under the ESA if one individual of an endangered or threatened species is harmed or harassed by impaction, we have to consider that an adverse effect, but . . . Unless we have a roll up to a population level effect, we still have the opportunity to move forward with projects.

Some things like sound thresholds, those are easy. There's a speed limit established.

If the ambient noise is above the threshold already then we need to start talking about changing that, because it doesn't make sense to regulate to the threshold if it's already exceeded in the ambient environment.

[Our standard is whether it is] not likely to adversely affect the species.

It's not like we said okay there will never be an interaction, there could never be an injury. What we said is it's probably discountable or it's unlikely that there could be.

We had some debate and discussion about what frequency and time horizon that was acceptable [to observe an event], which really felt like 'professional judgment' and implementability, and so by those terms I mean the implementability was the applicant thinking about how expensive it is to get out at sea.

Well if we see one sea lion haul out [on a device] is that a problem? Do we need to do something? Should it be ten? So then you start having these discussions, 'Well at what point is it a problem? And then at what point would we require you to take some sort of action?'

It felt kind of like a 'lick your thumb and stick it in the air, see which way the wind is blowing.' Is it three? Is it five? Is it seven? Just kind of what felt right, and its professional judgment what was going to be acceptable. I don't think there was any scientific basis or guidance that says [an event] of such and such frequency is an issue.

Most definitely it makes it simpler if we can just say there's a best management practice that eliminates this issue and that becomes an industry standard. Then that issue was pretty much put to bed permanently from our perspective. So yeah, sure, if we can get there that's great.

I think the question of how many anecdotal, 'We don't have a problems with it,' is okay, I mean that's a hard thing. It's not a study. You can't cite that, and zeros are a hard thing.

You know this first project was a lot of information gathering and I'm hoping that as we move forward it'll be more about decision-making around what is an acceptable threshold.

I think people are afraid to say there is an acceptable level. I think that it comes off his callous and untenable to some folks who are very passionate about the environment and about the work that they do and about the species that they are tasked with monitoring, so I think that any level of acceptable take to some people is anathema and they're not going to be happy with it.

I think it if you look at like the wind industry, they've I think in a lot of scenarios come to understand what is an acceptable level of risk. There are thresholds for takes. There are certain best management practices from a monitoring perspective. I think that's probably where the industry will go.

6.1.4. Scales of Risk

During interviews, some interviewees would discuss the benefits of MRE in terms of its potential to mitigate larger scale risks such as climate change and the reliance on fossil fuels. All participants who discussed this also noted that these potential benefits did not have a "voice" at the negotiating table. Some participants may have been sympathetic to the perspective that, "*This should all be contemplated, discussed, and perceived under the risk to not doing it. What's the risk to us all if we don't succeed in* *doing these things?*” However, participants from agencies also related that their specific missions focus on whether risks caused by the project are, “tolerable within their regulatory programs,” and they perceived that the larger risk context did not fall within their roles. Some posited that this perspective may best be voiced by NGOs and members of the public during the public comment period under FERC’s formal process.

6.1.5. Experts and Trust

Time and again, interviewees described the instrumental role of experts and expertise in the perception and management of uncertainty and risk. For pre-license investigations, expertise was valuable for building trust in environmental investigation methodologies and interpreting data. Subject matter-specific expertise, such as knowledge of whale migration paths and behavior, were described as valuable for reducing uncertainty, occasionally in lieu of additional data collection.

Expertise regarding marine investigation technologies was also highly prized within the collaborative group, and technological solutions were credited in the resolution of risk and uncertainty in at least two instances. In Maine, ORPC was an early adopter of side-scan sonar around the location of their tidal device, which allowed them to observe fish presence and movement within the project area.

Another example comes from the Oregon project and concerns about reporting timely acoustic information from the project area after the project is installed. Some participants were interested in monitoring sound levels at the project site in as near to real-time as possible, but the existing technology known at the time could only store recording data locally, requiring a special trip out to the site to retrieve it. As these conversations were ongoing, the NOAA Pacific Marine Environmental Laboratory developed an acoustic capture system with real-time satellite transmission capabilities (known as the RAOS) for direct application to a NOAA marine mammal research effort aimed at real-time Orca detection in the Pacific Northwest. PMEL staff recognized the potential benefit of this new technology to the PMEC-SETS process, and the transfer of this technology to the project became an effective solution to a difficult risk management problem.

Agencies brought expertise to the group related to their laws and processes, as well as subject-specific knowledge about the species and environments that they were responsible for protecting. A few interviewees made the point that FERC has no historical experience making decisions in the ocean environment, so it was important to utilize the experience of other agencies possessing that specific expertise. One respondent noted, "*There's been a few things like that where when you get a Federal agency who has experience with this who says, 'Yeah that's not the way it works.' That helps."*

Another type of expertise valued by participants was direct experience working in ocean environments. A few interviewees made the observation that not all regulatory agencies were familiar with the significance of ocean conditions during different times of year on the feasibility of collecting environmental data or conducting project-related activities at sea. Sources of expertise in this arena came from university scientists and from traditional ocean users such as fishermen or recreaters who occasionally participated in the collaborative process.

One respondent described:

> *One of the parts of this project that has been awesome is the support of the fishermen. That started before the permitting ever started through community engagement, careful engagement - and I really mean engagement not outreach - but listening to them, understanding they know a lot more about the ocean environment than we do, really taking them on as a partner and trusting them. That's been phenomenal having them be part of this project, and while they typically don't say much . . . they have opinions. Having the fisherman at the table being able to speak up and say, 'You know you're saying this, but that's not actually what happens.'*

The general perception from participants who discussed the role of experts was consistently trusting of the perspectives of experts within the process. Regulatory agencies from both case study processes consistently praised the strength of expertise deriving from applicant partnerships with their State Universities. One respondent noted that, unlike some other environmental debates featuring uncertainty, there did not appear to be a dynamic of competing expertise in the permitting process:

> *It wasn't a battle of Ph.D.'s, and hopefully I think that means that people respected those that were involved. I hope it's not an indication of not getting deep enough into the issues, because it could be the case that, 'Well, we didn't really get into a hard enough argument about [a particular issue] and we should have had the Celebrity Deathmatch between [the consulted expert] and whoever the next best expert is.' That was never really an issue for us.*

A couple of participants did wonder whether in some instances the role of OSU staff as both applicants and subject matter experts had an effect on the level of trust afforded to some of their technical assurances. This supposition did not appear to be a consistent theme based on the responses from interviewees in this research.

6.1.6. Information Sources

Several interviewees made the point that when FERC makes decisions regarding risk in a license, they consider all credible sources of information, but "best available science" is held in highest regard. As one respondent relayed that in cases of dispute over potential risks, "*If you've got science to support you and they don't, then you win*."

Many interviewees noted that the consultation of proxy information from other sites or industries can be useful toward understanding potential risks associated with their project. Such information can include reports from offshore energy installations in Europe, other marine industries such as oil and gas, undersea cables, ocean science, or shoreside nuclear facilities. Several interviewees made note of the TETHYS database (https://tethys.pnnl.gov/) as a valuable repository of information and new science related to MRE around the world.

While much of this information can be translated or modified to apply to the project under consideration, some interviewees contended that ultimately this proxy information must be supplemented by data specific to the project site. As one respondent explained,

> *If we're coming to a developer and saying, 'Here's all these unknowns. You have to go collect all these data for us,' and then they come back and they say, 'We already have those data. It came from Canada, it came from Scotland, it came from Portugal,' then we have to look at those and say, 'That can answer 90% of the question, so we just need you to go answer that last remaining 10% that's more site-specific.'*

Multiple agency participants also emphasized the perspective that it is the applicant's responsibility to be proactive about gathering available information, developing initial study designs, and collecting additional necessary data. These efforts were sometimes supported by Federal funding from either the Department of Energy or BOEM, which many participants described as essential contributors to the resolution of legally significant risk perception differences.

Some agency participants made oblique references to information quality requirements for environmental studies in support of the license application. If "best available science" is the standard for information, then it stands to reason that the design of studies should have these qualities in their design. However, one respondent made the observation that different agencies define what information is "good enough" differently. They explained,

> *Some agencies would check the box if [the application] just said 'environmental analysis', and other agencies want a 900-page document with cited sources and all sorts*

> *of data, and they want whatever valuable reference material is associated with those claims to be included.*

This difference in expectation relates to risk and uncertainty perception, as it reflects the methods by which different participants understand the environment and defend any decisions or recommendations that may involve risk.

As described elsewhere, traditional knowledge was a valid and valuable source of information to participants. In Oregon, fishermen and other ocean users provided input on the likely location of net activities, sea conditions at different times of year, and other observations related to the ocean environment. In Maine, several interviewees reported a perception that a minke whale had been spotted in the vicinity of the planned future Western Passage site, but none of the participants cited a source (note: these participants were not asked directly for a source). I risk to speculate that this reporting may have come from a local ocean user such as a fisherman or charter boat operator. At a public meeting, one participant described how ORPC had "characterized the waterway" from a human ocean use perspective through a process of local outreach, and that, "*It turned out . . . pretty much the way they said it was."*

6.1.7. Adaptive Management

Adaptive management processes were described as key features of managing and responding to differences in perception of risk and uncertainty in both the Oregon and Maine projects. Under an adaptive management process, monitoring plans negotiated between the applicant and the agencies involved in the FERC process are a key component to observing for environmental change. This negotiation can occur either during the pre-filing consultation phase of the licensing process, during formal FERC license consultation procedures, or as a condition of the FERC license soon after issuance.

One of the primary benefits of adaptive management, as described from a developer perspective, is that it allows the levels of monitoring and mitigation to change over time as uncertainties decrease and risk perceptions change. As one respondent described,

> *The industry is faced in the early days with levels of monitoring that are not proportional to the risk at all, but in order to adjust that so they are more proportional, adaptive management is a tool for us and it's also a tool for the regulators who have their own mandates that they need to adhere to, and it's very difficult for them to be able to step out of that box.*

For the Maine project, the AMP included five groups of environmental monitoring plans: Acoustic, Benthic, and Biofouling; Fisheries and Marine Life Interaction; Hydraulic; Marine Mammal; and Bird

Observation. Each plan provides detailed objectives for research and monitoring. The AMP is also incorporated into ORPC's pilot license, such that the license may be adjusted based on findings of the monitoring and allow continued collaboration between the participating agencies (Masterson 2014).

An example of successful adaptive management occurred during the initial installation of the project device. One of the license articles included restrictions on pile driving during parts of the year to protect salmon smolt and marine mammals from acoustic harm, but this left a short window of time after obtaining the license for ORPC to complete their operations or else be forced to wait seven months for a new window to open. To mitigate this risk, ORPC conducted in-water acoustic sampling of ambient conditions and pile driving activities using on a novel underwater noise measurement system, as well as employed sound mitigating technologies to reduce the noise from the pile drivers. With these activities combined, ORPC was able to bring data to the regulatory agencies proving that noise would not exceed thresholds during pile driving. Based on this information, the AMT made a recommendation to FERC and the license was modified to lift the date restriction.

In Oregon, one of the early tensions in the collaborative process was related to how the FERC license would interact with an adaptive management framework. As one respondent described, some participants proposed that due to the amount of uncertainty associated with the proposed project, perhaps a mechanism should be in place to, "*essentially go through the [licensing] process every year [and] do a review based on the information collected in a year, and sit down again and change the license requirements . . . every year of the project."* While functional aspects of this approach are similar to the adaptive management process currently ongoing in Maine, the primary difference lies in the legal requirement for formal consultation under the FERC licensing process if a license were to be perpetually open for expiration or renewal on an annual basis. By contrast, the adaptive management process in Maine allows the collaborative Adaptive Management Team to make recommendations for license modifications, with the final decision remaining under FERC jurisdiction. If adaptive management as a concept can be described as, "learning by doing" and "treating interactions with natural systems as an experiment", then the tension here appeared to center around whether an MRE project should be considered an annual renewing experiment, representing a higher risk to applicants, or a single 30-year experiment with more limited opportunities for non-FERC entities to dictate terms. The proposal ultimately failed, and the participants in Oregon interviewed appeared to expect that the final adaptive management process would likely resemble the consensus-based recommendation format employed in Maine. However, the specific governing structure of the Oregon AMT had yet to be finalized at the time of this research.

The types of responses to unanticipated risks described by participants included additional monitoring and investigation to define the extent of an emerging effect or mitigating actions such as species deterrents or curtailed project operation during high risk times. Interviewees were reluctant to anticipate that total cessation of the license would be a necessary response, although some did explain that in the presence of a severe enough impact, mechanisms such as enforcement actions, reinitiation of consultation procedures under the ESA, or issuance of a jeopardy opinion could theoretically lead to that outcome. Such actions were regarded by the participants who described them as requiring serious consideration involving agency management.

6.1.8. Does Adaptive Management End?

An open question within the FERC license lifecycle appears to be the circumstances under which an adaptive management regime may end. From the collected perspectives in this research, it appears that some monitoring activities are expected to be likely to persist through the life of a license, while others may taper off or disappear once a consensus indicates a level of comfort that effects are adequately understood.

One example of a persistent monitoring activity included the acoustic monitoring for the Oregon project. This is in part because as different devices are installed for testing, their acoustic profiles will need to be understood. However, acoustic information is also valuable to developers because as one respondent described, excessive sound production may be an indicator that a device is not working properly and requires attention.

Standardized durations of monitoring activities have not been developed for either project, but some interviewees suggested a range of five to ten years in hypothetical conversations, assuming no significant surprise results. As with the risk perception concepts described previously, there appeared to be an emphasis on understanding behavior of both devices and environments until a level of “comfort” has been reached. One respondent offered a dose of reality and described how they predicted adaptive management to end:

> *The reality of a lot of this adaptive management is that people get pulled onto other things. There's only so many resource biologists that are out there that are going to follow any of the [MRE] projects. [In our office], projects come in all the time . . . and so as much as I want the adaptive management process to be important, it's as important as it is for as long as it can be, and then the reality is it often fades and not because we're not interested but because we have so many other priorities . . . We can't do them all . . .*

> *These things keep coming and the workload changes priorities. Priorities change, and the adaptive management as much as I want to be involved, could change.*

A question pondered by several of the interviewees concerned how much evidence of what type is required to prove the absence of a negative effect. One respondent explained that monitoring regimes under an adaptive management framework differ from traditional scientific studies in that, “Scientifically you go in with a hypothesis, you come up with a methodology, you implement that methodology, you terminate your study, and then you answer the question. This is much more open-ended than that.” This dilemma echoes one of the criticisms of the Precautionary Principle that it requires the proponents of an action with uncertain potential for negative impacts to achieve the impossible task of, “proving something un-dangerous”.

6.2. Collaboration

Reflections on collaboration appeared to differ between the two case study projects, which may be associated with differences in the type and scale of projects proposed, or differences between the individuals involved (discussed later). Positive reflections on the collaborative process focused on the ability to have open and honest discussion, the building of “genuine relationships”, and the development of a common language for a new technology. Criticisms of the collaborative process included sentiments such as the collaborative process can be “arduous”, “very hard,” “incredibly long”, “exhausting”, or “circular”. There were a few interviewees who expressed that not all of their concerns had been addressed in the collaborative process, and they recognized that these unresolved issues would likely be addressed during a different stage of the licensing process.

The pre-decisional nature of the collaborative process was perceived to encourage agencies to be more frank and less guarded about some of their opinions. As one respondent described it, *“[There was a] huge perceived risk from the agencies, not much perceived risk on our part, and a big gulf in between the two perspectives. I don't think you could have gotten it together without a collaborative process. Lots of conversations needed to happen. There needed to be this this agreement that everybody's moving toward the same point*.”

It appears true that the collaborative process has contributed to greater flexibility for both case study projects. In Maine, the trust and shared understanding built between participants was credited with an ability to overcome technical challenges during installation of the project and reduce monitoring requirements over time. In Oregon, the collaborative process was credited with allowing the project to proceed despite the unique uncertainties that accompany the operation of a testing facility, where the full scope of devices to be tested is not known. As one respondent described, the collaborative approach, "*provides the forum, especially in a process when there are so many unknowns."* Another respondent expressed a similar sentiment that collaboration, "allowed us to manage all that uncertainty and get the regulatory agencies to a level of comfort that the risk will be managed."

One respondent explained that cooperation with project applicants was embedded in their operational philosophy, and, "*If you work with us we'll help you design a project that's going to minimize the impacts, then everybody wins."* One respondent, reflecting on the collaborative process, noted that in past projects, "*No was a pretty easy answer to give people*," but they perceived a shift in themselves and others toward an attitude of, "*How do we get to yes*?" Another participant viewed this as a revolutionary shift in regulatory culture that they had not seen in nearly 30 years of working on similar types of projects.

Many participants from both the applicant and agency perspectives described a process of co-learning that took place during project definition and environmental characterization. In Oregon, the applicant would bring scale models of wave energy devices and sections of actual transmission cable to meetings to familiarize regulators with the size and form factor of proposed infrastructure. "*Like the Pelamis device, the sea snake, that thing was 600 ft long!" said one respondent, "And people go 'What?' and it's like, 'Yeah, these things are huge.'*" Participants also solicited expert opinions regarding sea state effects on operations, practical constraints on the laying of undersea cables, the behavior of biological resources, and other aspects of the natural system surrounding the project site.

Despite the instances of co-learning and negotiation described, it was unclear based on interview responses whether these collaborative interactions had explicitly or directly changed a participant's perception of an uncertainty or risk. In fact, interviewees noted that the more technically complex discussions of risk and uncertainty often occurred one-on-one between the applicant and the agency with relevant authority, then reporting the outcome of those discussions back to the group.

6.3.1. Collaborative Decision Structure within the FERC Process

The types of decisions and agreements that were sought during the pre-filing collaboration phase included:

- Agreement on the risks and uncertainties warranting study, monitoring, or mitigation.

- Thresholds or triggering mechanisms to indicate when a risk or adverse effect is present and requires a response.
- Type and design of pre-filing environmental investigation studies to inform the environmental analysis preceding the licensing decision
- Type and design of post-license monitoring activities, which may influence agency recommendations or conditions during the post-filing FERC consultation phase

Most participants interviewed indicated that they felt they had the proper authority within their respective organizations to make the types of license-related decisions listed above at the table. However, not all participants in the collaborative groups will be the individuals to sign formal correspondence associated with the formal consultation phase of the licensing process. Some described internal review and consultation processes within their management structure associated with formal correspondence. Some also noted that if a severe effect were to be observed post-license issuance, consultation with management would likely take place before drastic risk management actions would be pursued.

In practice, the collaborative structure of a collaborative pre-filing process, such as the ALP, is limited in such that an agency with specific authority over a particular species, environment, or human use will have greater power within the process where those issues are concerned.

