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Rough Seas Ahead: Confronting Property Doctrines to Jumpstart Wave Energy

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ROUGH SEAS AHEAD: CONFRONTING CHALLENGES TO JUMP-START WAVE ENERGY

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The nascent wave energy business is expanding at an impressive pace. For those favoring sustainable alternatives to fossil fuels it is not quick enough. Getting wave energy to the grid will require increased technical knowledge and a legal framework that encourages investment in this form of alternative energy. This Article examines various challenges to the goal of accelerating wave energy development within the sustainable development framework. Three recommendations for paving the road ahead are to establish the role of ocean renewables within the larger energy policy, to prioritize research that will prove the "green credentials" of wave energy, and to move forward with ecosystem-based zoning to facilitate restoration and sustainable long-term management of our oceans. We are at an important time for government to encourage the development of offshore areas as a source of sustainable renewable energy. The question of how to prioritize a variety of uses offshore must be answered by the recognition that not all uses at ever-increasing intensities can be sustained. The recommendations discussed in this Article will illuminate the trade-offs of wave energy production with other competing uses of the oceans. Making those choices is necessary to facilitate responsible stewardship of the oceans as a critically important public resource for current and future generations.

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I. INTRODUCTION

The wave energy business is expanding at a rapid pace. For those favoring sustainable alternatives to fossil fuels it is not quick enough, and much attention has been directed to "expediting" the process.[1] But getting wave energy to the grid will require increased technical knowledge as well as a legal framework that encourages investment in this form of alternative energy. Further, the claims that such energy is "green" and sustainable must address concerns about environmental impacts to ocean and coastal areas and socioeconomic impacts to coastal communities. Various obstacles must be confronted to bring wave energy to the grid in significant amounts at an accelerated rate.

This Article will examine various challenges to the goal of accelerating wave energy development within the sustainable development framework. Three specific recommendations for paving the road ahead are to establish the role of ocean renewables within the larger energy policy, to prioritize research that will prove the "green credentials" of wave energy, and to establish marine reserves and conservation areas in an ecosystem-based ocean management system that plans for the sustainable long-term health of our oceans.

[1] U.S. DEP'T OF ENERGY, SMALL BUSINESS INNOVATION RESEARCH AND SMALL BUSINESS TECHNOLOGY TRANSFER PROGRAMS 73 (2009), *available at* http://www.science.doe.gov/sbir/solicitations/FY%202009/C27_topics.pdf.

The first paradigm to confront is the intellectual property regime. Providing property rights in new inventions provides a strong incentive to develop new technology. Technology is developed by trial, error, reevaluation, and success, all requiring a significant investment of time and resources with some degree of risk. The sharing of knowledge about wave energy generation would theoretically increase the likelihood that successful technology will be developed in a shorter time frame. With a very large data gap regarding offshore baseline conditions and potential mitigation measures, sharing information generated during pilot projects will be essential. On the other hand, the incentive for developing the technology is reduced if the right to profit exclusively (at least for a limited time) from the technology is not limited to the person who first produces the technology. Finding a solution that encourages the sharing of information but still retains the incentive to innovate is a challenge for bringing wave energy to the grid quickly. Solutions from other disciplines provide potential avenues for addressing this challenge. Establishing the anticipated role of ocean renewable energy in U.S. energy policy and progress in proving the "green credentials" of wave energy will also be critical to the budding industry.

A second paramount challenge, which must be addressed, is the complicated legal framework that has evolved to manage oceans. We have only limited experience with controlling individual rights in fixed areas of the ocean. For generations, the right of navigation was of the utmost importance for commerce and fishing.[2] Today, industrialization of the oceans is occurring at a fast pace, with various fixed-location activities competing with traditional uses that rely on open, unimpeded access.[3] Complicating the tension is increased awareness of the responsibility for preserving marine ecosystem integrity and biological diversity for current and future generations.[4] Thus, fixed activities such as aquaculture and wind and ocean (including, but not limited to, wave) energy generation must be reconciled with shipping, fishing, recreation, and environmental preservation. The interest in perpetuating the wisdom of the public emphasis on shared ocean benefits and responsibilities is a centerpiece of most recent reform efforts. Most will agree that a workable legal framework must balance wave energy among competing public benefits. However, putting this ideal into practice will be difficult and potentially quite time consuming. Prioritization must ultimately prevail. This controversial work will be helped by locating ocean renewable energy within a larger energy policy framework, proving wave energy's "green credentials," and utilizing marine reserves within area-based ocean management keyed to sustaining marine ecosystems for current and future generations.

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[2] *See, e.g.*, Holly V. Campbell, *Emerging from the Deep: Pacific Coast Wave Energy*, 24 J. ENVTL. L. & LITIG. 7, 20 (2009).

[3] *E.g.*, Laura Koch, Comment, *The Promise of Wave Energy*, 2 GOLDEN GATE U. ENVTL. L.J. 162, 167 (2008).

[4] *Id.* at 168.

II. BACKGROUND

A. Wave Energy and How It Can Contribute to a "Greener" Grid

Hydrokinetic energy is generated by tides, waves, and currents.[5] Various technologies have been created to capture wave energy generated in the oceans for use onshore. These include overtopping devices, point absorbers, attenuators, and oscillating devices.[6] Overtopping devices may consist of a floating structure that contains internal turbines.[7] Waves move over the device, and the water returning to the ocean moves the turbines.[8] Point absorbers are mounted to the seafloor or are floating buoys, which absorb energy from many directions.[9] Attenuators are floating segmented structures, visually similar to a snake, that when moved by waves would generate energy at the segment hinges.[10] Oscillating devices, such as an oscillating water column, would use the action of water entering a chamber to compress and decompress air to turn a turbine.[11] No single wave energy conversion device has yet emerged as the technology leader, and new designs continue to be proposed.[12]

Energy from the oceans is renewable and most technologies make minimal use of chemicals.[13] The primary argument that wave energy is more environmentally benign than other forms of energy focuses on the fact that most existing sources (fossil fuels provide over eighty percent of current U.S. demands) generate greenhouse gases that contribute to global

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5 ELEC. POWER RESEARCH INST., ASSESSMENT OF WATERPOWER POTENTIAL AND DEVELOPMENT NEEDS 2-1 (2007), *available at* http://my.epri.com/portal/server.pt?Abstract_id=000000000001014762 [hereinafter WATERPOWER ASSESSMENT].

6 See ELEC. POWER RESEARCH INST., PRIMER: POWER FROM OCEAN WAVES AND TIDES 4–5 (2007), *available at* http://my.epri.com/portal/server.pt?Abstract_id=000000000001015267 [hereinafter OCEAN ENERGY PRIMER], for an excellent primer on the different technologies currently under development. The Electric Power Research Institute (EPRI) is a nonprofit research organization expert in analyzing energy generation, delivery, and use issues. ELEC. POWER RESEARCH INST., STRATEGIC TECHNOLOGY RESEARCH BACKGROUNDER: ELECTRINET 4 (2009), *available at* http://www.smartgridnews.com/artman/uploads/1/BackgroundElectriNetFinal7-28-09.pdf. In public-private partnerships, EPRI has engaged in feasibility demonstrations of ocean wave energy conversion (WEC) technologies. *See* WATERPOWER ASSESSMENT, *supra* note 5, at 4-3 to 4-4; ELEC. POWER RESEARCH INST., RENEWABLE ENERGY TECHNICAL ASSESSMENT GUIDE—TAG-RE: 2006, at 8-53 (2007), *available at* http://my.epri.com/portal/server.pt?Abstract_id=000000000001012722 [hereinafter RENEWABLE ENERGY ASSESSMENT].

7 OCEAN ENERGY PRIMER, *supra* note 6, at 4–5.

8 *Id.*

9 *Id.*

10 *Id.*

11 *Id.*

12 *See id.* at 1, 4. The Anaconda is a wave attenuator that would be placed below the surface of the water. *See* Press Release, Eng'g & Physical Scis. Research Council, Rubber "Snake" Could Help Wave Power Get a Bite of the Energy Market (July 3, 2008), http://www.epsrc.ac.uk/PressReleases/RubberSnakeCouldHelpWavePowerGetaBiteofEnergyMarket.htm (last visited Nov. 15, 2009).