The Communications Protocol States that the CWG, "will be self-governing, reaching agreements by consensus," however it is emphasized that "participation in the CWG does not limit any entity or individual from exercising their legal rights or responsibilities." Taken together, these Statements recognize that the alternatives available for consensus-based decision-making are limited by the restrictions inherent in the authorities represented by the individual members of the CWG. Similarly, it follows that a decision made as part of the CWG would not negate a participant's ability to exercise their authority outside of the ALP. This form of collaboration could be argued to be inconsistent with the concept of "pure collaboration"[6] wherein no hierarchy exists between each participant's ability to dictate outcomes. However, this structural dilemma may be expected to be a necessary aspect of negotiation involving law-enacting agencies.

[6] http://www.transform-network.net/en/publications/yearbook/overview/article/journal-112012/hegemony-and-neoliberalism/

The consensus standard appears to be most effective as a way to measure the explicit buy-in of all participating agencies regarding the understanding of risk and uncertainty and the subsequent methods by which they will be managed. The consensus standard also allows dissenting perspectives to stall the process while attempts to reach consensus are reached, which does affect the power dynamic within the room insofar as a prolonged process represents a financial risk to the applicant and an expenditure of resources from busy agencies.

Despite these limitations, collaboration and consensus remain the goal of the CWG. The protocol envisions an open forum that, "allows all participants to voice opinions, create alternatives, and align expectations with the goal of reaching agreement." The protocol also envisions the attainment of consensus as a complex process including hand gestures to indicate participant positions, explicit definition of reasons for lack of agreement, and a formal multi-phase process to follow in the event of disagreement. If no consensus position can be reached, the issue is documented from all sides of the issue and becomes part of the record for the FERC formal process. Depending on how FERC ultimately rules, project design may have to change or an agency might enact different conditions or include different statements in their consultation with FERC.

If consensus cannot be reached, it appears that the enforcement of collaborative cooperation stems from the twin threats of delay and future project uncertainty. The developer must then decide how best to allocate their resources with regard to obtaining the permit - either satisfy the disputing agency's position, attempt to find an alternate solution through additional communication and clarification of each side's interests, or proceed toward the final permit application submittal with an additional element of project risk.

Under an ALP, the pre-filing process is, "*totally under the control of the applicant and all the stakeholders as part of the collaborative process.*" The perceived benefit of this approach is that it affords the applicant greater certainty regarding what the license conditions will be. Once the application is filed with FERC, the pre-filing collaboration ends and the formal FERC process of consultation takes over, followed by opportunities for public comment on the NEPA documents that FERC develops based on the information provided in the license application.

Many of the interview interviewees acknowledged that for issues that were unable to be resolved during the collaborative pre-filing phase, FERC will make the final decision regarding additional information needs or license conditions. As one respondent described, for issues left unresolved at the end of the collaborative pre-filing phase, "*They know where we stand, we know where they stand, and there's no point in arguing about this stuff anymore . . . and it will be up to FERC to decide.*"

Once a project reaches the post-license adaptive management phase, the collaborative arrangement serves as a platform for evaluation of collected data, joint interpretation of any environmental changes that occur, and a venue for recommending changes to the monitoring and mitigation regime established with the original license. As with the pre-filing collaborative, agencies retain their individual authorities, but permit modifications are still within the discretion of FERC. If an agency wanted to impose changes to the license without the consensus of the AMT, they would have to rely on the enforcement mechanisms within their own authorities, for example a reinitiation of consultation procedures under the ESA, or in cases of imminent serious threat to a species a jeopardy opinion declaration. Agencies who support the authority of leases but do not have direct authority, such as state fish and wildlife agencies, had a perceived lesser power to intervene.

An AMT may recommend modifications to the project license, such as the cessation of a particular monitoring activity, or conversely, additional monitoring or mitigation activities if an unanticipated adverse effect is observed. The power structure of the AMT is somewhat flexible due to the charter process, and consensus is not a requirement. As with the ALP, collaboration does not negate the individual authorities of the participants, and the ultimate decision regarding license modifications ultimately rests with FERC. However, the charter for the AMT in Maine States that decisions within the group will be made on a consensus basis. The experiences of the interview interviewees corroborated this dynamic, but it was also mentioned that no severe conflicts or uncertainties had emerged during the project lifespan to date.

The AMP does not specifically outline procedures for conflict resolution among parties, but instead it defers to the first meetings of the AMT to develop procedures. ORPC noted in the plan that they expect, "agencies with jurisdiction pertaining to specific environmental aspects of the project will continue to have final approval of any modifications to the monitoring programs" (p.20). This structure suggests that while consensus is desired, irreconcilable disputes within the AMT would follow the more formal dispute resolution process provided within the Integrated Licensing Process.

The process for minor modifications to monitoring methods, schedules, or parameters may be made without prior FERC approval if consensus is achieved within the AMT. If major modifications are desired (e.g., cessation of a monitoring activity), a more formal process of review and comment from the FPA-designated consulting agencies will ensue, with opportunity for public comment before FERC makes a final modification decision.

6.3.2. Trust

Twelve of the 23 participants in this research described the importance of trust to the successful navigation of the permitting process. Some made general statements such as,"*Building relationships and trust is the most important thing we do*," while others talked more specifically about the importance of an ability for the agencies to trust the motivations and future intentions of the developer with regard to environmental responsibility. From the opposite perspective, some noted that it was also important for the developer to trust that the agencies were as one respondent put it, "*not trying to be mean per se*," in the pursuit of the information they needed. The following are statements from participants regarding the importance of trust to a successful collaborative process:

> *Ultimately what it's about is trust. That the regulators have trust in the applicant and individuals, and that takes a lot of time, takes a lot of effort, but that is ultimately going to be what can drive a project forward or kill it.*
> ---
> *You know, when the industry first started it was, 'Trust us,' and we said, 'We can't. We'd love to.' . . . When you work with us and we build trust and we sit down and problem solve and we figure out a pathway forward, [the project] goes through. . . We are not holding this up, and yes we do have third-party lawsuits, and yes we do have the laws, and no I can't drop them just because you asked me nicely.*
> ---
> *It was difficult initially but after a while we came to trust each other and [the applicant] partnered with a local University of some really great researchers to start collecting some of the baseline information, and they quickly understood yes it clearly makes sense to have this information to evaluate potential consequences of construction and continued operation. So those were really the initial growing pains, just that new process for everybody. Obviously building relationships and trust, the most important thing we do, and then just collaborating. It's been a great collaboration, it truly has.*
> ---
> *It's trust that they're going to carry out the particular studies that they said they were going to, that they're going to report the results truthfully, and maybe to trust us that we are not trying to kill a project. That we just have to rely on the best available information. And once we got through that, we are all reasonable people, we all have our particular jobs to do. We recognize that this is a really novel technology, that we can't just ignore certain things, for instance baseline environmental conditions. I think it really solidified the trust and allowed us to work really well together.*
> ---
> *You always have the potential to miscommunicate, to misread an email or to misread someone's intentions, so I'm hanging up on the trust word because I'm trying to decide whether or not I feel like folks trust one another more now than when they started or if they're just more familiar and know what to expect, and we figured out the right way to work with each other.*

I will say that the [applicant has] been amazing as far as trying to make sure they do the right thing, and it's made our job as far as making recommendations and going forward with conservation in mind - because that is what we do - it has made it easy to go forward because they are so receptive to that . . . with a few caveats.

When describing what makes a permit approval decision viable in spite of the remaining uncertainties and associated potential risks, one respondent said, "*How I look at the future decision is I have to extrapolate and then some of it's a leap of faith just intuition, professional experience, which is limited in that type of field. But it's also relying on the future process*." This sentiment suggests that trust is a factor in ongoing risk management processes such as adaptive management.

A procedural element of the process that one respondent believed contributed to trust building, based on their experience with other projects, was to undertake as a group the iterative progression from identifying issues, to characterizing potential effects associated with issues, to developing mitigation strategies. By working through each step as a group rather than have the applicant propose a fully-formed uncertainty management strategy, "*Maybe the agencies don't think it has closed the door on their ability to participate and bring up different ideas*."

The role of universities as participants in the process was specifically discussed by interviewees in both Oregon and Maine. An applicant's inclusion of university experts was perceived by many to be a factor that appeared to increase trust within the process. One example was the partnership between ORPC and scientists at the University of Maine and other reputable institutions to produce the environmental characterization data and provide input to the monitoring strategies during device deployment. These studies included extensive before and after data that could visually demonstrate the behavior of fish around the submerged turbine during different times. Other valued data were the updated fisheries surveys, vessel usage data in the proposed area, and surveys of avian species presence.

This perception was not universal, however, and could be affected by other factors as described by one respondent:

I ran through my mind well OSU has all this expertise all the professors and graduate students, so it will be really interesting when we start talking about the issues and identifying issues and whether there's problems with particular issues or not, if there's more trust because of their expertise. And the initial several meetings, it was pretty apparent they didn't get any more trust than [Ocean Power Technologies] did. In fact it might have even been less.

A few other participants also felt that a high standard of proof appeared to be required of those OSU staff who were fixtures on the applicant's team; however, expertise from OSU subject matter experts that were brought into the process to contribute to specific discussions within their expertise may have encountered less scrutiny. It should be noted that the purpose of this research was not to solicit perceptions of the applicants, and insufficient data is available to draw conclusions from the information provided.

Another factor influencing the development of trust includes the past history between process participants. One respondent described a feeling of surprise that a new process was not the "clean slate" they expected because participant interactions on a previous project had resulted in a perceived deficit of trust that had to be overcome in the early stages of the new process.

While early interactions may have displayed a deficit of trust among participants, interview interviewees for this research spoke favorably about the type and degree of trust that had been built throughout the years of undergoing the collaborative process. In Oregon, some participants credited the applicant for working with the agencies and making concessions regarding studies or post-license monitoring, although some issues were expected to be forwarded to the formal FERC post-application process. For the Maine project, participants currently described a positive level of trust in the developer. One factor that seemed to contribute to this sentiment included the participants' knowledge and understanding of ORPC's efforts to engage the local community prior to and during the licensing process. ORPC was also credited with frequent communication with the regulatory agencies.

Some participants also described less tangible factors that contributed to trust. The importance of early interactions with agencies was stressed, as was the utilization of competent technical advisors and delivering on commitments. However, the perceived success of collaborative interactions seemed also to rely on the tenor of communication between parties that developed over time. As one respondent described, *"Somewhere along the line it really became, 'We need to figure this out.' I don't know if it was on our end or on their end or just a light went off at the same time, but we began to really start talking to each other about what we need and why, and that changed everything*." Another participant echoed a similar sentiment that, "*I think everybody's been very authentic from where they're coming from and so that's actually nice to be able to feel that way*."

One challenge identified in the development of trust was the necessity of keeping all participants notified in a timely manner as project designs or activities change. When project conditions "*can evolve quite quickly*," but collaborative group meetings only occur semi-annually or quarterly, there is a risk that such changes can leave a process participant feeling surprised and perceive, "*a bait-and-switch*". It did not always seem clear what new information would be perceived as relevant to the interests of all process participants, so one of the lessons learned among the applicant was to actively practice open communication and set clear guidelines regarding topics that warranted immediate notification to other participants.

One sign of trust building over time appeared to be an increased comfort among agencies regarding applicant-generated documents. As one respondent described, "*Before, if we'd put in a citation of a study or a synthesis that someone had done, there might have a lot of 'yeah buts'. 'We still don't know this, this, and this,' and I feel like there's maybe less of those 'yeah buts.'"*

6.3.3. Collaboration Takes Time

Most interviewees expressed that collaboration takes time to succeed, and many described variations on a "learning curve" associated with building relationships and a mutual understanding of project risks. This concept is intertwined with the importance of building trust between the parties and is epitomized by one respondent's comment that:

> *It's sort of an evolution where first for several meetings you have to sort of develop the trust, see what level of expertise is in the room, see if everyone is going to be willing to consider and listen to everybody's point of view and agree that they are going to work together rather than fight against each other. So it's more of a trust issue than anything, and that's where collaboration I think helps for the most part is it helps develop that trust.*

Another respondent noted that their perception that they, "*had never seen developers and regulators being so friendly*," and they felt that this group dynamic was "*a genuine relationship that had developed over time*."

While acknowledging that collaboration takes time to build trust, many participants in the Oregon process felt that the process had been too long. One respondent felt that it was, "*purposefully exhausting . . . You're constantly revisiting, you're constantly questioning, you're always facing reversals*." At the same time, others acknowledged that, "*a lot of conversations needed to happen,*" and the length of the process may have been a necessary consequence.

Similar concerns were not echoed by the participants in the Maine project. One participant was at a loss to suggest how the process could have moved any faster, reasoning that, "*It takes time to collect all that data* *and to analyze all that data, and I don't know how you speed that up any more. It takes three years to collect all the data and analyze it. I don't know how you shave any time off of that*."

6.3.4. Informal Discussions

Informality was a valued attribute of the collaborative processes evaluated. Several interviewees expressed that the informal structure allowed agencies to be less guarded in discussions and, as one person described it, "*It gives us the opportunity to vet ideas in an informal setting before we are on the clock, before decisions are having to be made*."

While the ALP is described as "open to the general public," this invitation extends to distinct points in the process such as NEPA scoping, public comment at any time during the process, or specific public comments on the license application and NEPA environmental analysis per public procedural laws. The meetings of the CWG by contrast are considered informal consultation, and participation in these meetings requires an invitation from the group. This decision is presumably to preserve the informal "pre-decisional" format of the CWG meetings and encourage participants to engage in frank dialogue.

One consequence of this public involvement structure is that the CWG meetings were not available for direct participant observation as part of this research. The Communications Protocol for the CWG in Oregon contains a section on public statements that establishes rules for communication outside of the process. As stated in the Communications Plan,

> In the interest of maintaining trust among CWG participants, no person or entity involved in the alternative licensing process is authorized to make a Statement on behalf of any other person or entity with regard to the process or any substantive issue affecting CWG discussions and/or the licensing process. With regards to making public Statements, all parties agree not to divulge the substance of positions taken by participants in CWG discussions (NNMREC, 2014, p 8).

When I reached out early in the research process to see if it would be possible to directly observe one of the meetings, the response I received was that a member of the party was concerned that the presence of an active researcher would have a "chilling effect" on discussions. This hesitation was understandable, because qualitative research of this nature may be seen as inviting the risk of unintended messages from a pre-decisional group conversation reaching public audiences who might perceive them as official positions of an agency. FERC staff on the east coast were also less inclined to participate in this research, stating that "[FERC] are not in a position to opine about how the licensing processes were handled for specific projects," and suggested instead that people interested in the process should consult the FERC eLibrary of formal project documentation and correspondence.

Once the official pre-filing collaboration process was nearing its end, interview participants appeared to welcome the opportunity to share lessons learned from the process, although they seemed careful not to speak for other agencies' positions or discuss in detail the technical substance of risk and uncertainty issues the group had navigated. One participant recalled the restrictions in the Communications Protocol during the interview and spoke of notifying the group that the conversation had taken place.

The guardianship over the collaborative process exhibited by the participants suggests that they valued the trust-building structural components of their interactions. While this finding does not necessarily correlate with a conclusion that trust existed between the people in the process, it does suggest that the people trusted the process itself.

While the pilot process for Maine followed the procedural rules and schedules of the ILP, interviewees described FERC's presence as minimal, with one respondent expressing the feeling that conversations within the group were less frank when FERC participated in meetings. In Oregon, FERC attended all meetings and the role at the table was described like a "silent judge", offering a perspective on FERC process when asked. One respondent noted that because FERC has no biological mandates for specific resources, they were able to provide, "*kind of a third-party unbiased voice*".

6.3.5. Participation

In both processes, the main participants in the collaborative groups were the State and Federal agencies with relevance in the FERC licensing process and the applicant's team of project personnel and subject matter experts. However, several non-governmental or local-level stakeholders, including traditional marine resource users, were invited to attend meetings and join discussions. A few interviewees described that the pre-filing collaboration varies from the traditional licensing process because it, "*brings the State in*." Once the application is filed with FERC, the process adheres to strict schedules and features limited opportunities to iteratively resolve issues. The open-ended negotiation period of the pre-filing collaboration was perceived by some participants to allow States a greater role in the management of uncertainty and risk.

When asked about the level of participation from stakeholders outside of the core agencies, interviewees reported that these groups seldom if ever participated in meetings. Several described a phenomenon where invited stakeholder groups participated in the beginning of the process, then tapered off their involvement over time. A few of the interviewees echoed a similar sentiment that perhaps those stakeholders found the process too “exhausting” or “painful”.

In Oregon, a few interviewees speculated that the inclusive siting process that led to the selection of the proposed SETS location had addressed the majority of concerns a local stakeholder may have with the project, and therefore a decision to not participate in the formal licensing phase may have seemed like less of a risk. Despite their sporadic involvement, the input of these other stakeholders appeared to be valued by members of the collaborative groups, with some remarking that at times a fisherman or local NGO member would provide information that illuminated the group’s perception of risk from an ocean user’s perspective.

Some of the interviewees from State agencies also perceived themselves as intermediaries between local citizen concerns and the discussions occurring at permitting meetings. They made it clear that while the process was ongoing, members of the public were welcome to voice their concerns to an agency with assurance that their issues would be raised for group consideration.

6.3.6. The Role of Individuals

The word “personalities” was used by many of the participants included in this research, appearing in both case study projects. Several interviewees reported that the personalities around the table were an important aspect of the process, separate from authorities.

Interpersonal dynamics and institutional roles also appeared to be a factor in the development of trust within the collaborative setting. One respondent perceived a lack of trust at points within the Oregon process, which they saw to be, “*predicated on either personalities or just the way others were perceived. ‘If you’re a government person, you must be like this,’ so you’re pigeonholed. If you’re a developer then you’re obviously this kind of mindset and person and we can’t trust you*.” Some interviewees from the Maine process recalled similar perception-based hindrances during the early stages of their process, but those perceptions appeared to have changed over time, as all interviewees reported feeling that the current relationship between the parties was, in the words of one respondent, “pretty easy”.

One respondent remarked that “the first risk at the table” for a new project concerns who is at the table, their relationships with each other, and their individual perspectives and attitude regarding the acceptability of MRE in “their ocean.” One respondent expressed surprise at how “emotionally-charged” meetings could be and that they perceived people to be "very passionate about the various environmental risks associated with projects". Another respondent went so far as to suggest, "*It was I think painfully obvious sometimes that it was interpersonal more than it was issue related, so the intransigence and the conflict to my perception was in some cases entirely interpersonal. Sadly so, because it's costing everyone else a lot of time and money*." This observation appeared to be true more of the Oregon project than in Maine, although interviewees from the latter project also described their pre-filing collaboration as "*a bumpy road in the beginning*." Another remarked that a successful collaboration relied on a number of factors, and, "*I'm not saying something just like clicked. There was a time component here, but it was certainly a personality thing*."

Several interviewees described issues for which participants would attempt to use logic or make connections to analogous examples of ocean uses in an attempt to resolve concerns about risks or uncertainties. One respondent reflected that the effectiveness of reasoning through perceived risk, "*Depends on who's listening. It depends who has the issue. And I would say it does depend on who. It's not just the agency, it's the person, and I guess it's not too surprising when you've got a people-driven process*."

Additionally, participants alluded to the importance of having the "right people" in the room, and described the following qualities to be important to the success of a collaborative effort:

- Leaving prejudices at the door;
- Frank and honest communication;
- Positive attitude, shifting from, "No is an easy answer to give people," to "How do we get to yes?";
- Timely notification and inclusion of the group in project-related news and information;
- A focus on needs and interests from the perspective of respective authorities;
- Open communication; and
- Patience.

6.3.7. Conflict Management

Conflicts seemed to occur around protection of authorities, protection of process, negotiation of monitoring, and negotiation of pre-installation studies. Action-based risk mitigation measures were seemingly easy compromises and included such activities as placement of lights to ward off vessels, utilization of sound reduction methods during project installation, alteration of project timing to avoid sensitive species migrations, or removal of whole wave energy device design types from the pre-approval process that were perceived as too risky.

As might be expected, both processes described a dynamic wherein agencies requested additional data to be collected during the pre-filing period that the applicant did not always agree with. These situations led to negotiations within the group, and there was a perception among some participants that the applicant made concessions during pre-filing that may not have been required by FERC upon submittal of the license application. Reasons behind these concessions included, "keeping people happy," or building trust that may pay dividends later on.

When conflicts arose, many interviewees noted that the conflict resolution and communication procedure portions of the group's charter proved invaluable. One respondent reflected, "*It has come around a couple times where we've reached difficulties . . . and if we didn't have a [Communications Protocol] to walk through and just say okay this is what we agreed to, this is our process, here's how we're going to get through this, we may not have gotten through it*." The conflicts alluded to by participants seemed to be more associated with communication and trust issues than intractable technical disagreements. Such conflicts were commonly resolved by elevating the issue to the management level outside of the CWG meetings.

7. Discussion

Any discussion of the benefits of collaboration on risk and uncertainty management must be caveated by the fact that this research was conducted while the two case study projects were still actively ongoing. The Oregon process in particular existed in a "bated breath" moment between the end of the CWG's collaborative mission but before any of the interviewees had seen the draft license application that was the culmination of their efforts. As a result, many of the responses from interviews had an air of uncertainty and anticipation about whether the gamble of collaboration had achieved its purpose. In the Maine project, the ORPC device had been out of the water for more than two years, and proceedings have not yet begun for the next deployment in Western Passage, so the collaborative AMT was not actively facing risks or uncertainties when they were interviewed. While acknowledging these influences on the analysis, some conclusions may still be drawn regarding the effect of collaboration on the perception and management of uncertainty and risk.

This research finds that the process of collaboration did affect the perception and management of MRE risk and uncertainty among participants in the group. A primary type of effect appeared to be that the process provided an opportunity for co-learning and more informed definition of uncertainty and risk that required a management action. Not all issues were resolved within the collaborative multi-party setting, as some interviewees reported the resolution of some technical issues in a direct one-on-one interaction between the applicant and a regulatory entity. Agencies were found to mostly focus on uncertainties and risks that pertained to their respective authorities, but another effect of collaboration was that agencies occasionally expressed positions on issues outside their authorities. The effect of this positioning on risk and uncertainty management was not clear within the research. Another perhaps more significant effect attributable to collaboration is that it allowed an opportunity to build trust, which a majority of participants identified as an important component of the permitting process. This research also found that collaborative risk and uncertainty management is not limited to the pre-application phase, but continues post-installation of a project with an adaptive management “action arena”. These topics are discussed in greater detail below.

7.1. Precautionary Meets Adaptive

Three out of 15 interviewees from agencies made direct reference to a precautionary approach to risk (UN Convention on Biodiversity, 1992), in that where a threat is perceived which may cause harm to an interest protected by that agency, the applicant is responsible for proving the absence of the perceived threat. Along a similar theme, a few other participants acknowledged that perceived risks were often fueled by uncertainty about either MRE devices or the specific environment proposed for a project, which is consistent with the Slovic model of risk perception.

Adaptive management (Holling, 1978) appears to be a process that can allow projects to move forward in spite of uncertain potential effects, provided that: 1) sufficient baseline characterization data is collected prior to project installation to allow the identification of future environmental effects; and 2) the applicant retains the responsibility to adequately monitor and mitigate unexpected project effects that risk jeopardizing compliance with environmental protection regulations. Adaptive Management is not without its weaknesses, and its relationship with the precautionary principle is complicated despite the fact that both approaches seek to increase understanding of a system and decrease the amount of uncertainty associated with a proposed action. One article observes, “There is a natural tension between adaptive management and the precautionary principle. Adaptive management requires a degree of risk taking as policies are implemented as experiments with uncertain outcomes, and advocates of precaution are wary of actions that may entail unforeseen results” (Johnson, 2012, p 9).

The adaptive management approach to MRE risk management is not without its own risks to participants or their institutions, who may face litigation or loss of reputation. Given the risk inherent in transitioning from a precautionary approach to an adaptive approach that itself could potentially pose a risk to the environment, there appears to be a relationship between "comfort" with an adaptive management approach and the level of trust that has been built between the applicant and the permitting process participants.

A criticism of the integration of the precautionary principle into species protection laws is that it does not allow comparison of the benefits or costs of protecting versus not protecting the environment or a species unless the threat of extinction is very low. This criticism appeared to be applicable to MRE permitting processes, as benefits of MRE to mitigate large-scale risks such as climate change did not appear to have a voice at the table. This finding relates to the Slovic risk perception model and the concept of the "affect heuristic", because a lack of official consideration of perceived benefits from MRE may lead to increase in the perceived "riskiness" of an MRE project. This coincides with the perception expressed by a few participants that regulatory agencies, "have nothing to gain" by approving an MRE project. The emerging debate over the conditions by which MRE will be allowed to exist offshore is consistent with the concept of a "green versus green" dilemma wherein, "climate mitigation efforts trigger renewable energy development, but then face substantial barriers from precautionary biodiversity protection instruments and practices" (Koppel et al., 2014, p 1).

7.2. Interrelationship between Collaboration and Risk Perception/Management

In a permitting process, every person involved has an interest to manage risks to the upholding of their responsibilities. Every actor in the arena has a different responsibility to uphold, however, whether that be the preservation of a species or habitat, the protection of human life, equity, the preservation of their institution's standing, economic viability of an industry, or decarbonization of our global energy system. With so many interests and authorities surrounding a single decision - whether and how to introduce a new human project in the ocean - a collaborative approach based on best available science has emerged as the preferred arrangement within which to negotiate these interests. Together these groups must navigate many types of risk and uncertainty across a number of sectors that from a regulatory authority perspective do not often overlap. As a result, the collaborative appears to contain a mixture of group co-learning and small group deep technical negotiation, of consensus and residual differences in power from agencies' authorities outside the confines of the collaborative working group setting.

It is apparent that although the FERC license operates within the bounds of many authorities, the licensing process itself is a human process. Environmental protection laws contain standards that are simultaneously strict yet ambiguous, and it is up to the enacting agencies to make recommendations about how to manage the potential risks of an MRE project based on an interpretation of those standards. This interpretation must account for uncertainties that in many cases cannot be resolved until a device is in the water, and even then a clear answer may not appear due to the inherent complexities in marine systems. Several regulatory agencies described a precautionary approach to risk and uncertainty, which manifested during negotiations of information needs pre- and post-license. Adaptive management is a framework that has allowed both projects to proceed in spite of this uncertainty, and it was clear from the participants' perspectives that Adaptive Management represents in many ways merely a continuation of the pre-filing discussions of risk and uncertainty in a collaborative setting.

The collaborative process during the pre-application stage is not the only venue by which all conflicting perspectives about risk and uncertainty must be resolved. This is by the design of FERC's process. Rather, the participants are intended to identify all the potential issues, agree where possible how best to address those issues, address as many as can be feasibly and reasonably performed prior to receiving a license, and agree where possible to how the project will be monitored for adverse change once the project has been installed.

In the permitting process action arena, the structure of power is by its legal context unbalanced. The collaborative group pre-license application is pre-decisional, and all voices had the right to be heard. The ultimate weight those words are given toward the management of a perceived risk or uncertainty, however, ultimately depended on whether they came from an entity with regulatory standing over the topic. Expertise within agencies appeared to be predominantly respected, such as biological expertise from NOAA or maritime experience from the US Coast Guard or BOEM. All participants recognized that FERC was the ultimate deciding entity regarding issuance of a license, and some in the Oregon process described FERC's role within the CWG like a silent judge observing reasoned arguments, taking in all sides of an issue with a special consideration for information derived from the best available science. The ability of agencies to step beyond their strict spheres of authority was seen as an endemic aspect of the collaborative process allowing all parties to have a voice toward the production of "an aggregate product".

Words used to describe the collaborative process included "very hard", "arduous", "exhausting", "circular", "necessary", "frank and genuine", and in some cases "emotionally charged". Values of the process included perceptions that projects with high uncertainty could not succeed without collaboration, that trust and relations between parties was an essential component to success, and that instances of co-learning had taken place toward a mutual understanding of some risks. However, most interviewees recognized that a gulf existed between perceptions of risk among participants, and it was unclear whether the act of collaborative interagency discussion had directly led to a change in a participant's perceptions. In fact, interviewees noted that the more technically complex discussions of risk and uncertainty often occurred one-on-one between the applicant and the agency with relevant authority, then reporting the outcome of those discussions back to the group.

Another purpose of the collaboration appeared to be the clarification of the ways in which agencies could not reach agreement. Because the FERC licensing process has a process for moving forward in spite of a lack of consensus, even though consensus is the desired outcome, then it is critical that FERC as the final decision-maker be presented with fully realized arguments to consider. Under a traditional process without a pre-filing collaboration phase, the applicant would submit their project information and environmental investigations, FERC would consult with the relevant agencies, and additional license conditions or study requirements may be imposed prior to the license. It may be argued that a collaborative process affords an applicant additional opportunity to both try and resolve differences with regulators before they go to FERC, as well as prepare their best justifications for why an additional study or mitigation action may not be required, equipped with an understanding of regulatory interests and perceptions of the risk involved.

In a way, the dynamic in Maine offers a look ahead at what is to come for the Oregon group. The way the participants in the ORPC process described it, they had formed a functional collaborative wherein information was shared, trusted, and deliberated among a group that understand each other's interests. Trust had been built during the pre-application process for the pilot license, helped along by adequate funding to collect the baseline data that agencies would rely on when evaluating how the project had changed the environment. Other aspects of this trust that participants talked about included trusted experts from University of Maine and other technical consultants, an observation of the company's commitment and responsiveness within the host community of Eastport. Some participants also mentioned the importance of a right mix of personalities in the room with a desire to collaborate. The Adaptive Management Plan represents a promise of good faith for the future activities of the project.

Should the goal of collaborative risk management be to reach alignment as a group on the perception of risks and uncertainties for a given MRE project and "see it the same way"? Or, should the goal of a collaboration in this arena, given the different interests and authorities around the table, be merely to acknowledge and understand that different risk perceptions exist, that alignment may not be possible, and design a project risk management strategy that can accommodate different perceptions of risk? Asked another way, should collaborative risk management take a fundamentally bottom-up or top-down approach? One respondent pondered this rhetorical question at the end of their interview and noted that potential benefits and drawbacks are present in either approach. It is a question that is open for debate as future projects undertake collaborations of their own.

8. Conclusions

The most consistent themes from this research were that the definition of unacceptable risk is elusive, adaptive management is a key feature of moving forward with MRE projects in the face of uncertainty, and trust is an asset that all participants felt worthwhile to develop by working together. With these essential themes in mind, perhaps the role of the collaborative process is to build the trust that is necessary to successfully accomplish Adaptive Management. If trust in a device′s effects on the environment cannot be verified with certainty, then perhaps trust in the people responsible for managing those risks must take its place.

So many uncertainties remain about how MRE devices will interact with their environment, and many risk thresholds have yet to be clearly defined. If this new industry is to find a place within the ocean, a vigilant and functional group of experts and professionals must endure to ensure that no responsibilities fail to be upheld. Collaboratives are places where a shared understanding may be generated and persist as staff changes and the group’s experience grows. This in turn improves the characterization of risk such that risk perceptions may be based on the best knowledge available and, by decreasing uncertainty, increase security that risks are being properly identified and managed over time.

It may not be apparent at the outset of a licensing process, but it seems clear that the relationships built during the process will not end once a license is issued. Rather, the Adaptive Management framework for MRE projects is akin to a continuing collaborative governance arrangement, where the patchwork of agencies that manage the ocean will continue to learn and manage risks together, for as long as they have interest to do so, up until the license term ends. Perhaps as time goes on and the risks and uncertainties of MRE find greater definition and acceptance, adaptive management will become a less important feature. Until then, it is in the interest of MRE developers and regulatory agencies to build a strong relationship based on mutual learning, reciprocity, and trust.

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Chapter 3: Best Management Practices for Marine Renewable Energy Permitting

Executive Summary

The marine renewable energy (MRE) industry has reached a stage in development where requests have proliferated for permission to use ocean places for new device testing or permanent power installations. These requests trigger a series of processes within governmental organizations, which have varying scales of authority but a shared interest in how risks to the ocean will be managed. As the permitting process has matured on both the west and east coasts of the United States, best practices have begun to emerge and spread to successive processes, in some cases being codified in regulations or guidance. There may also be ideas or approaches to risk management and collaboration that may have not been adopted by successive processes, either through the lack of a dissemination pathway or through natural selection. It is important to capture the lessons learned during these processes in hopes of informing successful ocean management and/or ocean energy development in the future. This research analyzes examples of collaborative marine risk management in practice, when multiple government agencies must work together to identify and manage uncertainty and risk associated with permitting MRE projects in the United States.

Two case study projects from Oregon and Maine are analyzed based on semi-structured qualitative interviews with process participants, analysis of relevant project documents, and participant observation of publicly available presentations, workshops, and conferences. This research characterizes and evaluates barriers and opportunities in multi-party collaborative permitting arrangements and identifies best management practices for future practitioners.

A multi-method approach was utilized to collect both primary and secondary data (Creswell, 2014; Ingles, 2007) from the two case study MRE projects. Research participants engaged in semi-structured interviews (Creswell, 2007), conducted by the researcher, with open-ended questions focused on recommendations for how future process participants could more effectively navigate the process. The methodological approach followed selected tenets of grounded theory, such as inductive reasoning, a focus on process, and an emergent style of investigation and knowledge pursuit (Glaser and Strauss 1967; Strauss and Corbin 1990).

Based on the results described above, the following best management practices may improve future MRE permitting processes:

- Engage a broad expertise early in the process to inform initial discussions with regulatory agencies and associated informational materials.
- Identify environmental impact uncertainties early based on a stressor-receptor framework, and work together with agencies to identify and prioritize uncertainties that have a "regulatory nexus" that affects the risk of violating an applicable regulation.
- Negotiate uncertainties that will be managed before or after permit approval and project installation. Recognize that agencies will expect the collection of sufficient site-specific data to develop a baseline characterization of the proposed project site. This will aid in the adaptive management process that should be expected to follow project installation.
- Employ best scientific practices when designing studies to address uncertainty, and seek technological solutions to permit-related investigations.
- Work to establish trust within a collaborative setting by:
    - Setting and abiding to ground rules and communication protocols.
    - Engaging in frank and genuine conversation.
    - Communicating early and often, especially as project designs change or operations at sea experience non-normal events. Recognize that "normal" may have a different meaning depending on the participant in the process.
    - Recording major agreements and points of understanding reached. This builds the institutional memory of the collaborative group and may improve permit application document reviews. Consider citing consensus understandings and agreements in the permit application.
    - Considering the possible benefit of additional data gathering activities and investigations, which could potentially not be required by FERC in the final permit, as a means to build trust and assist regulatory agencies in reaching comfort with the risks being introduced into their environmental aspect of concern.
    - Expressing the needs of your party and soliciting the needs of the other participants in the process. Seek a mutual understanding.
- Government funding of some environmental studies can clear permitting roadblocks.
- Milestones and deadlines may speed the process, but currently the FERC Alternative Licensing Process does not have a formal mechanism for enforceable schedules.

1. Introduction

The marine renewable energy (MRE) industry has reached a stage in development where requests have proliferated for permission to use ocean places for new device testing or permanent power installations. These requests trigger a series of processes within governmental organizations, which have varying scales of authority but a shared interest in how risks to the ocean will be managed.

The offshore areas of the United States possess an enormous amount of kinetic energy from the wind and waves which, if converted into electricity using a collection device, has the potential to offer a substantial renewable energy resource (EPRI, 2011). The MRE industry is still in its infancy, however, with many uncertainties for industry and resource managers alike. Compared to Europe, the United States has been slower to permit MRE facilities, and numerous studies have indicated that the permitting process is a significant burden that impedes technological progress (Dubbs et al. 2013).

The permitting process for MRE represents a platform from which human dimensions meet natural science and technological uncertainty, as managers from different agencies must decide how to safeguard acceptable risk to the marine environment within their respective sectoral spheres of authority. However, as permitting processes have added options for integrative and collaborative structures[7], and as lead agencies embrace marine management ideals such as the precautionary principle (UN Convention on Biological Diversity, 1992) and adaptive management (Holling, 1978) in their laws and guidance, these multi-agency structures begin to resemble integrative platforms from which the Ecosystem Based Management (EBM) framework may be realized.

1.1. Research Purpose

The purpose of this research will be to identify best management practices for future practitioners of offshore energy regulatory approval processes. Many existing scholarly works and analyses have focused on issues of economic and social trade-offs associated with MRE, but there have been fewer explorations into the institutional and technical human processes that occur alongside and after an energy development project has successfully found a host community. As the permitting process has matured on both the west and east coasts of the United States, best practices have begun to emerge and spread to successive

[7] FERC Licensing Processes: Integrated, Traditional, and Alternative Licensing Processes. https://www.ferc.gov/industries/hydropower/gen-info/licensing/licen-pro.asp

processes, in some cases being codified in regulations or guidance (DOE, 2016). It is important to capture the lessons learned during these processes in hopes of informing successful ocean management and/or ocean energy development in the future.

1.2. Research Questions

This research is focused on the following guiding questions:

1. What are participant perspectives regarding the value of a collaborative marine renewable energy permitting approach relative to traditional permitting processes?
2. What do participants perceive to be barriers and opportunities for future practitioners of the collaborative approach?

2. Case Study Context

2.1. PMEC-SETS Wave Energy Test Facility, Oregon

The Pacific coast of North America possesses an enormous amount of kinetic wave energy which, if converted into electricity using a collection device, has the potential to offer a substantial renewable energy resource that could replace other greenhouse gas-producing energy sources. The wave energy industry is still in its infancy, however, and its potential is hindered by a lack of direct experience testing new device designs in the marine environment.