13 OCEAN ENERGY PRIMER, *supra* note 6, at 1.

warming.[14] Although wave energy is renewable, uses minimal chemicals, and does not contribute greenhouse gases to the environment, any proposed wave energy project has the potential to disrupt marine ecosystems in a variety of ways, which are currently being researched.[15]

Environmental impact research is lagging behind the rapid expansion of claims in coastal waters by those eager to bring wave energy to the grid.[16] It will take time and effort to ensure wave energy production provides more benefit than harm, but existing research is supportive of the conclusion that wave energy is "green" energy in comparison with other nonrenewable sources such as oil, natural gas, and coal.[17]

One of the more interesting aspects in the progress of the wave energy industry to achieve the principles outlined by sustainable development advocates is reflected by the joint policy paper adopted by various ocean stakeholders, environmental groups, and industry leaders on ocean renewable energy.[18] Sustainable development requires a unity of concern for social and environmental well-being, and is development that will meet the needs of people today without jeopardizing the ability of future generations to meet their needs. A core part of sustainable development is recognizing that humans are dependant on a healthy environment. The principles adopted by the joint stakeholder group reflect the concern that wave energy contributes to a "greener" grid by providing a source of energy that does not harm the environment.[19] This is why the policy statement is supported by such prominent environmental groups as the National Resources Defense Council, the Surfrider Foundation, and the National Heritage Institute.[20]

The sustainable development model also urges us to recognize the potential impact on coastal communities. These communities will be most affected, but could also experience the benefits of wave energy development most directly. An efficient use of hydrokinetic energy would be within coastal communities. In fact, areas that have sufficiently developed infrastructure and a demand for energy have been most aggressive in pursuing hydrokinetic energy as an addition to their existing energy

14 According to the Energy Information Administration (EIA), 85% of U.S. energy needs in 2007 were met by coal, oil, and natural gas. ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, ANNUAL ENERGY OUTLOOK 2008, at 2 (2008), *available at* http://www.eia.doe.gov/oiaf/aeo/pdf/0383(2008).pdf. According to the most recent energy outlook published by the EIA, renewable energy provided only about 7% of U.S. demand. *See* ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, ENERGY OUTLOOK 2009 app. A, at 109 tbl.A-1 (2009), *available at* http://www.eia.doe.gov/oiaf/aeo/pdf/0383(2009).pdf (noting that renewable energy generation accounts for a relatively small share of total U.S. generation).

15 RENEWABLE ENERGY ASSESSMENT, *supra* note 6, at 8–10.

16 *See id.*

17 *Id.*

18 JACK STERNE ET AL., OCEAN RENEWABLE ENERGY: A SHARED VISION AND CALL FOR ACTION 2 (2008), *available at* http://www.edf.org/documents/8969_OceanRenewableEnergy_JointPrinciples_08.pdf.

19 *Id.* at 3.

20 *Id.* at 2.

portfolios.[21] However, this might be seen to conflict with the prevailing view of energy production, which focuses little on a diversified portfolio of multiple energy sources in favor of centralized, larger power sources that provide for the majority of energy demand.[22] This view has stalled development of technologies that have not yet proven their capacity and is a factor impeding wave energy offshore in the United States.[23]

But the potential energy to be produced from the oceans is vast. Estimates of the amount of energy that could be generated by wave energy, and all hydrokinetic energy (including tidal), vary. Reliable estimates suggest that it is feasible that the oceans could provide ten percent of existing U.S. energy demand.[24] Taking this estimate as valid, the United States could depend on ocean energy to provide a reliable source of energy to the grid.

B. What Is the Existing Regulatory Framework for Hydrokinetic Projects?

1. Jurisdiction: Permitting, Licensing, and Leasing

Although we have few examples of wave energy projects that are "up and running" (none, in fact, in the United States), many preliminary permits for wave energy projects have been issued by the Federal Energy Regulatory Commission (FERC)[25] and more are awaiting approval.[26] This is so despite

21 NAT'L OCEANIC & ATMOSPHERIC ADMIN., U.S. DEP'T OF COMMERCE, ECOLOGICAL EFFECTS OF WAVE ENERGY DEVELOPMENT IN THE PACIFIC NORTHWEST 5, 6 (George W. Boehlert et al. eds., 2007), *available at* http://spo.nwr.noaa.gov/tm/Wave%20Energy%20NOAATM92%20for%20web.pdf. Other factors cited as important drivers include the adoption of Renewable Portfolio Standards (RPS) and the high cost of energy in certain areas. *See, e.g.*, COASTAL STATES ORG., CSO ALTERNATIVE ENERGY SURVEY: EXECUTIVE SUMMARY 1 (2009) (on file with author) (citing RPS as potential incentive for investment in development of renewable energy); NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra*, at 1, 2 (noting that the RPSs in Oregon are the most significant policy driver for the development of renewable energy).

22 *See* VIJAY V. VAITHEESWARAN, POWER TO THE PEOPLE: HOW THE COMING ENERGY REVOLUTION WILL TRANSFORM AN INDUSTRY, CHANGE OUR LIVES, AND MAYBE EVEN SAVE THE PLANET 27–45 (2003) (critiquing centralized power delivery and supporting micropower technology).

23 *See generally id.* (criticizing centralized power delivery); STERNE ET AL., *supra* note 18, at 4–6 (discussing the shortage of testing and delay of full-scale economic deployment for ocean renewable energy technology).

24 OCEAN ENERGY PRIMER, *supra* note 6, at 3. This may be a conservative estimate, as the technology is continuing to advance. The U.S. Department of Energy estimated that there was a capacity of 240 gigawatts of wave energy available in 2006. MIKE ROBINSON, U.S. DEP'T OF ENERGY, OCEAN ENERGY TECHNOLOGY DEVELOPMENT (2006), *available at* http://www.nrel.gov/docs/gen/fy07/40461.pdf.

25 See FED. ENERGY REGULATORY COMM'N, ISSUED HYDROKINETIC PROJECTS PRELIMINARY PERMITS (2009), *available at* http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/permits-issued.xls, for a spreadsheet of preliminary permits issued by FERC for all hydrokinetic projects, including wave and tidal projects.

26 See FED. ENERGY REGULATORY COMM'N, PENDING HYDROKINETIC PROJECTS PRELIMINARY PERMITS (2009), http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/permits-pending.xls, for a spreadsheet of pending permits. A survey conducted by the Coastal States Organization of its members in 2008 identified 13 potential wave projects permitted or proposed within state coastal boundaries. *See* COASTAL STATES ORG., *supra* note 21, at 1.

the fact that jurisdiction over the siting and approval of hydrokinetic energy projects was only recently the subject of debate between federal agencies. Both the Minerals Management Service (MMS), within the Department of the Interior (DOI), and FERC assert a role in the process of developing offshore wave energy on the continental shelf: MMS asserts jurisdiction to issue leases and right-of-ways on the outer continental shelf (OCS) for alternative energy projects.[27] FERC issues preliminary permits and licenses hydroelectric projects.[28]

Although it may have been feasible to navigate both processes, including some overlap relating to consultation with other agencies and review of environmental impacts, the regulatory structure was widely considered a bottleneck to advancing projects, some of which were proposed for the OCS, others for state waters, or both.[29] With that in mind, FERC and MMS developed a memorandum of understanding (MOU) to resolve their jurisdictional dispute and to coordinate efforts to encourage wave energy development.[30] On March 17, 2009, FERC and DOI issued a joint statement identifying their intent to enter into an MOU to coordinate.[31] According to their agreement, FERC will be the lead licensing agency for hydrokinetic energy and MMS will still have a role in the process issuing leases for occupation of the OCS.[32] MMS must first issue its lease, easement, or right-of-way prior to FERC issuing a license or exemption from licensing.[33] Because this current agreement may not be the last word on jurisdiction over hydrokinetic projects on the OCS, a word on the background of the dispute is helpful to understand the conflict, how it arose, what impact it has on the nascent industry, and how the conflict may ultimately be further resolved.[34]

MMS asserts a right to site offshore development projects pursuant to the Energy Policy Act of 2005 (EPAct).[35] Section 388 of the EPAct amended

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27 *See* Outer Continental Shelf Lands Act, 43 U.S.C. §§ 1331(b), 1337(p)(1) (2006).