To address this challenge, in 2013 the Northwest National Marine Renewable Energy Center (NNMREC) at Oregon State University embarked on an effort to license and construct a wave energy test facility off the coast of Oregon (known as the Pacific Marine Energy Center - South Energy Test Site or PMEC-SETS), which would offer a preapproved venue for inventors to test their devices with a minimum of regulatory barriers. As currently envisioned, PMEC-SETS would consist of four grid-connected test berths, each with a capability to test up to five wave energy conversion devices, located approximately six miles offshore southwest of Newport, Oregon.

Following a successful public siting process (Goodwin, 2015), OSU requested to follow the Alternative Licensing Process toward a FERC license. Prior to official approval to use the ALP, the license applicant (OSU as represented by NNMREC) formed a Collaborative Workgroup (CWG) as the venue for permitting discussions and developed a Communications Protocol pursuant to 18 CFR Section 4.34(i)(3). The CWG was comprised of, “the agencies and stakeholders who began coordinating with NNMREC-OSU in early 2013, as well as representatives of other State and Federal agencies, local government, Native American tribes, and commercial fishing, conservation and recreation interests." (NNMREC, 2013). The Stated purpose of the CWG during the application pre-filing consultation phase of the ALP is to:

- Identify issues, concerns, goals, statutory responsibilities, and information needs relating to the proposed project.
- Identify and share any relevant information and data that can be used to inform the development and assessment of the proposed project.
- Identify and assess any potential gaps in the available information and suggesting ways to gather such information, including how it will be collected and how it will be used.
- With the facilitator's assistance, establish priorities, deadlines and critical paths essential for progress and achievement of desired outcomes in an efficient, effective manner.

A draft Communications Protocol was distributed to the CWG by the applicant in November 2013. The protocol establishes the ground rules for the information sharing and decision-making to occur during the pre-filing consultation, including a conflict resolution process. After a process of consultation and refinement, in March 2014 a total of 20 entities representing the CWG unanimously motioned their support for the Communications Protocol for the purposes of carrying out the ALP.

The CWG pre-filing consultation process is still ongoing as of 2017, with submittal of the Draft License Application to FERC expected toward the end of the year. The final permit application for the SETS is currently behind the planned schedule due to the need for unforeseen additional studies that emerged from the process. As such, the value of the experimental collaborative regulatory approach is not yet clearly understood. The findings of this research represent a snapshot of an ongoing process and should be considered in the context of the time when it was performed.

2.2. ORPC Cobscook Bay Tidal Project, Maine

In 2006, Ocean Renewable Power Company (ORPC) submitted an application to FERC for a License to construct a tidal turbine array in Cobscook Bay (CB) within the Bay of Fundy, offshore of Eastport, Maine. FERC became the lead agency for an Integrated Licensing Process involving the developer and State and Federal agencies with jurisdiction over the decision whether to permit placement of the device. ORPC received the preliminary permit from FERC in July 2007. This original project was large in scope, with 100 to 150 generation devices planned for Cobscook Bay.

In June 2008 ORPC changed course and formally requested to use the recently unveiled FERC Pilot License Process for a smaller testing project in Cobscook Bay. Environmental studies associated with the earlier effort were continued in support of the new process. In 2009, the State of Maine and FERC also signed an MOU outlining their collaborative approach to State and Federal regulatory consistency, with a goal of ensuring sustainable development of tidal energy resources and the commercialization of new technologies. Agencies from Maine's Departments of Conservation, Environmental Protection, Inland Fisheries and Wildlife, and Marine Resources, State Planning Office, and the Governor's Office of Energy Independence and Security and FERC came to together to create a coordinated process to review tidal energy projects with the pilot license process. Maine's Department of Environmental Protection was designated as the lead agency for Maine (ORPC, 2012).

In July 2010 ORPC submitted a preliminary permit application to FERC for the CB pilot project. FERC issued a second preliminary permit in January 2011. In September 2011, ORPC submitted its pilot license application to FERC. FERC developed an Environmental Analysis under NEPA based on the information submitted by ORPC, which resulted in a Finding of No Significant Impact in January 2012, and the developer received a pilot license in September 2012.

One of the provisions in the FERC license was that within three months of license issuance, the applicant would be required to develop an adaptive management plan (AMP) to guide ongoing monitoring and environmental effects evaluation activities. Basing their approach on the collaborative nature of the 2009 MOU between FERC and the State of Maine, ORPC drafted an AMP in 2012 in consultation with the USFWS, National Marine Fisheries Service, Coast Guard, Maine Department of Environmental Protection, and Maine Department of Marine Resources. The Adaptive Management Team (AMT) formed out of the Adaptive Management Plan and is composed of ORPC, NOAA NMFS, USFWS, USCG, USACE, Maine DEP, Maine DMR, and technical advisors. The AMT is responsible for evaluating environmental monitoring data and recommending license modifications where appropriate.

In the 2012 ORPC Adaptive Management Plan (ORPC, 2012), adaptive management is defined as, "a collaborative, consultative process among ORPC management, State and Federal agencies, and stakeholders that monitors and reviews the results of policies, Project actions and environmental data, and integrates this new learning into policy and management actions, adapting as necessary." Collaboration is embedded within the definition of AM in the plan, with an emphasis on co-learning. The plan continues, "In this approach, policy and management actions are viewed as scientific experiments that are conducted among scientists, managers, and other stakeholders on key policy decisions" (p.7).

ORPC's experimental tidal turbine was installed in Cobscook Bay in 2013. A failure of the power takeoff system caused ORPC to remove the turbine in 2014. ORPC is now planning to initiate another pilot project in a nearby location, Western Passage, which is expected to have more favorable energy generation potential. This second project will require a new FERC Pilot Project license.

3. Background on the MRE Permitting Process

The United States uses an agency-based system to execute its laws, which means in practical terms that any attempt to interact with these laws, for example via a permit application, must follow a human process with people in authority who will govern the outcome. Several local, State, and Federal government agencies are responsible for protecting and managing the busy ocean place, and together they provide a patchwork of management for the ocean. The permitting process for MRE is where the social and the technical combine, using the best available science to meet the needs and legal requirements of each agency at the table in order to manage both short-term and long term risk.

Each agency involved in the decision whether or not to allow MRE has its own process for consultation or permitting, which in past years energy companies have said made their overall process confusing, lengthy, and prohibitively costly (Dubbs, 2013). According to the 2016 Annex IV State of the Science for Marine Renewable Energy, "The consenting process is still regarded as a barrier for the sector to scale up and become cost-competitive with other forms of electricity generation. As summarized by Copping et al. (2016), "Time-consuming procedures — linked to uncertainty about project impacts and the need to consult with numerous stakeholders before reaching a permitting decision — appear to be the main obstacles to consenting of ocean energy projects."

Consistent with the National Ocean Policy (2012), the goal for ocean management is to follow the tenets of Ecosystem-Based Management (EBM). EBM is described as having, "an ecosystem approach to management [that] is intended to directly address the long-term, sustainable delivery of [the full range of] ecosystem services and the resilience of marine ecosystems to perturbations (Rosenberg and Sandifer, 2009)." Inherent in this description is an underlying mandate to manage all significant risks to marine ecosystems in the short- and long-term.

A key component of Ecosystem-Based Management (EBM) is the emphasis on cross-sector cooperation and integration (ORAP 2013). Much of the existing literature, both about collaborative governance in general and the MRE permitting process in particular, balances the potential benefits of increased cooperation with the perceived and actual costs and pitfalls. One article states, “Although long seen as desirable, inter-agency collaboration has remained conceptually elusive and difficult to achieve” (Hudson et al., 1999, p 236). Another article argues that, “Collaborative governance requires problem solving, broad participation, provisional solutions, the sharing of regulatory responsibility across the public-private divide, and a flexible, engaged agency,” but finds that these qualities are not always in supply in real-world processes (Freeman, 2011). With regard to risk management however, the potential benefits of integrative approaches are clearly laid out:

> Institutional diversity can offer considerable advantages when complex, uncertain and ambiguous risk problems need to be addressed because, first, risk problems with different scopes can be managed at different levels, second, an inherent degree of overlap and redundancy makes nonhierarchical adaptive and integrative risk governance systems more resilient and therefore less vulnerable, and third, the larger number of actors facilitates experimentation and learning (Renn and Klinke, 2011, p 1).

Consistent with EBM, the essential objective of the MRE permitting process is to manage risk within a set of governed boundaries, be they physical, subject-based, or administrative. Each agency participating in the process operates from a different legal mandate with its own history and relationship to the other legal authorities present. In addition, differing disciplinary, institutional, or personal perceptions of risk and uncertainty may color the living execution of law by the people operating within the process’s “action arena”, i.e., the social platform where decisions occur (Ostrom, 2011). Combined, this is a dizzying combination of influences on the risk management process.

1.1.1. Requirements and Authorities for a FERC MRE License

In order to gain permission to be installed in the ocean, an MRE project must obtain a number of permits and licenses from various Federal, State, and local government entities. It must also demonstrate that it adheres to all applicable environmental protection and human safety regulations, both during installation and throughout the life of operation. Masterson (2014) organized the framework for environmental review of MRE projects into three major areas: 1) the Federal Power Act, 2) the National Environmental Policy Act (NEPA), and 3) targeted environmental statutes such as the Endangered Species Act (ESA) and the Coastal Zone Management Act (CZMA). Pacific Energy Ventures (2012) summarizes the major laws that integrate with the MRE permitting decision. Each legal authority associated with the MRE permitting process is accompanied by an enacting agency whose staff interpret and execute their authorities within the process. For the purposes of this chapter, agency authorities will be described according to their roles within the FERC licensing process: lead, cooperating, or consulting agencies.

The Federal Energy Regulatory Commission (FERC), as the lead agency for licensing MHK under the FPA, makes approval decisions regarding issuance of a license to construct and operate a project. Such an approval may be augmented based on conditions or recommendations from other State and Federal agencies per the requirements of the Federal Power Act. Additionally, as the licensing of an MRE project constitutes a major Federal action, FERC is also the lead agency for the purposes of the administrative and environmental evaluation requirements of the National Environmental Policy Act (NEPA). The Bureau of Ocean Energy Management (BOEM) has lead authority over resources on the outer continental shelf, and as a result of a Memorandum of Understanding signed with FERC in 2009 (DOI and FERC, 2009) they have authority over the issuance of seafloor leases and rights-of-way for MHK projects.

Cooperating agencies are those that will be issuing their own approvals for aspects of the project, such as the use of navigable waters, and therefore are also subject to NEPA. At the Federal level they include the Department of Energy (DOE), US Army Corps of Engineers (USACE), and the US Coast Guard (USCG). For the PMEC-SETS project in Oregon, BOEM also elected to participate as a cooperating agency for the NEPA process rather than as a co-lead, presumably to reduce potential process-related conflicts.

Consulting agencies are those with whom FERC must consult before issuing a license per the Federal Power Act (16 U.S.C. 792 et seq.) and the Fish and Wildlife Coordination Act of 1934. They include the National Oceanic and Atmospheric Administration (NOAA), the US Fish and Wildlife Service (USFWS), and relevant State authorities, and they provide input to the FERC license in the form of official comments regarding the consistency of the proposed action with regulations under their responsibility (e.g., essential fish habitat under the Magnusson Stevens Act (MSA) administered by NOAA or Endangered Species protection under the Endangered Species Act administered by NOAA and the USFWS). Consultations also evaluate the adequacy of the environmental information, provided by the applicant and incorporated in the NEPA environmental analysis, to ensure that the environmental impacts from the project are sufficiently understood. Masterson (2014) notes that, while environmental review is required under the FPA, “such analysis is completed pursuant to the guidelines of key Federal environmental statutes rather than under the FPA itself, thus impacting the type of environmental analysis that occurs” (p.10).

Following consultation, FERC has the authority to request that the applicant perform additional studies or to include conditions in an approved license such as monitoring or mitigation activities. Some consulting agencies also have conditioning authority for a FERC license under the FPA. For example, the agency responsible for making a Federal Consistency determination under the CZMA in each State (e.g., DLCD in Oregon and the State Planning Office in Maine) can set mandatory conditions on the license to ensure that the MRE project is consistent with State ocean management plans.

Outside of the FERC licensing process, separate agency-specific approvals may include incidental take permits under the ESA or MMPA, a removal/fill permit under the authority of the USACE for the use of anchors and moorings, or private navigation aid permits under the USCG and USACE (33 CFR 66 §66.01; 33 CFR 322). Additionally, transmission cables that cross through State waters (up to 3 nautical miles offshore) must obtain seafloor leases and rights-of-way from the authorized agency (Department of State Lands in Oregon and Department of Conservation in Maine, for example). Once a cable comes ashore, the associated grid interconnection infrastructure must comply with State and local plans and ordinances, as well as any State or Federal regulations pertaining to the protection of terrestrial species and environments. Since 2013, projects in the State of Oregon are also required to adhere to the standards set in Part V of the Oregon Territorial Sea Plan and provide proof of decommissioning financial assurance (SB 606; ORS 274.879).

1.1.2. FERC Licensing Process Options

There are currently three "process tracks" for full licenses (30-year duration): the traditional licensing process (TLP); the Integrated Licensing Process (ILP); and the Alternative Licensing Process (ALP)[8]. Figure 4 shows a representation of the FERC licensing processes and highlights the components that differentiate them.

[8] https://www.ferc.gov/industries/hydropower/gen-info/licensing/licen-pro.asp

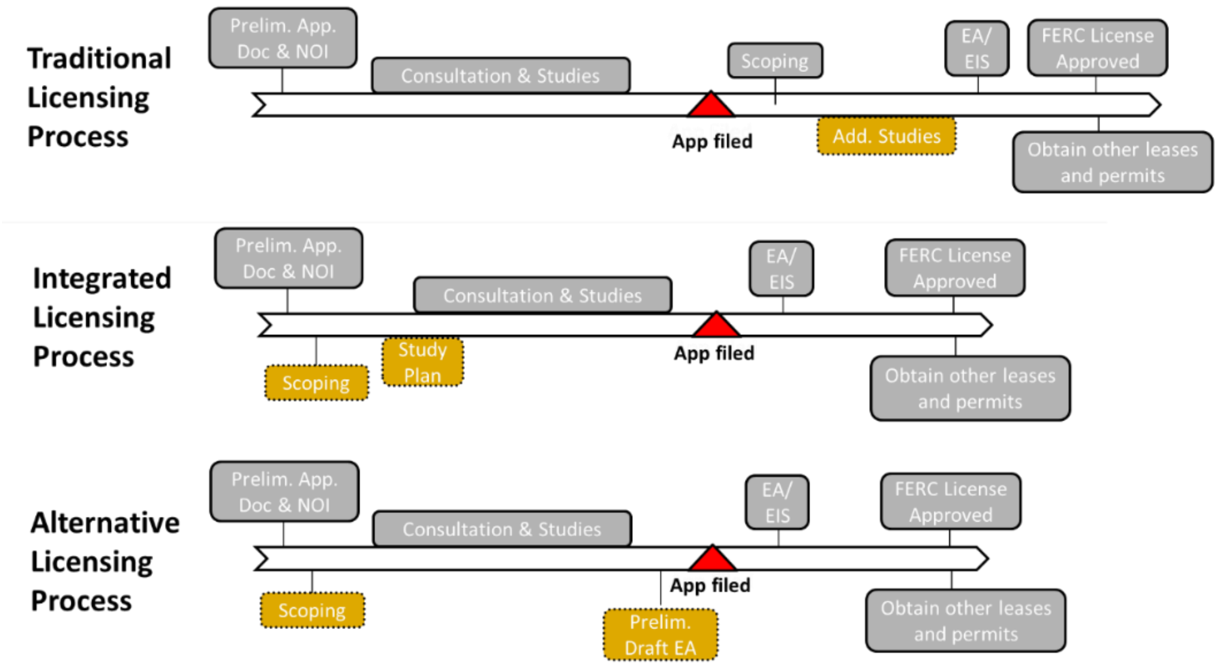

Figure 4. FERC License Process Tracks (adapted from Carter, 2015)

The TLP was the first process option under the FPA, and it is expected to take at least five years to complete (Gaffney, 2008). The traditional process provides that the formal proceeding before FERC does not begin until the application is filed, and FERC staff generally do not participate in prefiling consultation. After the application is filed, the Federal agencies with responsibilities under the Federal Power Act and other statutes, the States, Indian tribes, and other participants have opportunities to request additional studies and provide comments and recommendations. Although emphasizing extensive prefiling consultation, the traditional process has come to be viewed as "adversarial and applicant-driven." (Swiger and Grant, 2004, p 1) Moreover, the initiation of National Environmental Policy Act (NEPA) scoping often provides a "second bite" opportunity for resource agencies to raise new issues and expand the record (Swiger and Grant, 2004).

The ALP first emerged in 1997 and in its initiating regulation is explicitly designed to be a collaborative process under the expectation that,

> Early resolution of issues can result in less time and expense for the participants than the longer traditional process. . . A collaborative process affords all participants an opportunity to reconcile different interests and concerns. This process encourages participants to be flexible and creative in attaining their objectives (Interagency Task Force on Improving Hydroelectric Licensing Processes, 2000).

An applicant may use the alternative process, “if it can demonstrate that a consensus exists among the applicant, resource agencies, Indian tribes, and citizen groups that the alternative procedures are appropriate under the circumstances.” (Swiger and Grant, 2004, p 1)

The ALP allows pre-filing consultation and environmental review procedures to proceed concurrently. The ALP also allows the permit applicant to prepare their own preliminary draft environmental assessment prior to filing the formal license application with FERC. By allowing the applicant to draft the first environmental review, they become the de facto convener of the collaborative pre-filing consultation process because they must gather input from the agencies and accurately reflect the outcomes of the collaboration in the documents. Additionally, by having the Preliminary Draft Environmental Analysis occur prior to filing of the license application, theoretically the post-filing consultation between FERC and the relevant agencies would be streamlined because there are “no surprises” in the environmental analysis (Interagency Task Force on Improving Hydroelectric Licensing Processes, 2000, p 18).

The ALP requires development of a communications protocol, which includes a charter for a Collaborative Working Group (CWG) of participating agencies. In Oregon, the CWG communications protocol includes governing rules for a consensus-based process of information sharing to create “CWG Products” that will be incorporated into the application filing. Consensus agreements are not legally binding but assume a good faith intent by all agencies to act consistent with the agreement within their respective authorities.

Another key feature of the ALP is that FERC has a more active role in the collaborative process. Under the TLP and ILP, FERC *ex parte* rules do not permit Federal resource agencies with mandatory conditioning authority to be both cooperating agencies under NEPA (meaning they have access to informal communications with FERC) and intervenors for purposes of challenging a FERC license. FERC ultimately concluded that “precedent indicates that allowing Federal agencies to serve both as cooperators and intervenors in the same case would violate the [Administrative Procedures Act].” (Swiger and Grant, 2004, p 2)

Because the ALP is designed as a collaborative process, dispute resolution is expected to occur informally within the collaborative process rather than via the formal FERC process. The FERC Order instituting the ALP Stated, “We proposed to leave the existing, non-mandatory and non-binding dispute resolution procedures applicable to the ALP in place because mandatory, binding dispute resolution appears to be incompatible with the collaborative nature of the ALP.” (FERC Order 2002). ALP participants may request formal dispute resolution under FERC, but a resource agency may object to formal dispute resolution regarding subject matter of its statutory obligations (Interagency Task Force on Improving Hydroelectric Licensing Processes, 2000).