28 Federal Power Act, 16 U.S.C. § 797(e)–(f) (2006).

29 *See* STERNE ET AL., *supra* note 18, at 7–8.

30 Memorandum of Understanding Between the U.S. Dep't of the Interior and Fed. Energy Regulatory Comm'n 1 (Apr. 9, 2009), *available at* http://www.ferc.gov/legal/maj-ord-reg/mou/mou-doi.pdf [hereinafter Memorandum of Understanding].

31 Press Release, U.S. Dep't of the Interior and Fed. Energy Regulatory Comm'n, Interior and FERC Announce Agreement on Offshore Renewable Energy Development (Mar. 17, 2009), *available at* http://www.ferc.gov/news/news-releases/2009/2009-1/03-17-09.pdf.

32 Memorandum of Understanding, *supra* note 30, at 1. FERC recognizes that MMS has exclusive jurisdiction for nonhydrokinetic renewable energy projects. *Id.* Further, FERC agreed not to issue preliminary permits for hydrokinetic projects located on the OCS. *Id.*

33 *Id.* at 2; *see also* Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf, 74 Fed. Reg. 19,638, 19,639 (Apr. 29, 2009) (to be codified at 30 C.F.R. pts. 250, 285, 290).

34 STERNE ET AL., *supra* note 18, at 7–8. Other proposed solutions include congressional or executive action, either as part of a comprehensive bill addressing offshore management or as a stand-alone provision. *Id.* at 8–9.

35 Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594 (codified primarily at 42 U.S.C. §§ 15801–16524 (2006)).

the Outer Continental Shelf Lands Act (OCSLA)[36] to provide significant new authority to MMS to issue leases, easements, or right-of-ways for production of alternative energy on the OCS.[37] MMS historically has managed offshore drilling of oil and gas pursuant to OCSLA and accompanying regulations.[38] MMS has extensive experience in regulating development of the offshore and deepwater environment. However, critics of allowing MMS-wide participation on ocean energy development cite its lack of experience beyond oil and gas and its failure to make distinctions between the types of industries (wind, wave, oil, and gas) that an effective legal framework should have.[39] Following passage of the EPAct, MMS adopted an alternative energy program, completed a programmatic environmental impact statement (PEIS) pursuant to the National Environmental Policy Act (NEPA), published a subsequent record of decision (ROD) that identified fifty-two best practices for offshore alternative energy generation, and adopted interim policies for leasing and granting easements and right-of-ways on the OCS for alternative energy.[40] MMS later issued its final rule for renewable energy and alternate uses of existing facilities on the OCS, effective June 29, 2009.[41] These actions are part of a larger program wherein MMS has funded scientific research, collaborated with other federal agencies, and undertaken regional planning for additional infrastructure development on the OCS of the United States.[42]

FERC takes the position, however, that the EPAct did not alter FERC's general authority in the Federal Power Act (FPA)[43] to regulate energy

36 43 U.S.C. §§ 1331–1356a (2006).

37 Energy Policy Act § 388, 119 Stat. at 744 (amending 43 U.S.C. § 1337(p)).

38 NAT'L RESEARCH COUNCIL, ASSESSMENT OF THE U.S. OUTER CONTINENTAL SHELF ENVIRONMENTAL STUDIES PROGRAM: III. SOCIAL AND ECONOMIC STUDIES 12 (1992); *see also* Minerals Mgmt. Serv., U.S. Dep't of the Interior, Answers to Questions About Offshore Oil and Gas, http://www.mms.gov/omm/pacific/offshore/oil-and-gasfaq.htm (last visited Nov. 15, 2009). Several other laws play a role, such as the Coastal Zone Management Act of 1972, 16 U.S.C. §§ 1451–1466 (2006), the National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321–4370f (2006), and the Marine Mammal Protection Act of 1972, 16 U.S.C. §§ 1361–1423h (2006). *See infra* Part IV.B.2.

39 *See, e.g.*, Comments from Sean O'Neill, President, Ocean Renewable Energy Coal., and Carolyn Elefant, Legislative & Regulatory Counsel, Ocean Renewable Energy Coal., to the Minerals Mgmt. Serv., U.S. Dep't of the Interior 7 (May 2007), *available at* http://www.oceanrenewable.com/wp-content/uploads/2008/02/oreccommentsmmseis.doc (regarding MMS's draft Programmatic Environmental Impact Statement for Alternate Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf under Docket No. MMS 2007-010).

40 *See* Record of Decision for the Final Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf, 73 Fed. Reg. 1894 (Jan. 10, 2008); Alternative Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf, 73 Fed. Reg. 39,376 (proposed July 9, 2008) (to be codified at 30 C.F.R. pts. 250, 285, 290).

41 Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf, 74 Fed. Reg. 19,638 (Apr. 29, 2009) (to be codified at 30 C.F.R. pts. 250, 285, 290).

42 *See, e.g.*, Press Release, Minerals Mgmt. Serv., U.S. Dep't of the Interior, MMS Funding Expedition to Study Deepwater Coral Habitats (Aug. 31, 2009), *available at* http://www.gomr.mms.gov/homepg/whatsnew/newsreal/2009/090831.pdf (describing efforts to further understand deepwater coral habitat in order to protect it during oil and gas exploration).

43 16 U.S.C. §§ 791a–828c (2006).

generation projects.[44] FERC has expertise in energy generation, energy markets, and the policies, programs, and concerns that accompany commercial production and distribution of energy.[45] Thus, beyond its perceived authority, the idea of its lead on the issue is based in the realities of the agency's competencies.

FERC's position on its authority to permit and license hydrokinetic projects on the OCS was outlined in an order on rehearing that it issued on October 16, 2008.[46] DOI contested FERC's authority to authorize projects beyond the three nautical mile boundary of state and federal control.[47] While ceding that FERC had authority within the three-mile boundary of state waters and submerged lands, DOI argued that MMS had authority over such projects on the OCS and waters above.[48] FERC identified the sections of the Federal Power Act that provide authority to grant permits and licenses in "navigable waters" and on "reservations."[49] FERC rejected the argument that "navigable waters" was limited to state waters and asserted that the OCS meets the definition of "reservations" in FPA section 3(2) because it is "lands and interests in lands owned by the United States."[50]

FERC has also taken steps to encourage the development of hydrokinetic projects. In recognition of the emerging technology, FERC developed a pilot permit that would allow wave developers up to five years to gather information needed to ensure technical and commercial success of wave energy generation projects.[51] FERC issued a white paper explaining the expedited process for licensing hydrokinetic pilot projects.[52]

The jurisdictional conflict and the constituencies that support authority in one or the other agency reflect a variety of competing interests in offshore development. FERC is promoted as the agency best able to handle energy generation issues and to deal with an emerging industry. MMS, in its extensive dealing with the offshore oil and gas industry, is perceived as a potential bridge between oil and gas technologies and the technology needed to ramp up far offshore wave energy farms. MMS has experience with large development projects occurring offshore, generating billions of dollars, contrasted with FERC, which has relatively more experience with smaller energy projects. There is also a competing vision for wave energy as

44 Energy Policy Act of 2005, 42 U.S.C. § 7172(a) (transferring regulatory authority of ocean energy projects from the Federal Power Commission, which was created by the Federal Power Act, to FERC).

45 *See* Fed. Energy Regulatory Comm'n, What FERC Does, http://www.ferc.gov/about/ferc-does.asp (last visited Nov. 15, 2009).

46 Pac. Gas & Elec. Co., 125 F.E.R.C. ¶ 61,045, at 61,158–64 (2008).

47 *Id.* at 61,158.

48 *Id.*

49 *Id.* at 61,161.

50 *Id.* at 61,159–61; Federal Power Act, 16 U.S.C. § 796(2) (2006).

51 FED. ENERGY REGULATORY COMM'N, LICENSING HYDROKINETIC PILOT PROJECTS 13 (2008), *available at* http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/pdf/white_paper.pdf.

52 *Id.* at 2.

entrepreneurial and sustainable that is challenged with MMS, the agency best known for offshore oil and gas, as the primary governing agency.

2. Confronting Federalism Issues

The battle between federal agencies is not the only jurisdictional complication in siting offshore wave energy facilities. States have title to submerged lands from the shore to three geographical (nautical) miles, necessitating coordination with multiple governmental entities during planning and siting processes.[53] Proposals for wave energy projects offshore of California's Humboldt County are illustrative. Maps made available by the National Oceanic & Atmospheric Administration (NOAA) Digital Coastal Imaging Service show that projects are proposed in multiple areas, two of which straddle the three-mile state-federal boundary.[54] Furthermore, in the future, potential project locations may well cross state borders, involving more than one state in the decision-making process as well.

On that front, regional collaboration is taking shape. California, Oregon, and Washington have, through the West Coast Governors' Agreement on Ocean Health (WCGA), pledged to work together on responsible development of offshore renewable energy.[55] States like Oregon and Washington that are anticipating wave energy development have already entered into MOUs with FERC regarding development of offshore alternative energy or, like California, are working toward such an understanding to facilitate coordination.[56]

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[53] The Submerged Lands Act, 43 U.S.C. §§ 1301–1315 (2006), vests title and ownership in the States to three geographical (nautical) miles in most areas. *Id.* §§ 1301(a)–(b), 1311(a)–(b), 1312. The Outer Continental Shelf Lands Act retained federal ownership of submerged lands beyond the three-mile boundary. 43 U.S.C. § 1331(a) (2006). The boundary has been criticized and extensively analyzed in other works. *E.g.*, M. Benjamin Cowan, *Venue for Offshore Environmental Crimes: The Seaward Limits of the Federal Judicial Districts*, 49 VAND. L. REV. 825, 851–60 (1996); Rachael E. Salcido, *Offshore Federalism and Ocean Industrialization*, 82 TUL. L. REV. 1355, 1368–74 (2008).

[54] Nat'l Oceanic & Atmospheric Admin., Digital Coast in Action: Supporting Wave Energy Development in California, http://www.csc.noaa.gov/digitalcoast/action/marineplanning/waveca.html (last visited Nov. 15, 2009).

[55] CHRISTINE GREGOIRE ET AL., WEST COAST GOVERNORS' AGREEMENT ON OCEAN HEALTH (2006), *available at* http://westcoastoceans.gov/docs/WCOceanAgreementp6.pdf.

[56] Memorandum of Understanding Between the Fed. Energy Regulatory Comm'n and the State of Or. 1–2 (Mar. 26, 2008), *available at* http://www.ferc.gov/legal/maj-ord-reg/mou/mou-or-final.pdf [hereinafter Oregon MOU]; Memorandum of Understanding Between the Fed. Energy Regulatory Comm'n and the State of Wa. 1–2 (June 4, 2009), *available at* http://www.ferc.gov/legal/maj-ord-reg/mou/mou-wa.pdf. Officials of the State of Washington and Oregon have both signed MOUs with FERC that lay out processes to further cooperation and coordination for the siting of wave energy projects in Washington state waters and the Territorial Sea of Oregon respectively. *Id.* at 3; Oregon MOU, *supra*, at 3. California is also negotiating an MOU with FERC on hydrokinetic projects in California state waters. Letter from Brian Baird et al., State Policy Leads, W. Coast Governors' Agreement on Ocean Health, to Nancy Sutley, Chair, Interagency Task Force on Ocean Policy 3 (July 23, 2009), *available at* http://westcoastoceans.gov/docs/090722%20WCGA%20comments%20to%20CEQ_final.pdf.

One example of the controversial nature of the state-federal decision-making process involves an Ocean Power Technologies project proposed for an area offshore Newport, Oregon. As previously noted, FERC signed an MOU with the State of Oregon agreeing to coordinate its process with the State.[57] Thereafter, FERC approved a conditional license to Ocean Power Technologies in an area of prime crab fishing.[58] One explanation for the conflict with this approval and the MOU was that the State of Oregon had yet to finish its planning process for the territorial sea area.[59] The MOU identified the territorial sea planning process as ongoing and stated that FERC would coordinate procedures and review of wave energy projects with the state.[60] However, the state was confronted with difficulty in the designation of marine reserve areas (allowing only minimal human activities), which slowed down the planning process.[61] FERC moved ahead with the application for a preliminary permit, taking both the project proponents and state officials by surprise.[62] The incident is reflective of the context in which wave energy development is occurring. Although there is a perceived urgency to get wave projects going to prove technological feasibility and increase the U.S. supply of noncarbon sources of energy, offshore planning is not sufficiently far along to simply incorporate the projects into the existing plan. Because difficult tradeoffs among uses and users have yet to be resolved, wave energy projects are absorbing the pressure and some observers have voiced concern that they could be squeezed out altogether.

An example of the potential for conflict between states in the siting of offshore facilities involves a liquefied natural gas (LNG) conditional permit issued to British Petroleum for the Crown Point project.[63] The facility received a conditional permit from FERC in 2006, subject to Coastal Zone Management Act (CZMA) certification from Delaware.[64] Pursuant to CZMA, states with enforceable coastal management plans (CMPs) have the opportunity to determine a project's consistency with the enforceable provisions of such federally-approved CMPs.[65] Ultimately, Delaware denied

57 *See* Oregon MOU, *supra* note 56, at 1–3.

58 Susan Chambers, *Wave Energy Worries Fishermen*, WORLD, Apr. 10, 2007, http://www.theworldlink.com/articles/2007/04/10/breaking/tpn01041007.txt (last visited Nov. 15, 2009).

59 Or. Exec. Order No. 08-07 (Mar. 26, 2008), *available at* http://governor.oregon.gov/Gov/docs/executive_orders/eo0807.pdf.

60 Oregon MOU, *supra* note 56, at 1–2.

61 Or. Exec. Order No. 08-07.

62 Susan Chambers, *Feds OK Wave Energy at Newport*, WORLD, Feb. 3, 2009, http://www.theworldlink.com/articles/2009/02/03/news/doc49888bc32a417894263916.txt (last visited Nov. 15, 2009).

63 *See* New Jersey v. Delaware (*New Jersey I*), 128 S. Ct. 1410, 1415–16 (2008).

64 Coastal Zone Management Act of 1972, 16 U.S.C. § 1456(c)(3)(A) (2006); Del. Dep't of Natural Res. & Envtl. Control v. Fed. Energy Regulatory Comm'n, 558 F.3d 575, 577 (D.C. Cir. 2009). A later challenge by Delaware of FERC's conditional licensing authority was rejected on grounds that Delaware lacked standing, in part because FERC acknowledged that Delaware had power to block the project, so there was no injury in fact. *Id.* at 577, 579.

65 16 U.S.C. § 1456(c)(3)(A) (2006).

the certification.[66] The State of New Jersey contested Delaware's jurisdiction over the project, which originates in New Jersey.[67] The issue was determined by a special master and ultimately reached the Supreme Court.[68] The Court ruled that a 1905 compact between New Jersey and Delaware gave Delaware the power to block the project.[69] Although this conflict arose in a different legal context, it illustrates how a lack of consensus by adjacent states on acceptable risk-benefit calculations can stall energy projects.

3. Addressing Environmental Concerns

Although the body of knowledge is limited, existing studies project that there will be some impacts from wave energy devices in the near shore environment.[70] Depending on the technology used, the marine environment and its inhabitants may suffer negative impacts along the whole water column.[71] Concern has been focused on both pelagic (open water) and benthic (bottom dwelling) species, marine mammals, and marine birds.[72]

There is no lack of federal laws that may be implicated by wave energy projects. The CZMA, the Clean Water Act (CWA),[73] the Endangered Species Act (ESA),[74] the Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Fishery Conservation and Management Act,[75] the Marine Mammal Protection Act (MMPA), the Migratory Bird Treaty Act (MBTA),[76] and the National Environmental Policy Act (NEPA) may all play a role. There are species of fish, reptiles, birds, and mammals listed under these federal laws and various state counterparts that will be potentially impacted by wave energy projects depending on the proposed location, and will need to be specifically addressed in research and environmental impact studies.