The ILP is the newest of the processes, emerging in 2003, and is currently the default process for new license applicants (Swiger and Grant, 2004). It combines the multi-agency integration components of the ALP with the schedules and formal dispute resolution process of the TLP, but it must adhere to the ex parte requirements of FERC under the Administrative Procedures Act (APA), which prevents informal communications between FERC and cooperating agencies in the development of the Environmental Impact Statement (EIS) under NEPA. The ILP requires completion of a FERC approved study plan in consultation with resource agencies during the pre-filing consultation stage and encourages informal resolution of disputes associated with the determination of necessary studies, although formal dispute resolution under FERC is an option under the ILP. The ILP also contains process schedules and deadlines that, if missed, lead to cessation of the licensing process (Interagency Task Force on Improving Hydroelectric Licensing Processes, 2000). Based on conversations with permitting process participants, it was clarified that the ILP was originally envisioned to streamline the re-licensing of an existing project, such as a hydroelectric dam, where many aspects of the project and its environmental effects have been more clearly defined over time (Pers. Comm.).

Alongside these process options, FERC added the option in 2011 to apply for a 5-year Pilot Process for projects that are experimental in nature. The pilot licensing process was developed following the "Verdant Orders" in which, "the [FERC] interpreted the Federal Power Act in a flexible manner that allowed an experimental deployment without a license."[9] The Pilot License path was envisioned to follow the ILP track.

Applicable pilot projects are: "short-term; can be quickly modified, shut-down, or removed if significant, unforeseen risks to public safety or adverse environmental impacts occur; are not located in areas designated as sensitive by the Commission; and are removed, with the site restored, before the end of the license term" (FERC, 2008, p 5). When issuing the pilot process, FERC stated that "[The] Staff's goal is to provide expedited procedures through which a Commission decision can be rendered in as few as six months after the filing of the application. The procedures will be oriented toward the characteristics of small, pilot projects with short license terms. They will emphasize post-license monitoring with the

[9] https://www.ferc.gov/industries/hydropower/gen-info/licensing/hydrokinetics/pdf/white_paper.pdf

possibility of modifying, shutting down, or removing a device that presents an unforeseen risk to public safety or environmental resources. (FERC, 2008)" In order to satisfy requirements of a pilot license, the applicant will need "sufficient information to describe site conditions and identify potential project issues." FERC notes that such information will need to be gathered as part of the process if not already available. The pilot license application must also propose a monitoring plan to identify potential environmental effects that result from project operation.

1.1.3. The Collaborative Action Arena

Under collaborative FERC processes (the ILP and ALP in different forms), three distinct action arenas for interagency and applicant interaction exist during the life of a project. The first is the pre-filing consultation and studies phase, of which the Oregon CWG stands as an example. During this phase, issues are identified and addressed to the extent possible before filing the license application to FERC. Once the application is filed, a second action arena forms, during which FERC solicits formal recommendations from the relevant State and Federal agencies per the FPA and FWCA. During this phase, communication appears to proceed via letters containing comment on a NEPA environmental analysis. The NEPA process also included a public comment portion during which members of the public and NGOs may submit comments to FERC. Comments submitted to FERC are then considered, and FERC has the option to request more information from the applicant to address consultation concerns, or FERC can impose conditions on the license. If additional studies are required, an extended period of formal issue resolution may occur. At the end of the second action arena, FERC either issues or denies a license.

If the examples of Oregon and Maine are any indication, then the issuance of a license will initiate the start of a third collaborative action arena: adaptive management. Like the pre-filing arena under the ALP, the applicant is required to develop a charter for an Adaptive Management Team, whose purpose is to review monitoring information and make recommendations for any warranted modifications to the license. The Maine project is currently four years into an AM process.

2. Methods

The research presented here was performed between September 2015 and September 2017 and consisted primarily of qualitative semi-structured interviews with key stakeholders in two MRE permitting processes in the United States. Interviews and participant observations were supplemented by an analysis of relevant project-related documents.

A multi-method approach was utilized to collect both primary and secondary data (Creswell, 2014; Ingles, 2007) from the two case study MRE projects. Research participants engaged in semi-structured interviews (Creswell, 2007), conducted in person or via phone by the researcher, with open-ended questions focused on the research questions. A set of semi-structured interview questions was formulated by researchers at OSU to initiate and guide interviews (Appendix B). Participants directed the dialog, often lending insight into tangential, but important issues in the process. The methodological approach followed selected tenets of grounded theory, such as inductive reasoning, a focus on process, and an emergent style of investigation and knowledge pursuit (Glaser and Strauss 1967; Strauss and Corbin 1990).

The semi-structured interviews are supplemented by textual analysis of publicly available documents pertaining to the selected case studies, including relevant laws, directives, and guidance from agencies, permit application documents, working group charters, interagency correspondence, and Memoranda of Understanding between agencies. These documents provided additional insights into the permitting process structure, the roles of the participants around the table, and the dominant risks that were managed within the process.

2.1. Data Analysis

Collected data were coded and analyzed using a modified grounded theory qualitative analysis, with support from the software program MAXQDA12 (Auerbach and Silverstein, 2003; Strauss and Corbin, 1990). The grounded theory approach to data analysis utilizes an inductive-coding framework to extract repeating ideas and themes from data (Miles, Huberman, & Saldana, 2014) and identify emergent themes, patterns, and relationships among participants in the MRE permitting process.

The coding process includes two rounds of analysis that extract details, then generalize themes. The first round of coding classified text along general thematic categories (e.g., roles within the process, authorities, risk perceptions, uncertainty, collaboration experiences). The second round of coding expands upon the codes to include more detailed aspects of the text themes. This aided in determining if there were any underlying themes that were initially missed in the first round of coding.

In the early stages of the coding process, inter-coder reliability was practiced. Two other social science researchers independently coded a sub-set of transcriptions, and these results were compared to the original analysis to ensure emerging themes were similar across researchers. This process increased validity and reliability of data analysis (Auerbach & Silverstein, 2003; Bernard, 2011; Miles et al., 2014; Robson, 2011; Ryan & Bernard, 2003; Strauss & Corbin, 1990).

2.2. Ethics

Standard Institutional Review Board (IRB) verification protocol was followed, and acceptance was granted for the participation of human subjects in this study. Due to the demographic configuration of participants, this study did not interview any vulnerable populations. Prior to data collection, ethical training was required to ensure the appropriate consent, confidentiality, and data collection and storage parameters were followed.

In accordance with IRB protocol, participant consent was required for the audio recording of all interviews. The goals and intentions of the study were explained in full, and an opportunity to ask questions was given to every participant before pre-approved IRB consent form was distributed (Appendix A). All interviews were voluntary, and participants had the right to decline recording. Participants also had the right to remove their interview consent freely at any time.

2.3. Case Study Selection

An initial list of potential case study projects was developed based on secondary document and Internet-based research, including the marine hydrokinetic projects listed on the FERC Hydrokinetic Projects tracking website[10](FERC 2017). The final list of case studies to undergo direct participant interviews was ultimately limited to two projects: the Pacific Marine Energy Center-South Energy Test Site (PMEC-SETS), planned for offshore Newport, Oregon; and the Ocean Renewable Power Company (ORPC) Cobscook Bay tidal energy pilot project near Eastport, Maine. This decision was made for the following reasons:

- The chosen case studies are still actively ongoing, which improved the ability to locate current process participants with fresh recollections of interactions.
- A case study for an offshore wind project (the Block Island Wind Farm project in Rhode Island) was considered for inclusion but ultimately dismissed because it operates under a different process framework led by BOEM and would complicate an analysis of the decision-making structure of the process.

[10] http://www.ferc.gov/industries/hydropower/gen-info/licensing/hydrokinetics.asp

- The chosen case studies provided greater opportunity for in-person interviews given a lack of travel funding and the proximity of these process participants to Oregon and planned travel to Maine during the research period.
- Time constraints in the research schedule, coupled with the number of participants in a given MRE permitting process, limited the ability to capture a broad range of participant perspectives from more than two projects during the available research period.

2.4. Study Population

For each of the selected case study projects, an initial list of potential interview participants was generated purposively (Palinkas et al., 2015; Creswell, 2007) from permitting process-related documentation such as mailing lists, official correspondence, and permit application documents. This list was supplemented by snowball sampling (Creswell, 2014) based on recommendations from interview participants regarding other relevant perspectives to gather. Interviews were gathered opportunistically from the list of potential participants within the time constraints of this research effort, with preference given toward agencies with lead permit approval authority or consultation authority for environmental protection laws.

Eligible participants were limited to people with direct experience interacting in multi-party permitting process meetings, however due to staff turnover among government agencies and MRE developers, not all interviewees were participants throughout the entirety of their respective multi-year collaborative permitting processes.

For this research, a total of 16 participants were interviewed directly. Input from an additional seven participants was also obtained from participant observation of publicly available presentations, workshops, and conferences.

One limitation of this study is that not all organizations associated with the MRE licensing and permitting decisions for their respective projects were able to be interviewed. As a result, this research should not be considered a comprehensive representation of all process participant perspectives. Furthermore, while multiple people with differing specific responsibilities from a given agency or organization may have been involved in the permitting process, interviews were limited to one person per agency or organization per project. In cases where multiple potential interview participants were identified for a particular entity, the decision regarding who to recruit for this research was based on guidance from other process participants or from recommendations by management level personnel at the entity in question.

Perspectives not gathered as part of this research included tribes, local government (i.e., city or county personnel), nongovernmental organizations, or economic stakeholders such as the fishing community.

3. Findings

Based on the perspectives of MRE permitting process participants interviewed for this research, the following best management practices may improve future MRE permitting processes:

- Engage a broad expertise early in the process to inform initial discussions with regulatory agencies and associated informational materials.
- Identify environmental impact uncertainties early based on a stressor-receptor framework, and work together with agencies to identify and prioritize uncertainties that have a “regulatory nexus” that affects the risk of violating an applicable regulation.
- Negotiate uncertainties that will be managed before or after permit approval and project installation. Recognize that agencies will expect the collection of sufficient site-specific data to develop a baseline characterization of the proposed project site. This will aid in the adaptive management process that should be expected to follow project installation.
- Employ best scientific practices when designing studies to address uncertainty, and seek technological solutions to permit-related investigations.
- Work to establish trust within a collaborative setting by:
    - Setting and abiding to ground rules and communication protocols.
    - Engaging in frank and genuine conversation.
    - Communicating early and often, especially as project designs change or operations at sea experience non-normal events. Recognize that “normal” may have a different meaning depending on the participant in the process.
    - Recording major agreements and points of understanding reached. This builds the institutional memory of the collaborative group and may improve permit application document reviews. Consider citing consensus understandings and agreements in the permit application.
    - Considering the possible benefit of additional data gathering activities and investigations, which could potentially not be required by FERC in the final permit, as a means to build trust and assist regulatory agencies in reaching comfort with the risks being introduced into their environmental aspect of concern.

- Expressing the needs of your party and soliciting the needs of the other participants in the process. Seek a mutual understanding.

- Government funding of some environmental studies can clear permitting roadblocks.
- Milestones and deadlines may speed the process, but currently the FERC Alternative Licensing Process does not have a formal mechanism for enforceable schedules.

Further details associated with these recommendations are discussed below.

3.1. Collaboration and the Alternative Licensing Process

Reflections on collaboration appeared to differ between the two case study projects, which may be associated with differences in the type and scale of projects proposed, or differences between the individuals involved. Positive reflections on the collaborative process focused on the ability to have open and honest discussion, the building of "genuine relationships", and the development of a common language for a new technology. Criticisms of the collaborative process included sentiments such as the collaborative process can be "arduous", "very hard," "incredibly long", "exhausting", or "circular". There were a few interviewees who expressed that not all of their concerns had been addressed in the collaborative process, and they recognized that these unresolved issues would likely be addressed during a different stage of the licensing process.

The pre-decisional nature of the collaborative process was perceived to encourage agencies to be more frank and less guarded about some of their opinions. As one respondent described it, "[There was a] huge perceived risk from the agencies, not much perceived risk on our part, and a big gulf in between the two perspectives. I don't think you could have gotten it together without a collaborative process. Lots of conversations needed to happen. There needed to be this this agreement that everybody's moving toward the same point."

One respondent described the purpose of the collaborative process in this way:

> I guess it comes down to communication. One key issue that I feel is particular to this industry is that regulators come from a perspective of, "We understand our statutes, our rules, our laws," and then the developer comes in and says "I built this thing and I want to put it in [the water], and I have to get through your process before I'm allowed to put it in, so what do you want me to do?" They understand their thing that they built and how it works. The collaborative process allows those two parties to communicate what they consider important. "You have to do this, it's the law." "Well I have to do it this way because that's how my device works."

> So that way we are able to kind of take steps closer together until we can shake hands and come to an agreement, whereas the traditional licensing process in some ways obstructs that sort of communication and information sharing, because you're in the formal process and so everybody's being very careful what they write down on paper and what they communicate, making sure that they are not overstepping or overextending their jurisdiction or anything of that nature, and so people don't have the same flexibility or willingness to share information and perspectives. The collaborative process allows parties to look each other in the face and say, "Okay, but again that doesn't work for me, do you understand why? If you don't understand let's go through it again. Here's the law, blah blah blah." "Okay, well if you don't understand, here's my device. Here's how it works, blah blah blah." So it allows parties to invest that time, as frustrating as the amount of time can sometimes be.

A positive result of the collaborative process described by a few interviewees was an observation that the applicant's documents showed a marked improvement in quality as a result of the informal feedback and review process. One respondent described, "We had a great collaboration where when they proposed various studies or surveys, drew up study plans that we would be able to comment on, and we would sit down and go over things and, generally speaking, the final product was really quite good. It addressed all of our concerns."

Not all interviewees were comfortable with the more "decisional" elements of the pre-decisional collaborative process. One respondent described,

> It's kind of weird to go to a meeting and have people go, "You're saying you're okay with this, like we have your approval and your confirmation? Thumbs up?" The advice from my peers in my division were, "No, you don't want to say you're okay because then you can't sue them later." So it was a little bit weird because I felt like it was stuck between the new world and the old world, and maybe my division wasn't really used to this process yet.

Others felt that the process would have been more efficient if more participants were "decision-makers" willing to take the risk of voicing a position. While several interviewees reported the feeling that they felt empowered to make the decisions associated with their process, it seemed that this perception was not universal. Some interviewees stated that final decisions are the responsibility of their management staff, who were either non-participants in the collaborative process or who attended meetings periodically, sometimes accompanied by legal counsel.

One respondent noted that their experience had shown that historically, the difficulties associated with collaborative project planning caused ALPs to be less successful than the more formal FERC licensing processes. "The projects that attempt an ALP often devolve into an ILP or TLP because the ALP is designed to be collaborative. It's built on consensus. You have to agree to things, and so if parties won't bend, FERC has no option but to say, ‘Okay, we tried. It's not going to be an ALP now.’”

Many if not most of the participants interviewed described the importance of trust to the successful navigation of the permitting process. Some made general statements such as, ”Building relationships and trust is the most important thing we do,” while others talked more specifically about the importance of an ability for the agencies to trust the motivations and future intentions of the developer with regard to environmental responsibility. From the opposite perspective, some noted that it was also important for the developer to trust that the agencies were as one respondent put it, “not trying to be mean per se,” in the pursuit of the information they needed. Participants from both case study projects expressed positive assessments of the applicants’ efforts to build trust within the collaborative process.

One respondent summarized their experience in this way:

> It was difficult initially but after a while we came to trust each other and [the applicant] partnered with a local University of some really great researchers to start collecting some of the baseline information, and they quickly understood yes it clearly makes sense to have this information to evaluate potential consequences of construction and continued operation. So those were really the initial growing pains, just that new process for everybody. Obviously building relationships and trust, the most important thing we do, and then just collaborating. It's been a great collaboration, it truly has.

Another echoed a similar sentiment:

> I will say that the [applicant has] been amazing as far as trying to make sure they do the right thing, and it's made our job as far as making recommendations and going forward with conservation in mind - because that is what we do - it has made it easy to go forward because they are so receptive to that . . . with a few caveats.

When describing what makes a permit approval decision viable in spite of the remaining uncertainties and associated potential risks, one respondent said, “How I look at the future decision is I have to extrapolate, and then some of it's a leap of faith. Just intuition, professional experience, which is limited in that type of field. But it's also relying on the future process.” This sentiment suggests that trust is a factor in ongoing risk management processes such as adaptive management.

Despite the risks, many participants agreed that due to the novel nature of the proposed project, the ALP seemed to be the appropriate process for pre-filing consultation because, “It gives us the opportunity to vet ideas in an informal setting before we are on the clock, before decisions are having to be made.” One participant additionally noted that because the ILP FERC process is intended for re-licensing of projects where the infrastructure and environment are prone to less uncertainty than the nascent MRE industry, the ALP is likely going to be the process preferred by FERC until the industry matures.

3.2. Length of the Process

While acknowledging that collaboration takes time to build trust, many participants in the Oregon process felt that the process had been too long. One respondent felt that it was, "purposefully exhausting . . . You're constantly revisiting, you're constantly questioning, you're always facing reversals." At the same time, others acknowledged that, "a lot of conversations needed to happen," and the length of the process may have been a necessary consequence. Interviewees noted however, that the collaborative process represents a significant expenditure of time and resources, and a drawn-out process makes it harder to stay involved when they have other priorities competing for their attention.

Similar concerns were not echoed by the participants in the Maine project; their pre-filing process was also several years in the past. One participant was at a loss to suggest how the process could have moved any faster, reasoning that, "It takes time to collect all that data and to analyze all that data, and I don't know how you speed that up any more. It takes three years to collect all the data and analyze it. I don't know how you shave any time off of that." It was unclear to what extent the three-year collection period was a regulatory requirement.

Some interviewees in both Oregon and Maine recognized that the decision to collaborate during the pre-filing stage may have contributed to the need for a less exhaustive document format for the environmental analysis performed in support of the FERC license, which they perceived to have garnered time savings. NEPA analyses either take the form of an an Environmental Analysis, which is a shorter and less comprehensive analysis that may be performed if there is an expectation that the action will not have a significant effect on the environment, or an Environmental Impact Statement, which is a "more detailed and rigorous" form of analysis (EPA, 2017[11]). As one respondent in Oregon described, "I don't think [the impacts are] as significant as they were expecting, so it might be an EA because they've addressed a lot of the problems. Part of working through the whole process is talking about what you are going to do to make sure that it stays on the downside of impacts."