Both MMS and FERC regulatory processes contemplate the study of significant environmental impacts, which is likely to be encompassed in an

66 *Del. Dep't of Natural Res. & Envtl. Control*, 558 F.3d at 577.

67 *New Jersey I*, 128 S. Ct. at 1415–16.

68 *Id.* at 1419.

69 *Id.* at 1427 (holding that the 1905 compact did not give New Jersey exclusive jurisdiction to all riparian improvements originating on its shores). The project extended some 2000 feet from the New Jersey shoreline into territory that was adjudicated in *New Jersey v. Delaware* (*New Jersey II*), 291 U.S. 361, 363, 378 (1934), to be that of Delaware. *New Jersey I*, 128 S. Ct. at 1415.

70 NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 21, at 15, 18–19; *see also* Michelle Ma, *Concerns Emerge About Environmental Effects of Wave-Energy Technology*, SEATTLE TIMES, Nov. 17, 2008, http://seattletimes.nwsource.com/html/localnews/2008399727_oceanenergy17m.html (last visited Nov. 15, 2009) (discussing the possible environmental effects of wave technology).

71 GREGORY MCMURRAY, OR. DEP'T OF LAND CONSERVATION & DEV., WAVE ENERGY ECOLOGICAL EFFECTS WORKSHOP: ECOLOGICAL ASSESSMENT BRIEFING PAPER 41–44 (2007), *available at* http://hmsc.oregonstate.edu/waveenergy/WaveEnergyEffectsBriefingPaper.pdf.

72 NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 21, at vi.

73 Federal Water Pollution Control Act of 1972, 33 U.S.C. §§ 1251–1387 (2006).

74 Endangered Species Act of 1973, 16 U.S.C. §§ 1531–1544 (2006).

75 16 U.S.C. §§ 1801–1883 (2006).

76 16 U.S.C. §§ 703–712 (2006).

environmental impact statement (EIS) pursuant to NEPA.[77] A coordinated environmental review is likely to provide the opportunity for expedited project approvals, but maintain the needed input from the public on the potentially significant environmental impacts. That said, given the state of existing knowledge, one may still be skeptical about the degree of certainty that will accompany even a most thorough review of the best available scientific information applicable.

In light of the situation, where concern for environmental impacts has been emphasized by the public and project developers have acknowledged the need for minimizing environmental harm,[78] in April 2008, FERC made available a white paper on licensing hydrokinetic pilot projects.[79] FERC's objective in developing this program was to encourage the commercialization of wave energy technology.[80] Many of the ways FERC anticipates addressing concerns about potential environmental impacts are detailed in the white paper. The core principle at work appears to be keeping the pilot project nimble:

> [W]e believe this class of project may be able to be carried out with little risk to public safety and the environment if the projects are (1) short term; (2) small; (3) can be quickly modified, shut-down, or removed if significant, unforeseen risks to public safety or adverse environmental impacts occur; (4) are not located in areas designated as sensitive by the Commission; and (5) are removed, with the site restored, before the end of the license term. Under these conditions, the risks to the environment will be minimal, while the rewards from testing the technology and understanding interactions with the environment could be substantial.[81]

As FERC has emphasized, it seems clear that pilot projects will be essential to evaluating the promise of wave energy. At this time there is limited research available on the environmental impacts of wave energy technology.[82] Despite a variety of laws addressing water quality, species protection, and marine habitat preservation, there is little guarantee that simply the existence of a multiplicity of laws will prevent degradation of the marine environment.[83] The most promising aspect of the emerging industry and the regulatory structure established to date is the continued focus on

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77 *E.g.*, Federal Power Act, 16 U.S.C. § 797(e) (2006); Minerals Mgmt. Serv., U.S. Dep't of the Interior, About the Minerals Management Service, http://www.mms.gov/aboutmms/OCSLA/ocslahistory.htm (last visited Nov. 15, 2009).

78 *See* STERNE ET AL., *supra* note 18, at 3.

79 FED. ENERGY REGULATORY COMM'N, *supra* note 51.

80 *Id.* at 2–3.

81 *Id.* at 8 (footnote omitted).

82 *See infra* Part IV.B.1. See H.T. HARVEY & ASSOC., PIER FINAL PROJECT REPORT: DEVELOPING WAVE ENERGY IN COASTAL CALIFORNIA: POTENTIAL SOCIO-ECONOMIC AND ENVIRONMENTAL EFFECTS (2008), for an in-depth discussion beyond the overview of potential impacts discussed here. *See also* NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 21 (discussing the ecological impacts of wave energy).

83 John Charles Kunich, *Losing NEMO: The Mass Extinction Now Threatening the World's Ocean Hotspots*, 30 COLUM. J. ENVTL. L. 1, 2–4 (2005).

data gaps, uncertainty, and conceded importance of environmental protection that must be part of wave energy development.[84]

4. Offshore Mapping, Zoning, and Planning Efforts

Perhaps the greatest challenge is moving forward quickly with marine renewable energy at a time when mapping, zoning, and planning efforts are still taking shape. Again, it is important to emphasize that prioritization among ocean uses and users is ongoing. It is inevitable that not all activities can be undertaken, some locations will be best suited to one or more uses or nonuse, and existing uses will be challenging to displace.

NOAA and the United States Geological Survey (USGS) have been working on identifying physical features of the seabed since the 1980s following the proclamation of a 200 nautical mile Exclusive Economic Zone (EEZ) by the President in 1983.[85] The Marine Board of the National Academy of Sciences (NAS) noted, "The foundation of wise policies for long-term management of the seabed and its resources is an understanding of its geologic, biologic, chemical, and physical characteristics."[86] Since then, planning for uses of the EEZ has been a research priority enunciated by NAS, and similar recommendations for marine spatial planning and improved governance resulted from studies by the Pew Oceans Commission in 2003[87] and the U.S. Commission on Ocean Policy in 2004.[88]

Despite this, progress on planning for development of the EEZ has been occurring at a snail's pace. More recently, a directive for planning uses of the EEZ was contained in the EPAct, where Congress authorized MMS to undertake development of an alternative energy program for the OCS.[89] NOAA and MMS, working together, have gathered data on the physical characteristics of the U.S. EEZ for potential users. Their work culminated in a database that is now available to the public. Interested members of the public can access the U.S. marine cadastre to identify the jurisdictional boundaries, existing uses of various parts of the ocean, and existing marine reserves.[90]

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84 *See* STERNE ET AL., *supra* note 18 (outlining principles to guide ocean wave energy development).

85 MARINE BD., NAT'L RESEARCH COUNCIL, WORKING TOGETHER IN THE EEZ: FINAL REPORT OF THE COMMITTEE ON EXCLUSIVE ECONOMIC ZONE INFORMATION NEEDS, at v (1992).

86 *Id.*

87 PEW OCEANS COMM'N, AMERICA'S LIVING OCEANS: CHARTING A COURSE FOR SEA CHANGE 33–34 (2003), *available at* http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Protecting_ocean_life/env_pew_oceans_final_report.pdf.

88 U.S. COMM'N ON OCEAN POLICY, AN OCEAN BLUEPRINT FOR THE 21ST CENTURY: FINAL REPORT 9–10 (2004), *available at* http://oceancommission.gov/documents/full_color_rpt/000_ocean_full_report.pdf [hereinafter BLUEPRINT].

89 Energy Policy Act of 2005, Pub. L. 109-58, § 388, 119 Stat. 594, 744–47 (2005) (codified at 43 U.S.C. § 1337(p) (2006)); *see also* Press Release, Minerals Mgmt. Serv., U.S. Dep't of the Interior, MMS Proposes Offshore Alternative Energy and Alternate Use Regulations (July 8, 2008), http://www.mms.gov/ooc/press/2008/press0708.htm (last visited Nov. 15, 2009).