Similarly, the NOAA NMFS consultation with FERC can involve either a formal or informal consultation process depending on the degree of anticipated effects. One respondent noted,

[11] https://www.epa.gov/nepa/national-environmental-policy-act-review-process

> I knew we could design a project . . . that we could probably do informal [consultation]. I think I expected that the issuance of the license would require formal consultation, and I don't think we did . . . I was really confident that we could work with the Corps of Engineers, the FERC, and the applicant to avoid interactions as we collected information during the preliminary licensing process.

3.3. Communication

Many interviewees in Oregon expressed that the Communications Protocol developed at the formation of the ALP Collaborative Working Group was instrumental to the success of the collaboration. One respondent described, “Any ALP that I've ever worked on requires a lot of communication. It made sense to do the Communications Protocol just for establishing ground rules and a way of doing business, so to speak.”

When conflicts arose, many interviewees noted that the conflict resolution and communication procedure portions of the group’s charter proved invaluable. One respondent reflected, “It has come around a couple times where we've reached difficulties . . . and if we didn't have a [Communications Protocol] to walk through and just say, ‘This is what we agreed to, this is our process, here's how we're going to get through this,’ we may not have gotten through it.” The conflicts alluded to by participants seemed to be more associated with communication and trust issues than intractable technical disagreements. Such conflicts were commonly resolved by elevating the issue to the management level outside of the CWG meetings.

One challenge identified in the development of trust was the necessity of keeping all participants notified in a timely manner as project designs or activities change. When project conditions, “can evolve quite quickly,” but collaborative group meetings only occur semi-annually or quarterly, there is a risk that such changes can leave a process participant feeling surprised and perceive, “a bait-and-switch”. It did not always seem clear what new information would be perceived as relevant to the interests of all process participants, so one of the lessons learned among the applicant was to actively practice open communication and set clear guidelines regarding topics that warranted immediate notification to other participants. Similarly, participants requested clearer communication regarding how their input was being incorporated into the license application and other collaborative work products.

It was noted that the scientific experts within an agency were not always the lead participants in the permitting process, which occasionally led to “games of telephone” between experts among different organizations through the process participants. One respondent reported that, for example, comments on study plans sent to an agency for review would be interpreted and rewritten for presentation back to the collaborative group. This led to a perceived inefficiency in the resolution of some technical issues.

3.4. Information Sources

Several interviewees made the point that when FERC makes decisions regarding risk in a license, they consider all credible sources of information, but “best available science” is held in highest regard. As one respondent relayed that in cases of dispute over potential risks, “If you've got science to support you and they don't, then you win.”

Many interviewees noted that the consultation of proxy information from other sites or industries can be useful toward understanding potential risks associated with their project. Such information can include reports from offshore energy installations in Europe, other marine industries such as oil and gas, undersea cables, ocean science, or shoreside nuclear facilities. Several interviewees made note of the TETHYS database (https://tethys.pnnl.gov/) as a valuable repository of information and new science related to MRE around the world.

While much of this information can be translated or modified to apply to the project under consideration, some interviewees contended that ultimately this proxy information must be supplemented by data specific to the project site. As one respondent explained,

> If we're coming to a developer and saying, ‘Here's all these unknowns. You have to go collect all these data for us,’ and then they come back and they say, ‘We already have those data. It came from Canada, it came from Scotland, it came from Portugal,’ then we have to look at those and say, ‘That can answer 90% of the question, so we just need you to go answer that last remaining 10% that's more site-specific.’

Some agency interviewees described individual learning activities, such as consultation with their counterparts in other regions or self-directed study of scientific journals and informational reports associated with MRE. Multiple agency participants however emphasized the perspective that it is the applicant’s responsibility to be proactive about gathering available information about their device and the proposed site environment, developing initial study design proposals, and collecting additional necessary data. Data collection efforts were sometimes supported by Federal funding from either the Department of Energy or BOEM, which many participants described as essential contributors to the resolution of legally significant risk perception differences.

Some agency participants made oblique references to information quality requirements for environmental studies in support of the license application. If “best available science” is the standard for information, then it stands to reason that the design of studies should have these qualities in their design. However, one respondent made the observation that different agencies define what information is “good enough” differently. They explained,

> Some agencies would check the box if [the application] just said ‘environmental analysis’, and other agencies want a 900-page document with cited sources and all sorts of data, and they want whatever valuable reference material is associated with those claims to be included.

This difference in expectation relates to risk and uncertainty perception, as it reflects the methods by which different participants understand the environment and defend any decisions or recommendations that may involve risk.

As described elsewhere, traditional knowledge was a valid and valuable source of information to participants. In Oregon, fishermen and other ocean users provided input on the likely location of net activities, sea conditions at different times of year, and other observations related to the ocean environment. In Maine, several interviewees reported a perception that a minke whale had been spotted in the vicinity of the planned future Western Passage site, but none of the participants cited a source (note: these participants were not asked directly for a source). I risk to speculate that this reporting may have come from a local ocean user such as a fisherman or charter boat operator. At a public meeting, one participant described how ORPC had “characterized the waterway” from a human ocean use perspective through a process of local outreach, and that, “It turned out . . . pretty much the way they said it was.”

3.5. Team Expertise

Several interviewees described the expertise of the applicant teams as being assets during the process. Trusted participants in the process included experimental scientists versed in the current methods of scientific investigation and subject matter experts with experience as marine biologists, physical oceanographers, ocean technology developers, EMF specialists, engineers, and traditional ocean users, among others. These teams of expertise appeared to develop over the course of the licensing process. In Maine and Oregon, participants described the applicant as taking a proactive approach to investigation design, bringing proposals to the table for group discussion. In Maine, several interviewees emphasized the quality of investigative work performed by the University of Maine to characterize fish assemblages in the area and fish behavior around the installed turbine. The first piece of advice given by one respondent in Maine was, “Leave your prejudices at the door and come in with some science, you know?”

Some interviewees in Oregon noted that when developing their first drafts of environmental analysis and study plans, the applicant did not always tap into what was perceived as a rich well of scientific expertise associated with the University who had relevant information, “coming out of their heads, [and] they don’t even have to look in a book.” Some experts from the University had been involved since early in the process, while others came later as issues arose within working group discussions. A recommendation for future processes was that the applicant assemble a broad team of expertise early in the process and reflect that expertise in proposals before the CWG. Such access cannot be assumed to come without costs, however, and not all future applicants will be attached to a University. (It should be noted that NNMREC is a separate entity from OSU funded by the US Department of Energy, but it is housed at OSU and collaborates extensively with OSU staff and faculty.)

In line with the Precautionary Principle of risk management, regulatory agencies maintained that it is the responsibility of the applicant to collect information in support of determinations of project effects, including pre-license environmental characterization data and post-installation monitoring for signs of adverse change. One respondent recommended:

> If the tools are in fact out there, go get them and spoon-feed them to the regulators. Spoon-feed them to the resource agencies. Show us what you know and then that will help streamline your process. But if you come to us and say that information has got to be out there, you go find it. Well that's not really how it works right? The onus is on the developer to pull that stuff together.

3.6. Risk and Uncertainty Management

Key concepts for managing risk described by participants focused on a desire to “retire” risks through pre-license study or ongoing monitoring measures post-license, coupled with an adaptive management framework of continued collaborative interaction between relevant parties. Within these strategies, the development of measurable levels of risk and thresholds for unacceptable effects were viewed as critical inputs to risk management. Where thresholds are not available, evaluations seemed to rely on statistically significant changes to the environment or more qualitative observations of change such as species behavior.

In Maine, all of the interviewees mentioned how “seeing behavior” was a key contribution to their feelings of comfort regarding potential risks posed by the underwater turbine on passing fish. The environmental investigation pre-filing included intra-second side scan sonar data for three years, and post-installation monitoring included spatio-temporal sonar data to the AMT that showed the fish swimming around the turbine.

The most readily measurable risk inputs are related to acoustic effects and species presence or absence. EMF, while readily measurable in the vicinity of an undersea cable or device, appeared to still carry uncertainty regarding the definition of a harmful effect specific to a wide variety of electrosensitive species. Several interviewees referred to a recent study by BOEM that suggested the EMF effects from transmission cables do not pose significant harm to species. Some participants considered the study to have taken EMF "off the table", though some residual uncertainty appeared to remain among some participants regarding EMF emissions from devices themselves or EMF effects to a broader range of electrosensitive species.

Specific interactions between species and devices were recognized by some participants as being difficult to measure with current technological solutions. A few participants recognized that new monitoring technologies will be needed to reduce the cost of monitoring and significantly reduce uncertainty. A commonly referenced method of monitoring was opportunistic observation for species presence at the site during project maintenance activities. This method was recognized to have limitations because it required trained observers to be present, which complicates shipboard logistics. It was also mentioned by a few participants that opportunistic observations may not adequately meet scientific standards for structured sampling design, and therefore it may be difficult to draw conclusions that significantly reduce uncertainty regarding species presence or interactions.

When managing identified uncertainties, the participants described the main responses to be: 1) model potential effects based on data from other projects globally (e.g., via the TETHYS database); 2) consult subject matter experts who have researched this or a similar issue; or 3) collect data, either pre- or post-license, to support type-specific, place/time specific, or receptor-specific studies, designed to "definitively" resolve or bound uncertainty. Some management actions involved a blend of multiple strategies.

The availability of funding for environmental studies was seen by many interviewees as a significant consideration for uncertainty and risk management. Both case study processes described a period of negotiation regarding the types of information to be collected prior to licensing and as part of ongoing monitoring while projects were out in the ocean. Most of the participants in Maine described additional funding from the Department of Energy as being critical to the resolution of conflicts surrounding information adequacy pre-license. One participant recalled, “At some point the Department of Energy started investing in the development of this technology and [the applicant] was very successful at getting those grants . . . which really helped in the willingness to do some of the monitoring. Money was a driving factor for that.” Similarly in Oregon, DOE funding of a study on green sturgeon activity in the proposed project site led to resolution of a risk-related issue. One respondent said, “So that was humongous, and we were like, ‘Look DOE, your ALFA project saved us!’” The previously-mentioned BOEM study of EMF effects was similarly regarded as a beneficial input to risk discussions.

3.7. Top Down vs. Bottom Up Risk Negotiation

One of the tools for understanding risk and uncertainty described by many participants in Oregon was a detailed stressor-receptor matrix that the group populated collaboratively. The purpose of this bottoms-up approach was based on a framework proposed by Pacific Energy Ventures (2012), and the purpose was reported to be to compare perceptions of risk and uncertainty and identify key issues requiring management through investigation, monitoring, or mitigation activities. Reviews of this approach varied, and the effort eventually stalled.

> I thought it was pretty good because it was something that I think that was developed as a collaborative approach with scientists and agencies in the room. It seems like a fairly reasonable way to say, ‘These are the things we need to worry about if there's a stressor and a receptor.’ If there's a stressor and no receptor, why do you even need to worry about it?
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> I thought we were all understanding, like, all those interactions had been talked about [in a previous project], and we were all on the same page about, and now we just have to think about, well, now the stressors are more devices in a larger footprint with more permanence. But I was shocked how far back we started . . . but it wasn’t the wrong decision because the resource agencies had a lot to say about those stressor receptor interactions and where they thought the bins were about the level of risk and uncertainty.
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> We had a big wall and we had little sticky notes, and we were supposed to populate with sticky notes and someone took that whole thing and put it into a spreadsheet and said, ‘Okay is this what we did? How does it need to change?’ It was complicated, but it was the path forward. I mean it ultimately led to how we proceeded.
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> I just remembered that thing. I mean it was pages and pages of color coded columns and rows that I was just like, ‘Aaahh!’
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> ---
>
> I don't know if it was effective or not. I know that as I recall things that had intersection points on the stressor receptors I think are basically the things that we are busy monitoring and mitigating now.

The “top down” approach was described as focusing on the “regulatory nexus” between perceived risks and uncertainties and the regulation-based recommendations or actions that would warrant a risk response. Reflecting on the process of building a collaborative understanding of risk and uncertainty within the group, one respondent said:

> I wish we could have kind of done the bottoms up a little more, but stepping back and thinking about it, maybe going from the top down and looking at the big things that matter to all the parties, and as long as everybody felt their primary concern was properly either monitored or mitigated or captured by adaptive management, maybe that's what really matters is that we agree on that and stay [at that level]. And we understand we all have different risk perceptions, but we just understand and respect that and know that we can accommodate all those various risk perceptions in the design of a project.

It would appear that both approaches have value as methods to frame and manage risk and uncertainty, and they seemed to complement one another toward the design of management strategies.

3.8. Decision Process Improvement

The decision to license does not fall upon the FERC participant of the process, but instead will be made at a higher level of the organization supported undoubtedly by the advice of their staff. Nor will the post-application consultation with FERC come directly from the resource agency participants most commonly at the table. Most of the environmentally focused participants will either provide technical input to their management or to another agency with a direct authority over the permitting process; however, the scientific judgment of these participants will inform the formal correspondence.

Those participants who had criticisms of the collaborative decision-making process cited a perceived lack of high-level decision-making authority from all agencies at the table and a deficit of political will outside of the process to influence risk averse agencies toward the definition and acceptance of a reasonable level of risk relative to the potential benefits of MRE. Such changes would need to occur beyond the boundaries of the FERC collaborative process action arena and would likely be a product of legal or political change. Participants generally acknowledged that the participants in the collaborative process are bound by the context within which their respective laws and institutions operate, so applicants within that process have a greater chance of gaining efficiencies through more productive collaboration and an increase in the scientific resources that may be brought to bear to achieve existing regulatory standards.

A procedural element of the process that one respondent believed contributed to trust building, based on their experience with other projects, was to undertake as a group the iterative progression from identifying issues, to characterizing potential effects associated with issues, to developing mitigation strategies. By working through each step as a group rather than have the applicant propose a fully-formed uncertainty management strategy, “Maybe the agencies don't think it has closed the door on their ability to participate and bring up different ideas.”

3.9. Preserving Institutional Memory

An emergent theme in this research regarded the effect of staff turnover on the permitting process. For both case study projects, many of the staff who began the licensing process were no longer associated with the project by the end of the pre-filing consultation phase or the ongoing Adaptive Management process. As an adaptive management may extend through the life of a full-term FERC license (30-50 years), staff turnover should be considered a certainty. One respondent expressed that a significant risk to the efficiency of the process is the “lost memory” of issues that had been resolved earlier in the collaborative process. This risk is compounded when the staff involved in those discussions are themselves lost from the process. As another respondent noted, “I think in some cases there's a huge attempt to try to do that but it's still a very small community of people who are getting to know what MHK is all about. When somebody peels off, whoever joins is unlikely to be somebody who can come in with that level of experience.” Therefore, the preservation of institutional memory is an aspect of the licensing process that may be ripe for improvement.

Based on interview responses, it appears that the first step in the onboarding process for new collaborative group members is to review past meeting notes and engage in orientations within their respective agencies. A couple interviewees also described that new members of the collaborative group tended to ask a number of clarifying questions during their first interactions with the group in order to “catch up” to the shared understanding of potential risk issues that the group has developed over time. As one respondent noted, “We have cycled through some new people and I don't think that's necessarily been a holdup, because we've sat down with them and spent a fair amount of time trying to get them up to speed.”

When asked how the permitting process may be improved in the future, a few interviewees expressed a hope that as experience grows among agency staff and consulting service providers for applicants, the process of defining and investigating potential environmental effects may gain efficiency. However, these interviewees noted that this hope may be stymied by the rate of staff turnover.

One example of this was given from the oil and gas industry, which over the years has matured its understanding of the permitting process for offshore infrastructure. One of the lessons that the MRE industry could learn from the oil and gas industry was described as follows:

> [Oil and gas is] an industry that has been around for decades, and the consultants that work on it are very well versed and they've got their templates for everything, so when they come to you they've got everything 90% done. And I feel that this industry if they want to get there faster, then they need to invest in understanding that maze that they have to navigate through, and why site-specific analysis is so important, and what sorts of data it is that we are going to be requiring. And when we get into that conversation about your site and what sort of data we need to move forward with that, go get it.

A respondent observed that one way the MRE industry could trend in this direction is to utilize monitoring and mitigation plans developed for prior projects (e.g., the lighting plan developed between the USCG, USFWS, and FAA for the Ocean Power Technologies project in Oregon) as initial templates for negotiation in subsequent projects. A publicly accessible repository of negotiated technical standards and agreements could increase the efficiency of the agency consultation process with applicants and prevent “reinventing the wheel.”

A similar concept that may increase future efficiency would be to cite major agreements from the collaborative pre-filing phase into the application documents to FERC. Many interviewees described risks or uncertainties that had been “taken off the table” during pre-filing negotiations, but it was not clear whether these agreements were being documented outside of the notes from collaborative group meetings. Examples of this kind of institutional knowledge could include technical details regarding investigation design, traditional knowledge from ocean users that illuminated participants’ understanding of conditions and operations at sea, or the informal knowledge conveyed by subject matter experts in response to specific participant questions or concerns.

At the time of this research, meeting notes were not easily accessible publicly, and as the CWG employs an informal pre-decisional communication structure not open to the general public, it was not clear whether these notes would be incorporated in the official FERC public record. The Communications Protocol for the ALP does not explicitly state that meeting notes of the CWG will be included in the FERC Public Reference File, but rather that the decision will be at the discretion of a consensus by the members of the CWG. There exists a risk that the institutional memory of collaborative working groups could be lost to future processes, forcing them to repeat past discussions from elsewhere in the nation. For reference, the FERC public record does contain emails and meeting notes from the OPT project, which specify details such as monitoring proposals that never became formalized in license-related plans before the ultimate withdrawal of the project license; however, the OPT project followed a Traditional Licensing Process. By including important meeting interactions in the license application, the risk of institutional memory loss may be avoided; however, such a decision would likely need to be approved by the members of the collaborative group.

In the Maine process, the annual environmental monitoring reports generated for FERC are included in the public record. These reports contain presentations given by the applicant during Adaptive Management Team meetings, but the subsequent discussions, clarifications, and shared understandings that result from these presentations are not recorded publicly. This also represents a lost opportunity to memorialize and disseminate the evolving understanding of risk and uncertainty among regulatory agencies that may be occurring during the adaptive management process.

3.10. Future Constraints

In addition to the opportunities and barriers described in the findings section of this report, participants described a number of constraints that make navigation of the permitting process more difficult.

1. The lack of deadlines in the collaborative pre-filing process, the consensus standard, and a lack of political will to instill a sense of direction or urgency to agencies can all lead to delays in the process.
2. The definition of acceptable risk is elusive and often depends on the judgment of agency officials when interpreting "fuzzy" regulatory standards. Participants discussed the need to develop quantitative thresholds for unacceptable effects as the industry matures. This topic is further discussed in Chapter 2 of this manuscript.
3. Risks and uncertainties for larger scale projects have yet to be defined and are expected to entail a new type of scientific investigation effort.
4. The offramp for Adaptive Management has not yet been defined. Participant perspectives differed on whether monitoring activities will persist through the full term of the license, be reduced or eliminated as risks are "retired", or "fade away" after a number of years without observing change or as agency attention shifts toward new priorities and projects.
5. New technologies are needed to reduce the expense of post-installation monitoring activities.