90 Fed. Geographic Data Comm. Marine Boundary Working Group, Nat'l Oceanic & Atmospheric Admin., The U.S. Marine Cadastre, http://www.csc.noaa.gov/mbwg/htm/cadastre.htm

A recent press release by NOAA regarding the mapping of the seafloor along Oregon's coast emphasizes the benefits of detailed maps and increased knowledge of the sea and seabed habitats.[91] These include identifying potential danger from tsunamis, locations for alternative energy projects, and important habitat areas. Sites identified as potential wave energy locations or marine reserves will be prioritized for immediate study, generating the information necessary to successfully plan for sustainable development offshore.[92]

Marine spatial planning, managed by U.S. governmental entities, provides a way for integrating conservation measures throughout the entire ocean environment. President Obama recently directed a task force to develop a recommended framework for coastal and marine spatial planning.[93] While states have developed coastal zone management plans pursuant to the CZMA, such plans are not required to be detailed zoning plans.[94] That said, some states have made significant progress toward marine spatial planning, including Oregon's territorial sea zoning efforts[95] and the implementation of California's Marine Life Protection Act[96] and related laws.[97] Important to the future of sustaining healthy oceans is the overlay of ecosystem-based planning efforts, focused on managing integrated parts of ocean ecosystems in a way that our current sectoral governing efforts (e.g., focus on waste in one law, water quality in another, and species protection separate from those) have failed to achieve adequate stewardship.

(last visited Nov. 15, 2009). The MMS also has an explanation of the mapping project and a link to the cadastre available. Minerals Mgmt. Serv., U.S. Dep't of the Interior, Multipurpose Marine Cadastre Viewer, http://www.mms.gov/offshore/mapping/Viewer.htm (last visited Nov. 15, 2009).

91 Press Release, Nat'l Oceanic & Atmospheric Admin., NOAA and Oregon State University Map Oregon's Seafloor (Aug. 12, 2009), http://www.noaanews.noaa.gov/stories2009/20090812_oregon.html (last visited Nov. 15, 2009).

92 *Id.*

93 Memorandum on National Policy for the Oceans, Our Coasts, and the Great Lakes, 74 Fed. Reg. 28,591, 28,592 (June 17, 2009).

94 *See, e.g.*, Am. Petroleum Inst. v. Knecht, 456 F. Supp. 889, 919 (C.D. Cal. 1978) (holding that the California coastal plan need not contain elaborate detailed criteria under the CZMA, but rather must only contain standards of specificity to guide public and private uses), *aff'd*, 609 F.2d 1306 (9th Cir. 1979). The Ninth Circuit determined that the plan had to provide a framework for balancing competing interests and provide guidance to private users. Am. Petroleum Inst., 609 F.2d at 1312, 1314. Since this time, the pressure to site offshore facilities has increased. *See, e.g.*, Salcido, *supra* note 53, at 1359–68 (highlighting several examples of recent offshore development projects in concluding that the "industrialization of the oceans is fully upon us").

95 *See, e.g.*, Or. Exec. Order No. 08-07 (Mar. 26, 2008), *available at* http://governor.oregon.gov/Gov/docs/executive_orders/eo0807.pdf.

96 Marine Life Protection Act, CAL. FISH & GAME CODE §§ 2850–2863 (West Supp. 2009).

97 *See, e.g.*, Brian E. Baird & Amber J. Mace, *Regional Ocean Governance: A Look at California*, 16 DUKE ENVTL. L. & POL'Y F. 217, 220–21 (2006).

III. INTELLECTUAL PROPERTY CONFRONTS THE OBLIGATION TO SHARE RESEARCH

A. Background on Research, Development, and Intellectual Property for Wave Energy

The potential benefits of using wave energy will not become a reality unless significant research support is provided to further the technology, as well as to identify potential environmental impacts and ways to mitigate those impacts. Repeated calls for increased government funding of general ocean research and funding specifically for research on marine alternative energy projects have made only limited progress.[98]

A fundamental challenge of developing sustainable energy offshore is that we lack baseline ocean ecosystem data. Many have suggested that government entities need to coordinate research efforts and compile research data on impacts and baseline conditions.[99] Much of that emphasis is to hasten the development of wave and other renewable energy technologies, as it is a way to reduce the costs and efforts of developers.[100]

With the EPAct, Congress indicated that offshore energy development was in need of research funding. The Energy Independence and Security Act (EISA)[101] was signed into law by President Bush in 2007.[102] This Act authorized the Department of Energy (DOE) to develop a program for furthering hydrokinetic energy development.[103] DOE has yet to sufficiently fund research endeavors, and many groups are calling on the government to fulfill its promise of research support.[104] However, significant progress was

98 Both the U.S. Commission on Ocean Policy and the Pew Oceans Commission reports emphasize the need for increased funding of ocean research. *See* BLUEPRINT, *supra* note 88, at 11; *see also* PEW OCEANS COMM'N, *supra* note 87, at 89. Some of the calls for increased funding of research stem from the belief that technology is the key to an effective climate change policy. *See, e.g.*, Daniel Van Fleet, *Legal Approaches to Promote Technological Solutions to Climate Change*, 2008 DUKE L. & TECH. REV. 8, ¶ 1 (2008), *available at* http://www.law.duke.edu/journals/dltr/articles/pdf/2008dltr0008.pdf (providing a taxonomy of potential approaches to spurring technology to combat climate change and noting that "many experts are calling for a major, government-sponsored scientific effort").

99 *See, e.g.*, STERNE ET AL., *supra* note 18, at 6.

100 *Id.* at 6–7.

101 Energy Independence and Security Act of 2007, 42 U.S.C. §§ 17001–17386 (Supp. I 2007).

102 Library of Cong., THOMAS, H.R. 6: All Actions, http://thomas.loc.gov/cgi-bin/bdquery/z?d110:HR00006:@@@X (last visited Nov. 15, 2009). The Act authorized $250 million for research and development and commercialization for hydrokinetic projects, with $50 million per year for the 5 years between 2008 and 2012. *See* 42 U.S.C. § 17215 (Supp. I 2007).

103 42 U.S.C. § 17212 (Supp. I 2007).

104 *See, e.g.*, OCEAN RENEWABLE ENERGY COAL., THE CASE FOR SIGNIFICANT AND SUSTAINED OCEAN RENEWABLE FUNDING 1 (2009), *available at* http://www.energycentral.com/download/products/case-for-funding_feb_2009.pdf (urging increased funding and noting that "[t]he most important Research and Development needs of this industry involve getting projects into the water and conducting environmental monitoring and testing"). The Ocean Renewable Energy Coalition encourages ocean renewable research funding from EISA and the American Recovery and Reinvestment Act of 2009 (which authorized $6 billion for renewable energy and electric transmission technologies). *Id.* at 4; American Recovery and Reinvestment Act of 2009, Pub. L. 111-5, § 406, 123 Stat. 115, 140, 145.

made in September 2008 when DOE announced the recipients of upwards of $7 billion in its competitive grant process.[105] The areas of grant funding included technology development (industry-led partnerships to develop or test technologies), market acceleration (market penetration and commercialization), and establishing National Marine Energy Centers where research will be conducted.[106] A production tax credit (PTC) of 1.5 cents per kilowatt hour for marine renewable projects coming online between October 3, 2008, and December 31, 2011, was authorized by the Energy Improvement and Extension Act of 2008.[107]

Commentators have compared the current climate of offshore energy technology development to the "wild west."[108] A multitude of entrepreneurs are engaged in research and development of wave capture and energy generation technology.[109] Coordination of research is an area that could be improved. As the technology is in a nascent stage, we expect to see much trial and error, although already many patents have been issued and further applications have been filed for wave energy technology.[110]

B. Theories: Incentives, Efficiency, and the Scientific Process

In a race to be the first to perfect a technology, individual researchers have an incentive to safeguard their results—good and bad. However, this can lead to lost opportunities to move the technology forward if similar mistakes could be avoided by others. As the U.S. government approves pilot

105 *See* Press Release, U.S. Dep't of Energy, DOE Selects Projects for Up to $7.3 Million for R&D Clean Technology Water Power Projects (Sept. 18, 2008), http://www.energy.gov/news/6554.htm (last visited Nov. 15, 2009).

106 *Id.*

107 Energy Improvement and Extension Act of 2008, 26 U.S.C.A. § 45(a), (c)(1), (c)(10) (West Supp. 2009). Notably, this does not put marine renewables in fair competition with other renewables, such as wind, geothermal, or some biomass facilities, which receive a credit of 2.1 cents per kilowatt hour. N.C. Solar Ctr. et al., Database of State Incentives for Renewables & Efficiency: Renewable Electricity Production Tax Credit (PTC), http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US13F (last visited Nov. 15, 2009).

108 *Energy Development on the Outer Continental Shelf and the Future of Our Oceans: Joint Oversight Hearing Before the Subcomm. on Energy and Mineral Resources and the Subcomm. on Insular Affairs, Oceans and Wildlife of the H. Comm. on Natural Resources*, 111th Cong. 33 (Mar. 24, 2009) (prepared statement of Thomas Kitsos, Consultant, The Joint Ocean Commission Initiative); *Offshore Hydrocarbon Production: Hearing Before the S. Comm. on Energy and Natural Resources*, 109th Cong. 66 (Apr. 19, 2005) (prepared statement of Scott A. Angelle, Secretary, Louisiana Department of Natural Resources).

109 *See, e.g.*, ROGER BEDARD, ELEC. POWER RESEARCH INST., OVERVIEW: EPRI OCEAN ENERGY PROGRAM 19, 21 (2006), *available at* http://oceanenergy.epri.com/attachments/ocean/reports/EWTEC_Bedard_Sep_11.pdf (discussing research and development of various types of ocean and wave technology).

110 See Press Release, Heslin Rothenberg Farley & Mesiti P.C., Heslin Rothenberg Farley & Mesiti P.C. Announces Clean Energy Patent Growth Index Results Through 2nd Quarter 2009: CEPGI Hits Record High (Aug. 20, 2009), *available at* http://www.hrfmlaw.com/img/articles/article_575647.pdf, for an example of a quarterly publication tracking the number of patents issued for alternative energy technologies generally, and wave energy specifically.

demonstration projects, we will obtain data about the environment and the types of technology that might be best adapted to particular ocean conditions. Much of that needed information must remain in the public domain to inform future development projects.

Many in the clean energy business emphasize the importance of patent protection for innovation, particularly to start-up and small companies.[111] One scholar notes that "a debate has begun in the biotechnology, pharmaceutical, semiconductor, and software industries over the role of intellectual property in innovation, but such a controversy has all but been ignored by the energy policy literature."[112] Some advocates, both political and judicial, urge refinement of the patent laws without loss of the incentives to risk significant time, effort, and capital on emerging technologies, particularly clean technologies.[113] On the other hand, critics argue that more open research systems provide greater likelihood of technology advancement.[114] The critics emphasize that the scientific process works best when researchers publish their findings so that knowledge can be built on.[115] At bottom, the divergence is focused upon what balance should be struck between the public domain and property rights.

C. Sharing Information and Retaining Incentives

While the multiple legislative efforts providing funding and competitive tax treatment for renewable energy generation are steps forward, the most promising step has been the creation of National Marine Energy Centers, government-funded academic research institutions.[116] When Oregon State University secured a five-year, $1.25 million per year federal grant for wave energy research, commentators noted that the marine renewables center would "help bridge the gap between university research and commercial

111 Press Release, U.S. Chamber of Commerce, U.S. Chamber Joins IDEA Coalition to Protect IP Jobs (May 20, 2009), http://www.uschamber.com/press/releases/2009/may/090520_idea.htm (last visited Nov. 15, 2009) (announcing launch of the Innovation, Development, and Employment Alliance (IDEA)). Organizations promoting strong intellectual property protection include Microsoft, Sun Solar, and General Motors. *See generally* RODGER A. SADLER ET AL., ORRICK, IP STRATEGIES FOR A CLEAN ENERGY ECONOMY (2009), *available at* http://www.orrick.com/fileupload/2070.pdf.

112 Benjamin K. Sovacool, *Placing a Glove on the Invisible Hand: How Intellectual Property Rights May Impede Innovation in Energy Research and Development (R&D)*, 18 ALB. L.J. SCI. & TECH. 381, 384 (2008) (evaluating the relationship between innovation and intellectual property rights).

113 *See* Thomas C. Feeney & Andrew M. Grossman, *Patent Proposal Puts Property and Innovation at Risk* (The Heritage Found., Legal Memorandum No. 40, 2009), *available at* http://www.heritage.org/Research/LegalIssues/upload/lm_40.pdf.

114 *See, e.g.*, Sovacool, *supra* note 112, at 426–27.

115 *Id.*

116 *See* Press Release, U.S. Dep't of Energy, DOE Selects Projects for Up to $7.3 Million for R&D Clean Technology Water Power Projects (Sept. 18, 2008), http://www.energy.gov/news/6554.htm (last visited Nov. 15, 2009).

development."[117] The Northwest National Marine Renewable Energy Center (NNMREC) is only one of two research centers that have received significant funding for wave energy, with a center in Honolulu, Hawaii, being the other.[118] The NNMREC is a partnership between the University of Washington and Oregon State University.[119] Oregon State University is taking the lead on research for wave technology.[120]

Consideration should be given to models of research coordination and property rights sharing that also provide incentives for innovation.[121] We are not limited to domestic examples, as the interest in alternative energy systems is global. For example, the International Energy Agency (IEA) is an intergovernmental agency that advises its member countries on energy policy, including technology issues and best practices.[122] The IEA has an implementing agreement focused on ocean energy systems, reflecting the collaboration of countries toward the goal of bringing ocean energy onto the grid in a near-term timeframe.[123]

D. Conclusion

If the goal is to get wave energy to grid quickly, then the priorities are well understood to be increasing research, development, and deployment financing and getting projects into the water for demonstration. National Marine Energy Centers funded by government grants are well suited to spearhead the basic research needed to make wave energy a reliable contribution to a greener grid. These research centers can assist specifically in determining if wave energy is "green" energy by serving as an unbiased source of basic scientific research.

The government, and thus the public, is funding a significant amount of the research and development in wave energy.[124] Some recognition of the subsidy is required, particularly if more money is allocated by the government toward this industry. Moreover, the public has come to expect a

117 Len Reed, *U.S. Backs OSU's Wave-Energy Efforts with $6 Million*, OREGONIAN, Sept. 18, 2008, http://www.oregonlive.com/news/index.ssf/2008/09/us_backs_osus_waveenergy_devel.html (last visited Nov. 15, 2009) (quoting Stephanie Thornton, Executive Director of Oregon Wave Energy Trust).

118 *See* Press Release, Senator Daniel Kahikina Akaka, $5 Million Federal Grant to Establish National Marine Renewable Energy Center in Hawaii (Sept. 18, 2008), *available at* http://www.hnei.hawaii.edu/docs/announcements/2008/Akaka_PressRelease_Award.pdf.

119 *See generally* Nw. Nat'l Marine Renewable Energy Ctr., About the Center, http://depts.washington.edu/nnmrec/about.html (last visited Nov. 15, 2009.

120 *Id.*

121 See Robert P. Merges, *Contracting into Liability Rules: Intellectual Property Rights and Collective Rights Organizations*, 84 CAL. L. REV. 1293, 1301–27 (1996), for an excellent overview of the issues and discussion of rights-sharing organizations.

122 *See* Int'l Energy Agency, About the IEA, http://www.iea.org/about/index.asp (last visited Nov. 15, 2009).

123 *See* Int'l Energy Agency, Ocean Energy Systems Implementing Agreement Site, http://www.iea-oceans.org (last visited Nov. 15, 2009).