4. Conclusions

This research identified a number of practices from the case study projects investigated, which could potentially improve the efficiency and effectiveness of MRE permitting processes going forward. It also identifies barriers that still lie ahead as both the industry and the regulatory culture surrounding MRE mature.

MRE is an industry that currently involves significant uncertainty that affects the perception of risk. The associated agencies are charged with managing risk to their protected resources and interests. When asked whether they could recommend any tools to future MRE practitioners to help them resolve uncertainty and risk in the regulatory process, one interview respondent put it simply: “The only tool we use is making everybody sit at the table for months on end and hash out the issues.” The decisions that must be made surrounding the idea of introducing a new human presence in a complex and legally complicated ocean environment cannot be made alone.

The most consistent themes from this research were that the definition of unacceptable risk is elusive, adaptive management is a key feature of moving forward with MRE projects in the face of uncertainty, and trust is an asset that all participants felt worthwhile to develop by working together. With these essential themes in mind, perhaps the role of the collaborative process is to build the trust that is necessary to successfully accomplish Adaptive Management. If trust in a device′s effects on the environment cannot be verified with certainty, then perhaps trust in the people responsible for managing those risks must take its place.

Information to regulators should come with an awareness, to the degree possible, of the uncertainties present in their proposed project environment. This can include species presence and customary behavior, physical characteristics of the site’s benthos and wave climate, human uses, and the aspects of their proposed device that will interact with all of these. Based on sentiments expressed during my research, this knowledge could greatly accelerate the attainment of a mutual understanding of the integrated ocean system.

I hazard to put forth that the purpose of the permitting process is to coax a group of public servants who adhere to a precautionary approach to make the transition to an adaptive approach that accepts the risk of learning from potentially unpleasant surprises. In order to take this step, it appears that regulatory agencies place a great deal of value on a trust existing with the applicant. Once an adaptive approach has been reached, the majority of the interactions appear to focus on first designing a monitoring approach that is sufficient to answer lingering legally-relevant questions, then on reaching a shared understanding of monitoring results once the project is in the water. These results must be compared to an existing baseline understanding of the system, or else the collaborative group of adaptive managers will have no way to identify change.

It may not be apparent at the outset of a licensing process, but it seems clear that the relationships built during the process will not end once a license is issued. Rather, the Adaptive Management framework for MRE projects is akin to a continuing collaborative governance arrangement, where the patchwork of agencies that manage the ocean will continue to learn and manage risks together, for as long as they have interest to do so, up until the license term ends. Perhaps as time goes on and the risks and uncertainties of MRE find greater definition and acceptance, adaptive management will become a less important feature. Until then, it is in the interest of MRE developers and regulatory agencies to build a strong relationship based on mutual learning, reciprocity, and trust.

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Chapter 4: Regulatory Perceptions of MRE in Emergencies, Including Deployable MRE Conceptual Regulatory Path

Abstract

Energy security is a vitally important but often overlooked vulnerability in communities. Electricity availability is essential to the functioning of the economy, individual households, and the collective essential services that provide health, safety, and the basic human needs to sustain life. Coastal communities in Oregon face special vulnerability because they are almost entirely dependent on outside sources of electricity generation routed via a limited number of transmission lines. This vulnerability raises a question whether this risk to coastal community energy resilience could be mitigated through utilization of a local and abundant renewable energy source: marine renewable energy (MRE). This research is part of a transdisciplinary project under a National Science Foundation Research Traineeship in risk and uncertainty quantification in marine sciences. The transdisciplinary project evaluated the validity and value of a temporary, deployable MRE system as an emergency power source for an example community on the Oregon coast. The research in this chapter supported that effort with an evaluation of key regulatory considerations that may affect the validity of the emergency MRE use case. The purpose of this research is to investigate how regulatory perceptions of risk associated with MRE may be affected by the presence of an emergency, and how this relates to potential regulatory pathways for emergency MRE project concepts. The research consisted of semi-structured qualitative interviews with MRE permitting process participants from two case study projects in Oregon and Maine, analysis of relevant legal and policy precedents in emergency management, and participant observation of publicly available presentations, workshops, and conferences.

1. Introduction

Energy security is a vitally important but often overlooked vulnerability in communities. Electricity availability is essential to the functioning of the economy, individual households, and the collective essential services that provide health, safety, and the basic human needs to sustain life. Coastal communities in Oregon face special vulnerability because they are almost entirely dependent on outside sources of electricity generation routed via a limited number of transmission lines. If enough of these lines fail, as occurred during a winter storm in 2007 (Elliott and Tang, 2012), the coast would be electrically stranded from the regional grid network. This vulnerability raises a question whether this risk to coastal community energy resilience could be mitigated through utilization of a local and abundant renewable energy source: ocean wave energy.

The traditional permitting process for marine hydrokinetic devices under the Federal Energy Regulatory Commission (FERC) can span five or more years (Gaffney, 2008) and entail extensive consultation and environmental studies to satisfy regulatory agencies with authority over the ocean and coastal zone. In addition to the FERC license, a WEC developer must also obtain permission to lease the seafloor and install transmission cable landing infrastructure on shore, which involves additional technical and public process requirements. However, the presence of an emergency situation may present an opportunity to change the rules of the regulatory landscape and allow emergency approval of a temporary WEC array.

This chapter is part of a transdisciplinary effort under a National Science Foundation Research Traineeship in Risk and Uncertainty Quantification and Communication in Marine Sciences at Oregon State University. A collaborative, multi-disciplinary team of graduate researchers underwent a project to assess key *technical*, *natural system*, *socio-economic*, and *regulatory* considerations surrounding the validity and value of Wave Energy Converters (WECs) as an emergency power generation resource for the example community of Newport, Oregon.

This chapter imagines a scenario in which an event such as a winter storm causes a regional transmission line outage that isolates a coastal community's local electrical grid from the generation sources of electricity in other parts of the region. It envisions a system of rapidly deployed WECs connected to the local electrical grid to allow conversion of the local utility's service area into an "islanded microgrid" that can provide for the community's critical infrastructure services (e.g., water, fuel, wastewater sanitation, heating and cooling, food preservation, communication capabilities, and emergency services such as medical care, police, and fire protection). Within this context, this chapter investigates the regulatory processes and authorities that may foster or inhibit the emergency temporary deployment of a WEC system, as well as how the presence of an emergency threatening human life and property may influence regulatory perceptions of risk to protected ocean resources.

2. Methods

This chapter discussion begins with a review of existing literature on emergency processes and authorities as they relate to disaster management actions, ocean governance, and the specific agencies and authorities related to the permitting of marine renewable energy (MRE). The purpose of this review is to identify potential regulatory pathways by which a deployable temporary MRE solution may be approved for installation, either before an emergency event or directly in its aftermath. Next, the discussion draws upon data collected from a series of interviews and participant observations from the participants in two MRE permitting processes in the United States.

A multi-method approach was utilized to collect both primary and secondary data (Creswell, 2014; Ingles, 2007) from the two case study MRE projects. Research participants engaged in semi-structured interviews (Creswell, 2007), conducted by the researcher, with open-ended questions focused on themes relating to risk perception and collaboration within MRE permitting processes. Participants were further asked how their perceptions of risk may be affected by the presence of an emergency, and how such an emergency might affect the permitting process. The methodological approach followed selected tenets of grounded theory, such as inductive reasoning, a focus on process, and an emergent style of investigation and knowledge pursuit (Glaser and Strauss 1967; Strauss and Corbin 1990).

Interviews were conducted in person or via telephone and typically lasted for 1-2 hours. In-person interview locations were chosen by the participant and often took place in private offices or conference rooms, while phone interviews most commonly took place with the participant in their work space and the researcher in a private location. A set of semi-structured interview questions was formulated by researchers at OSU to initiate and guide interviews (Appendix B). Participants directed the dialog, often lending insight into tangential, but important issues in the process. The questions for the semi-structured interviews were focused on one of three general topic areas: perspectives on collaboration within the permitting process; perceptions of uncertainty and risk associated with the MRE permit decision; and elements of the authorities and structure of the MRE permitting process itself that may have affected process outcomes.

The semi-structured interviews are supplemented by textual analysis of publicly available documents pertaining to the selected case studies, including relevant laws, directives, and guidance from agencies, permit application documents, working group charters, interagency correspondence, and Memoranda of Understanding between agencies. These documents provided additional insights into the permitting process structure, the roles of the participants around the table, and the dominant risks that were managed within the process.

2.1. Data Analysis

Collected data were coded and analyzed using a modified grounded theory qualitative analysis, with support from the software program MAXQDA12 (Auerbach and Silverstein, 2003; Strauss and Corbin, 1990). The grounded theory approach to data analysis utilizes an inductive-coding framework to extract repeating ideas and themes from data (Miles, Huberman, and Saldana, 2014) and identify emergent themes, patterns, and relationships among participants in the MRE permitting process.

The coding process includes two rounds of analysis that extract details, then generalize themes. The first round of coding classified text along general thematic categories (e.g., roles within the process, authorities, risk perceptions, uncertainty, collaboration experiences). The second round of coding expands upon the codes to include more detailed aspects of the text themes. This aided in determining if there were any underlying themes that were initially missed in the first round of coding.

In the early stages of the coding process, inter-coder reliability was practiced. Two other social science researchers independently coded a sub-set of transcriptions, and these results were compared to the original analysis to ensure emerging themes were similar across researchers. This process increased validity and reliability of data analysis (Auerbach & Silverstein, 2003; Bernard, 2011; Miles et al., 2014; Robson, 2011; Ryan & Bernard, 2003; Strauss & Corbin, 1990).

2.2. Ethics

Standard Institutional Review Board (IRB) verification protocol was followed, and acceptance was granted for the participation of human subjects in this study. Due to the demographic configuration of participants, this study did not interview any vulnerable populations. Prior to data collection, ethical training was required to ensure the appropriate consent, confidentiality, and data collection and storage parameters were followed.

In accordance with IRB protocol, participant consent was required for the audio recording of all interviews. The goals and intentions of the study were explained in full, and an opportunity to ask questions was given to every participant before pre-approved IRB consent form was distributed (Appendix A). All interviews were voluntary, and participants had the right to decline recording. Participants also had the right to remove their interview consent freely at any time.

To attain full transparency and secure consent, the researcher began each interview with a full explanation of the project's goals and intentions and obtained consent for capturing the audio content of the interview.

Interviewees were assured that the information they provided would be kept confidential to the extent permitted by law. Others may know that they had participated in the research, but nothing they said would be directly attributed to them or their organization. Interviews were audio recorded and transcribed verbatim to ensure consistency and open-coding analysis (McLellan, MacQueen, and Neidig, 2003).

3. Governing Authorities and Precedents

The Federal Energy Regulatory Commission (FERC) is the Federal agency with lead authority over the licensing of non-Federal grid-connected marine hydrokinetic (MHK) projects in the US.

FERC currently offers two types of license: a pilot license and a traditional license. Pilot project licenses are intended for testing new device technologies no greater than 5 MW in size and have a 5-year duration (FERC, 2008). The traditional license has a duration of 30-50 years. Both of these license types can take 3-7 years to complete and involve consultation with several federal, State, and local agencies with specific regulatory authorities over some aspect of the ocean or coastal zone. To support the licensing decision, authorized projects also require extensive environmental investigation and monitoring regimes. Additionally, an MRE developer must obtain separate permits for use of the seafloor and construction of land-based cable interconnection facilities, each with its own public and technical process.

MRE project developers have noted that the permitting process is arduous and expensive, representing a barrier to the growth of the industry (Dubbs, 2013). Because losses associated with a blackout begin immediately, hours count. If an MRE project did not already exist near an affected community, and a traditional permitting process under FERC may be expected to take 3-7 years, then the traditional permitting process also presents a significant risk to the validity of MRE to be an effective emergency power source in the aftermath of a disaster. Alternatively, no mechanism currently exists for an MRE applicant to secure pre-approval to deploy a temporary MRE project in response to an emergency situation.

Because the MRE industry is still nascent in the US, there is a high degree of uncertainty regarding the potential environmental effects of development. As a result, the licensing and permitting process for MRE has become the primary venue for characterizing and mitigating uncertainties and perceived risks, using the best available science, to ensure compliance with marine protection regulations. In Oregon, permitting process participants have identified the following high-priority risks: potentially harmful or harassing acoustic levels, electromagnetic frequency effects on sensitive species from devices and cabling, pinniped haulout on devices, fish aggregation and artificial reef effects to the environment from structures in the water, and entanglement of fishing gear which increases marine mammal entanglement risk.

While no legal path to allow the emergency temporary use of a WEC system currently exists, legal and historical precedents suggest that such a system may be able to obtain rapid approval in an emergency. Following Hurricane Katrina in 2005, many emergency response actions were exempted from Federal and State environmental protection laws. Flood waters were pumped into Lake Pontchartrain without the normal requirement for a National Pollutant Discharge Elimination System permit under the Clean Water Act. Materials were deposited in wetlands, without a permit under Section 404 of the Clean Water Act, based on the authority of executive procedures from the US Army Corps of Engineers. EPA granted "four kinds of waivers from Clean Air Act requirements," to allow refineries to increase fuel production to stabilize Gulf Coast industries. At the State level, "The Louisiana Department of Environmental Quality granted relief from the rules applicable to wastewater discharges; air emissions relating to repair activities and temporary power sources; on-site solid and hazardous waste management; inspection and rehabilitation of underground storage tanks; and numerous inspection, monitoring, and discharge reporting requirements." Several other instances like these led one scholar to conclude that "the emergency response to Hurricanes Katrina and Rita . . . was not inhibited by the environmental laws. Exemptions or waivers were granted, or the authorities simply looked the other way." (Gerrard, 2006)

Following the Deepwater Horizon oil spill, an Incident Command System under USCG leadership[12] came to a decision to employ formulations of the dispersant Corexit to oil at the ocean surface and in the subsurface at the location of the Macondo well. While it later came to light that this decision carried environmental consequences of its own, it shows a utilization of the Precautionary Principle (UNCBD, 1992). The precautionary approach to natural resource management, which first emerged in Germany in the 1970s and was codified in Principle 15 of the Declaration of the United Nations Conference on Environment and Development, States:

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[12] Per the National Contingency Plan (40 CFR 300), The USCG is the On-Scene Coordinator (OSC) for maritime spills and is charged with ensuring that the responsible party takes appropriate action. NOAA is designated by Congress to be the scientific advisor to the OSC and act as the Scientific Support Coordinator for scientific issues that include "expertise in environmental chemistry, oil slick tracking, pollutant transport modeling, natural resources at risk, environmental tradeoffs of countermeasures and cleanup, and information management." (Lubchenco et al., 2012)

> In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

In emergency instances such as the Deepwater Horizon spill, this language could be used to support a risky decision, such as the use of a treatment with uncertain system effects, when there is a perceived threat of a greater irreversible harm (e.g., a massive oil spill). In this case, the uncertain effects of the remedial alternative were judged to be a lesser risk than the imminent threat to irreplaceable human and natural resources. This example begs the question whether a similar justification might apply to a long-duration power outage scenario wherein some degree of ocean risk may be weighed against imminent threats to human life and property.

The environmental protection laws that most directly affect the permitting process for MRE are the National Environmental Policy Act (NEPA), the Coastal Zone Management Act, the Endangered Species Act, the Marine Mammal Protection Act, the Magnusson Stevens Act, the Rivers and Harbors Act, and the Federal Power Act. Of these, NEPA[13], CZMA, and the ESA all have exemption provisions in Federal disaster areas or when it is "in the paramount interest of the country"[14] (Gerrard, 2006). The MMPA does not contain emergency provisions, but a process exists to obtain preemptive permission for incidental take of a protected species resulting from a proposed action. Under the Magnusson Stevens Act, NOAA-NMFS requires consultation for emergency Federal actions that may adversely affect essential fish habitat, but guidance States that agencies, "may consult after-the-fact if consultation on an expedited basis is not practicable before taking the actions" (NOAA 2004). For the Rivers and Harbors Act, the US Army Corps of Engineers has the authority to provide emergency authorizations for projects in navigable waters (USACE, 2015). Additionally, the USCG has broad authority to govern maritime navigation and the anchorage and movement of vessels in navigable waters of the United States, so it is reasonable to assume that exemptions from maritime regulations are also within the USCG authority.

Existing precedents in law discussed in this section suggest that in the event of a natural disaster, legal and political will favors actions to preserve human life and property over environmental protection

[13] While the text of NEPA itself contains no emergency exemptions, the implementing regulations of the Council on Environmental Quality authorize lead agencies to make "alternative arrangements" in emergency situations." 40 C.F.R. § 1506.11

[14] 16 U.S.C. § 1456(c)

regulations. If one considers the relative risk posed by a temporary moving structure in the ocean that could alleviate human suffering, such a regulatory path may be considered reasonable to pursue on a policy level.

4. Potential Regulatory Pathways for Emergency MRE

The potential regulatory paths for deploying an emergency MRE system may generally fall under two categories: approval pre-event or post-event.

If a community or private MRE developer were to propose a temporary WEC project specifically intended for emergency deployment prior to such an emergency taking place, they would need the ability to secure some form of anticipatory pre-approval of a WEC deployment if it is to be effective at mitigating risk during an emergency. Such a permitting process might include conditions under which an emergency deployment is allowed, limits on the duration of deployment, monitoring regimes as practicable during the emergency, and technical standards for interconnecting a WEC to a grid, which may or may not require local grid modifications prior to a disaster occurring. To facilitate this option, policymakers could petition the FERC to develop a new class of MHK permit that allows rapid deployment of temporary solutions immediately after a disaster provided that qualifying conditions are met. Such an anticipatory regulatory pathway would also need to incorporate the relevant consultations with resource protection agencies and also secure conditional approval from the USCG, BOEM, and State and local authorities for use of the sea floor, navigable waterways, and terrestrial cable landings.

As an alternative to the FERC licensing path, one of the interview interviewees emphasized that FERC does not have jurisdiction over a project if it is fully funded by a Federal agency and therefore a license would not be required. This agency would still need to conduct a NEPA analysis of potential environmental effects, as well as obtain the necessary permits from USACE and BOEM and also uphold environmental protection laws such as the ESA, MMPA, MSA, and others. If an agency such as the Navy, the USCG, or FEMA were to adopt a deployable MRE technology among its suite of emergency response options, that agency could hypothetically follow a process of its choosing for implementing emergency MRE.

If a community or developer had not previously obtained a conditional WEC permit before a disaster strikes, but a Federal Disaster is declared, then the leader of the Federal Incident Command System (normally FEMA) may be able to order the deployment of an emergency WEC system under current authorities. Any concerns related to safe ocean navigation would fall under the purview of the Incident Command Structure (ICS) system, as the USCG is the designated ICS commander for ocean-related emergency response.

Because an emergency WEC is an untraditional disaster mitigation application, it does not appear that FERC has been historically included under the Incident Command umbrella authorized by the Stafford Act. Therefore, it is uncertain whether the Incident Commander would be able to override FERC's permitting authority. As described above, this issue may potentially be circumvented if the technology proponent is a Federal entity. An Incident Commander may also lack the ability to override seafloor leasing authorities (BOEM in Federal waters and the Department of State Lands in State waters), the renewable energy development area designations defined in the Oregon Territorial Sea Plan, any rights of way required to run the electrical cable from shore to a grid substation, or a myriad of State and local plans and ordinances. Again, the temporary nature of the mitigation solution, combined with the severity of the emergency, may lead State and Federal executives (e.g., the Governor or President) to direct that these regulations not impede deployment.

5. Regulatory Perceptions of MRE Risk during an Emergency

To better understand how regulatory perceptions of risk associated with MRE are affected by the presence of an emergency, a series of semi-structured qualitative interviews (Creswell, 2014) was conducted with participants in current FERC permitting processes for a MRE project off the coast of Newport and a tidal energy project in Maine. Interviewees were asked to describe their perceptions of risk associated with MRE from their individual perspectives as participants in the process (generally categorized as agency regulators or MRE development staff). Interviewees were further asked to speculate on how their perceptions of risk might be different in the event of an emergency that threatened life and property, as well as what legal avenues may exist to accelerate the approval of an MRE project were an emergency to occur.

The quotes below reflect perspectives from MRE permitting process participants, collected during this research, regarding how emergencies change perceived risk within a permitting context. Interview participants were not asked directly whether the consideration of emergency scenarios changed how they thought about the risks being managed under their current FERC permitting processes, but rather how the presence of an emergency might affect a proposal to deploy MRE as a response measure. This formulation may have introduced bias toward a temporary deployable MRE use case. However, because the bulk of the interviews were conducted in support of a separate research effort to characterize risk perception within their existing processes, some insights may be gleaned with relevance to the research question of this NRT report.

Generally, interviewees from resource agencies appeared to be primarily concerned with ensuring protection of the specific resources and issues for which they have regulatory authority and responsibility. Some talked about the perceived benefit of renewable energy sources to help mitigate the onset of climate change and ocean acidification, but it was explained that in collaborative permitting process discussions, those benefits were not weighed relative to risks in a way that affected regulatory requirements for environmental studies to determine the direct effects of project approval. None of the interviewees specifically mentioned the potential outage disaster mitigation benefits of their MRE projects, nor mentioned that they had been discussed within the permitting discussions. Several interviewees described a proportionality aspect to the intensity of environmental study required for a project depending on its size, scale, and duration of deployment in the water. Projects with shorter durations and with a perceived smaller physical footprint of potential environmental effect were described as having less stringent characterization and monitoring measures.

When prompted to consider the potential for a long-duration blackout and the possibility of employing a MRE technology to mitigate detrimental effects, responses were generally consistent with the concept that an emergency situation does affect the perception of relative risk to the ocean. As one described, “You can have things in an emergency situation that wouldn’t [otherwise]. You bypass all permitting in an emergency situation . . . but you can’t play that card for anything short of national disaster, imminent real risk to the population, and a need to rescue people.” All but one respondent who speculated on the regulatory response to an emergency situation predicted that protection of human life and property would supercede short-term risks to environments and protected species. However, it was expected by at least two interviewees that some form of environmental effects analysis, either before or after the fact, would still need to take place. A respondent explained, “We step aside and what we do is we do an after the fact consultation, so after they're done dealing with this emergency situation we issue a biological opinion and any take that would have occurred then is considered.”

Interviewees’ conceptualizations of the permitting process for such a solution varied between the three potential regulatory pathways described in this section. Some speculated that a declaration of emergency authority would need to be made by Congress, the President, or a Governor in order to clear a regulatory path for emergency deployment of an MRE system. Others were of the perspective that governments, utilities, and communities should be more proactive about planning for emergency power provision and seek some form of contingent approval for the use of emergency MRE if it is a preferred response measure. One respondent reasoned, “I would imagine it’s a State or Federal agency like FEMA or something that’s saying ‘We’d like to have this in our suite of options,’ so then it’s one agency asking another agency as opposed to a private applicant.” Those who described this approach tended to envision an integrated process that engages policymakers, regulators, and utilities as part of a regional planning effort.

One interview respondent stressed that in consideration of the many technical and regulatory uncertainties associated with MRE, the most prudent course of action to mitigate risks from long-duration blackouts should be to invest in the traditional type of WEC permitting process and installation before it is needed. Such a path would provide the proponent of the project to have greater regulatory certainty, greater forethought in designing the optimal system for the specific ocean environment, and a greater return on investment because the WEC will be able to produce power with or without an emergency. “Who doesn't want renewable energy when you really need it?” one respondent said, “and in a State of emergency, if you need it, you need it.”

6. Discussion

Based on the findings in this research, it appears that in an emergency the balance in the coupled natural human system shifts to favor the preservation of human life and property. Various mechanisms exist by which Federal and State laws could be superceded on the command of the President, a Governor, and/or Congress (the Stafford Act, 42 U.S.C. §§ 5121-5207). Additionally, it appears that sufficient policy interest and process flexibility may exist for interested parties to seek some form of anticipatory approval to deploy an MRE solution under predetermined emergency conditions.

The practical application of a temporary deployable WEC presents new technical challenges whose solutions may introduce new types of ocean-related risks compared to the traditional WEC installation method. The transmission cable would need to be temporary in nature, meaning that it would not be possible to bury the cable in the seabed to reduce the potential risk of EMF effects on species or interference with fishing gear that touches the seafloor. If a floating cable were deployed with sequential floats, it may represent a hazard to navigation per USCG authority. One potential path to USCG approval given the emergency nature of the deployment would be to ensure that a floating transmission line is clearly marked and its presence advertised on marine radio channels.

Even a temporary WEC solution will require some kind of anchoring system to keep it stationary, but the current State of the art of using three multi-ton concrete anchors presents issues related to supply chain, specialty vessel availability post-disaster, and benthic disturbance. As a potential solution, one company is developing Anchoring Remotely Operated Vehicles (AROVs) (Sustainable Marine Energy Ltd., 2017) that would allow an operator to lower an autonomous anchor installation machine from an overhead vessel, drill into a rocky seabed, and install a helical screw anchor that reportedly can hold 100 tons depending on the rock type. The screw anchor would be removable upon decommissioning. While one interview respondent reported that rocky environments are recognized as important habitat for valued marine species in Oregon, it is possible that a similar system could allow rapid deployment of a WEC in a soft bottom environment in the future.

7. Conclusions

Given the real and likely risks that a sustained coastal power outage represents, communities may be interested in local energy generation to foster emergency resilience. MRE presents one possible avenue to achieve this. Currently the approach to MRE development may favor the idea of creating community- or regional-scale MRE projects as “resilience zones”. By making the motivation behind MRE development one of community support, and by potentially sizing their project scales to match community needs rather than bulk power for the grid, a project may gain greater community acceptance.

Responses from participants in the FERC licensing process for MRE appeared to suggest that proactive emergency planning that includes MRE would be supported. This finding is consistent with the concept of a resilience zone model for MRE development. However, because the traditional commercial MRE projects are stationary and permanent, it is likely that such a process would still require many years to obtain a permit. By contrast, a temporary MRE deployment in direct response to an emergency situation would, based on interviewee responses, face a different regulatory environment. A temporary deployable system may be able to circumvent some of the extensive and expensive environmental investigation and monitoring requirements associated with the traditional permitting process.

The potential benefit of a deployable WEC model would be the ability to deliver emergency power wherever and whenever it is needed (within the limits of portability), as well as benefit from an entirely different risk perception profile. In such a case, a Federal entity such as FEMA, the Navy, or another emergency management agency may be well situated to have a supply of emergency MRE capability ready to respond to an emergency. With the currently available technology, however, many logistical challenges would complicate the ability to deploy an MRE array of sufficient size to supply critical infrastructure services to a coastal city. If these challenges can be overcome, a temporary deployable MRE use case may be a viable alternative worth pursuing on the State and Federal policy level.

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Chapter 5: Conclusions and Implications

The first chapter establishes the regulatory framework of MRE FERC permitting processes in the US and describes how these processes provide a venue to integrate multiple sectors of ocean and coastal governance across multiple scales. Chapter 1 also introduces the risk management philosophies of precaution and adaptability, their importance in governing new ocean uses such as MRE, and how they can potentially complement and contradict one another.

In the second chapter, we see examples of MRE permitting processes in practice, when representatives of different institutions must work together to navigate risk and rules in an uncertain environment. Consistent with the work of Slovic, the perception of risk is intertwined with the uncertainties in the ocean environment and in the proposed devices themselves. The research also shows that the definition of acceptable or unacceptable risk is elusive, relying on the perceptions and judgment of the people in the process until more quantitative methods become available. The MRE permitting process appears to address these risks and uncertainties via an adaptive management approach that is predicated on trust built between participants during the pre-licensing phase and the continuation of that trust in an ongoing collaborative effort that persists after an MRE project is installed in the ocean.

The third chapter builds on the findings of the second chapter to identify best management practices for future MRE process participants. It highlights a number of methods by which the participants in the case study projects have sought to decrease uncertainty and increase trust.

The fourth chapter delves more specifically into how the risk perceptions of the case study participants may be affected by the presence of a hypothetical emergency that threatens coastal communities. It finds that the rules surrounding acceptable risk appear to change when human life and property are under serious threat. This change in the regulatory landscape may open an opportunity for MRE developers or emergency responders to employ solutions that can mitigate acute risks, as the perceived benefits of such a solution may outweigh the perceived uncertainties and risks of deploying MRE on a limited scope and scale.

The discussions about ocean energy described in this research tell a story about a government in conversation with itself. MRE offers a powerful potential to benefit economies and the environment on a large scale, but it also poses potential risks at local and regional scales. When these mechanical works of imagination exit the workshop and try to interact with the natural world, they run up against a great monolith of interwoven governing authorities, some of which are built on a foundation of precaution. Some may celebrate that it is a sign of sophistication that a people can so thoroughly study and model a decision before they make it. It seems no industry is immune from catastrophe, especially in the energy business (the Deepwater Horizon disaster was built on a pile of failed or ignored precautions), so it is vital to carefully plan ahead. It is valuable to have a part of government dedicated to supporting innovation and willing to take risks for the sake of potential benefits, but it is also valuable to have a part of government concerned with what is precious and in possession of a will to defend it with their most powerful legal tool: uncertainty.

The precautionary principle in modern government began in Europe, yet it is in the US that it has become a determining factor in the growth of the industry. MRE as a new venture on the ocean comes with a bill for the most comprehensive data and sophisticated scientific reasoning our civilization can reasonably muster. The legal purpose of all of this scientific effort may be, from a skeptic's perspective, to prove inarguably that the government did the most it reasonably could to protect species upon which our nation has conferred special legal status in the name of the public trust. Others may argue that even when considering solutions to dire risks, we must first have a reasonable expectation that we can prevent serious harm and be good neighbors within the living, peopled seascape.

In recent years, prospective new ocean users have adopted new paradigms like adaptive management and Marine Spatial Planning in an attempt to inspire the government to reconsider how it balances risk against human progress. However, these frameworks have been met in some instances with resistance and suspicion. Is adaptive management trying to evade the burden of thinking something through before acting? Can a risky decision be designed such that it will be completely responsible to those it puts at risk? Is Marine Spatial Planning a sea grab in disguise, built with a bias toward economic uses and not rooted firmly enough in the concept of local and regional sustainability? Are these new policy philosophies simply new ways to enable human territorial expansion and its seemingly constant companion: degradation?

For ocean energy to win a spot in America's oceans, it needs to not only respond to these fears, but it must also understand the place it is trying to enter and the beings that inhabit it, arguably better than the resource agencies know it themselves. Furthermore, each marine energy device has to be designed so exquisitely that it is inoffensive to both nature and man. This last requirement is an especially difficult task when designs are still evolving and the only way to learn more is to put them in the ocean. Much like the space program during the race to the moon, no degree of failure seems allowable, but unfortunately wave energy currently appears to lack the political will and financial support of the Apollo program.

In an age of science-based ocean discourse, the reduction of uncertainty is both a luxury and a responsibility of wealth. Environmental investigation may be the pound of flesh the industry will have to pay to get their steel in the water, but it is important to remember that the resource agencies' authority over sea life does not disappear once a license is given to build a MRE project. While politically unfavorable, it would be within some agencies' rights to penalize any projects that cause measurable harm, possibly even evict a wave energy tenant or the whole industry altogether if powerful enough evidence appeared. Maybe they would rather anticipate all thinkable scenarios for disaster than allow an environmental "offender" onto their turf unknowingly and be doomed to seek compensation for an irreplaceable loss after the fact. The way forward appears to be for developers and agencies to make a covenant, based on trust, to learn and change together.

It seems unlikely that the interest in marine energy will fade now that the idea exists. Europe is developing MRE in a seeming desperation to escape its dependency on foreign fossil fuels[15], and the threat of climate change will only increase the urgency to utilize every clean energy option available. For coastal communities, the potential benefits of locally produced energy toward building resilience and addressing global problems may motivate greater community acceptance of a new industry in their backyards. Under sufficient pressure, the prevailing philosophies in government regarding acceptable risk may all align. Yet there is a real possibility that if the MRE industry cannot resolve its uncertainties and learn by experience, then solar, wind, nuclear, and whatever comes next will leave ocean energy in the dustbin of abandoned ideas alongside the Stirling engine, the zeppelin, and the electric car (though the latter was later retrieved). Maybe the final risk calculus will be as much about where we place our hope as where we see our fear.

The institutions within our government act as surrogates for the varying interests in the ocean, but ultimately the decisions regarding MRE rely on genuine conversation within a fundamentally human process. MRE acts as a catalyst that brings many different ocean interests to the table to talk about an uncertain future and the responsibilities we all share. To succeed, these conversations must be coherent across many disciplines and perspectives, considerate of the many perceived risks of those safeguarding

[15] Yale Environment 360, 2016. "Offshore Wind Energy is Booming in Europe". http://e360.yale.edu/features/european_offshore_wind_industry_booming (retrieved November 2017).

different aspects of the public trust, inclusive of the best available science, adaptive to change in the face of uncertainty, and built on a trust that can last into the future. Through it all we must remember: government is made of people. We should take heart when its risk management processes are a struggle for those engaged in them, because it shows that it reflects the varied perceptions and perspectives of the society they represent.

Appendix A. IRB Consent Form

Written Consent Form

PLEASE READ: You are being asked to take part in a research project to understand the interrelationship between collaboration in multi-agency permitting processes and the perception and management of uncertainty and risk in the context of marine renewable energy projects. We would like to understand your perspective regarding the value of a collaborative marine renewable energy permitting approach relative to traditional permitting processes, and the barriers and opportunities for future practitioners of the collaborative approach.

This research will result in a report to the funder, the Northwest National Marine Renewable Energy Center, as the foundation for a "best practices" guide, and a thesis in the Marine Resource Management graduate program at Oregon State University. You are being invited to take part in this study because you are at least 18 years old and have participated in a relevant marine renewable energy permitting process. As such, you can provide valuable insights from your experience. The following interview should take between an hour and an hour-and-a-half to complete.

If the results of this study are published, your identity will not be made public. Your responses to questions will be similarly presented in such a way to protect your confidentiality to the extent possible and required by laws to prevent harm to human research participants. Your participation in this study is voluntary and your may refuse to answer any question(s) for any reason. In order to accurately reflect what you share with me, I will be audio recording this interview. You have the option to decline recording, but any information you provide will be kept confidential and will only be used in our research.

This study is not designed to benefit you directly but we hope that it will inform future processes. If you do not want to participate and do not wish to be contacted further, please let us know. Should you agree to particpate, please respond to this email or call me at 541-502-0211.

If you have any questions about this research project, please contact: Jeff Burright at burrighj@oregonstate.edu or (541) 502-0211 or Flaxen Conway at fconway@coas.oregonstate.edu or (541) 737-1339. If you have questions about your rights or welfare as a participant, please contact the Oregon State University Institutional Review Board (IRB) Office, at (541) 737-8008 or by email at IRB@oregonstate.edu

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Signature Date

Jeffrey D. Burright

Appendix B. Semi-Structured Interview Guide

Adaptive Meets Precautionary: Navigating Risk and Rules in Collaborative Marine Renewable Energy Permitting Processes

Phase 2: Eligibility Screening Interviews for Potential Case Study Projects

1. Can you please briefly describe the leading laws, policies, or processes that governed, guided, or otherwise provided structure to the permitting process for this project?
2. Can you please describe any formal or informal collaboration that took place between the developer of the project and the Federal, State, and local agencies that had responsibility associated with the decision whether to permit the project?
3. Can you please tell me which agencies participated? Were there any organizations that were invited to participate but declined or who you believe should have been included in the process that were not?
4. During any collaborative interactions between agencies and project developers, can you please describe in what ways risk and/or uncertainty were explicitly discussed?

Phase 3: Semi-Structured Qualitative Interviews of Selected Case Study Projects

Contextual Information

1. How long have you been with your organization?
2. Have you been involved in other similar types of processes in the past? What were they?

Collaboration Process

1. What was your interest in participating in the collaborative process? Was that interest satisfied?
2. What was the power sharing dynamic? How much power was in the room vs. outside among management/legal counsel?
3. Was there preexisting social capital between participants or barriers to collaboration prior to initiation of the permitting process, such as via facility siting, regional marine spatial planning, or other public processes? How did interagency relationships change by the end of the collaborative permitting process?
4. How long was the collaborative process? What factors slowed down or sped up the process?
5. What factors contributed to the success or failure of the process?

Uncertainty/Risk: Perceptions and Management

1. What was your perception of the uncertainties and risks associated with the permitting decision for this project? In what ways did these perceptions change during the collaborative process?
2. How would you characterize your organization's institutional rules or preferred approach to managing uncertainty/risk during the permitting process? Did it change, and if so, to what do you attribute this change?

3. How was acceptable risk defined in the context of permitting the facility?
4. What in-practice rules emerged regarding the type and quality of information to address risks and uncertainty?
5. How did you perceive the power dynamic affecting decisions regarding risk and uncertainty management?

Permitting Process and Governing Legal Structures

1. What are the legal and procedural rules underpinning the collaborative permitting process? How did they affect the process of collaboration?
2. What were the major regulations that affected the treatment of risk? (e.g., ESA, NEPA, MMPA)
3. How did the governing legal structures foster or inhibit process flexibility and adaptability?
4. What barriers and opportunities did you perceive to improve the collaborative permitting process in the future?
5. How effective would you say the multi-agency collaborative permitting process was relative to traditional document-driven processes?