124 *See supra* notes 101–07 and accompanying text.

return on private use of public resources offshore.[125] One way this will likely be accomplished is by lease payments and requiring an adequate royalty amount from profits generated by using public resources. Thus, a private company would make money by using public resource (waves), but public trust principles would support the government as trustee seeking rents from the use of the resource. A royalty payment may be very small in the initial stages, but will increase as a profit margin emerges. FERC and MMS contemplate a royalty scheme that is fair for the public, but does not unduly impede the development of wave energy by posing an unreasonable burden on an emerging industry.[126]

IV. FROM FREEDOM AND COMMON HERITAGE TO INDIVIDUALIZING OCEAN SPACE

A. Historical Development of Domestic and International Management Paradigms

The traditional notion of the freedom of the seas emphasized that all members of the public had rights to ocean resources that should be recognized.[127] Hugo Grotius championed the view that the seas must be free for navigation and fishing,[128] a view which ultimately prevailed over rival arguments articulated by John Selden, then British scholar and diplomat, that countries could control ocean territories to the extent of their military strength.[129] Originating in a seventeenth-century dispute over commerce, the freedom of the seas concept still holds today, if much hemmed in by the introduction of an Exclusive Economic Zone of 200 nautical miles as agreed by many nations in the third United Nations Convention on the Law of the Sea (UNCLOS).[130]

In contrast, the concept of managing certain marine natural resources pursuant to the view that they are the common heritage of mankind emphasizes interconnectedness and seeks to address the problem of

125 U.S. COMM'N ON OCEAN POL'Y, PRELIMINARY REPORT 66 (2004), *available at* http://oceancommission.gov/documents/prelimreport/00_complete_prelim_report.pdf.

126 *See, e.g.*, Alternative Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf, 73 Fed. Reg. 39,376, 39,380 (proposed July 9, 2008) (to be codified at 30 C.F.R. pts. 250, 285, 290) (noting that MMS does not anticipate that the royalty scheme will "deter investment in a meaningful number of otherwise, prospective alternative energy projects"); MINERALS MGMT. SERV. & FED. ENERGY REGULATORY COMM'N, MMS / FERC GUIDANCE DOCUMENT ON REGULATION OF HYDROKINETIC ENERGY PROJECTS ON THE OCS 10 (2009), *available at* http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/pdf/mms080309.pdf.

127 *See* HUGO GROTIUS, MARE LIBERUM 8 (James Brown Scott ed., Ralph van Deman Magoffin trans., Oxford Univ. Press 1916) (1633).

128 *Id.*

129 *See* JOHN SELDEN, OF THE DOMINION, OR, OWNERSHIP OF THE SEA 21 (Marchamont Nedham trans., Lawbook Exchange, Ltd. 2004) (1652).

130 United Nations Convention on the Law of the Sea art. 57, Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter UNCLOS]. Although the United States did not ratify UNCLOS, in 1988 President Reagan declared that the U.S. territorial sea would be extended from three nautical miles to 12 nautical miles. Proclamation No. 5030, 3 C.F.R. 22 (1984), *reprinted in* 16 U.S.C. § 1453 (1988).

overutilizing ocean resources.[131] In UNCLOS, the doctrine applies to address the nonliving resources of the deep seabed beyond the national jurisdiction of individual sovereign nations.[132] It is argued that using the common heritage concept promotes holistic ocean management.[133] At a minimum, the prevailing view that the oceans contain limitless resources must be eliminated if there is any hope of conserving the living resources of the ocean such as fish, marine mammals, and marine birds. Scholar Jon Van Dyke, in identifying the responsibility to share in the twenty-first century, states bluntly that "[t]he world's common resources must be shared if they are to be exploited at all."[134] Although these two doctrines largely apply to the way the United States manages ocean resources in harmony with international law, they tell us much about the vision of ocean governance emerging from disputes over exploitation of marine resources and how they can be adopted to conserve and protect marine resources.

In the United States, the public trust doctrine has been used by states to steward tidelands and navigable waters for public benefit.[135] The concept is traced to Roman law, which decreed certain things, such as air and the running sea, as beyond the power of the government to abdicate to private interests.[136] Similar to the common heritage sharing regime promoted on the international level for deep seabed resources and holistic ocean management more generally, the public trust doctrine is increasingly promoted as an absolute necessity for stewarding ocean resources that are under the management and jurisdiction of the federal government on the OCS.[137] In parallel with traditional trust concepts, the government should not squander the body of the trust to seek profit.

The greatest weakness in hanging hopes for marine ecosystem repair and conservation on the public trust peg, and one that must be confronted, is that the doctrine emphasizes use,[138] thus at worst conflicting with more aggressive tools such as no-take marine reserves to conserve marine biodiversity, and at best supporting conservation measures without prioritizing those above other competing interests. The seminal public trust case, *Illinois Central Railroad Co. v. Illinois*,[139] emphasized the state

131 Jon M. Van Dyke, *Sharing Ocean Resources — In a Time of Scarcity and Selfishness*, *in* LAW OF THE SEA: THE COMMON HERITAGE AND EMERGING CHALLENGES 3, 4–5 (Harry N. Scheiber ed., 2000).

132 UNCLOS, *supra* note 130, art. 137.

133 YOSHIFUMI TANAKA, A DUAL APPROACH TO OCEAN GOVERNANCE: THE CASES OF ZONAL AND INTEGRATED MANAGEMENT IN INTERNATIONAL LAW OF THE SEA 13–15 (Alex Conte ed., 2008).

134 Van Dyke, *supra* note 131, at 35.

135 *See* Allan Kanner, *The Public Trust Doctrine,* Parens Patriae*, and the Attorney General as the Guardian of the State's Natural Resources*, 16 DUKE ENVTL. L. & POL'Y F. 57, 61–62, 76 (2005); Gail Osherenko, *New Discourses on Ocean Governance: Understanding Property Rights and the Public Trust*, 21 J. ENVTL. L. & LITIG. 317, 369–70 (2006).

136 Kanner, *supra* note 135, at 62–63.

137 Mary Turnipseed et al., *Legal Bedrock for Rebuilding America's Ocean Ecosystems*, 324 SCI. 183, 183 (2009).

138 Donna R. Christie, *Marine Reserves, The Public Trust Doctrine and Intergenerational Equity*, 19 J. LAND USE & ENVTL. L. 427, 432 (2004).

139 146 U.S. 387 (1892).

government's inability to alienate lands protected by the public trust.[140] Only in more recent cases, such as *National Audubon Society v. Superior Court*[141] and *Marks v. Whitney*,[142] is the public trust doctrine used to promote goals such as recreation and conservation. While the proactive use of the public trust doctrine in *National Audubon Society* illustrates that courts may compel public trust managers to balance a perceived over allocation of trust resources toward private rather than public benefits,[143] the doctrine itself expresses no preference among public trust uses (including fishing and navigation), eschewing a strict hierarchy.[144] As it has been noted elsewhere, the most traditional recognized public trust uses, fishing and navigation, can be extremely destructive to the environment.[145] In fact, it has proven most difficult to displace well-entrenched fishing interests when confronted with proposals for managing marine areas with limitations on fishing gear and related regulatory measures such as catch limits.[146]

A public trust *for the oceans* extends the idea that the government has a fiduciary responsibility to its citizens to manage the oceans for public benefit. U.S. laws addressing ocean resources, both living and nonliving, emphasize the responsibility to manage those resources for the public benefit.[147] Although in text and arguably in spirit such statutes were designed to protect the environment from overutilization and negative human impacts, their success has been quite limited. A broad spectrum of ocean experts are advocating for the formal adoption of the public trust doctrine on the OCS to encourage rational ecosystem management goals across political boundaries.[148] Other experts, such as Coastal State Organization executive director Kristyn Fletcher, point out that the doctrine can serve as

140 *Id.* at 455.

141 658 P.2d 709, 727–28 (Cal. 1983) (indicating that the Supreme Court of California required re-evaluation of the water allocation to balance conservation of natural resources and public trust uses); *see also* Gregory S. Weber, *Articulating the Public Trust: Text, Near-Text and Context*, 27 ARIZ. ST. L.J. 1155, 1155 (1995).

142 491 P.2d 374, 380 (Cal. 1971) (recognizing that the public trust was a doctrine inherently flexible to accommodate changing public needs).

143 *Nat'l Audubon Soc'y*, 658 P.2d at 727–28.

144 Christie, *supra* note 138, at 432.

145 J.B. Ruhl & James Salzman, *Ecosystem Services and the Public Trust Doctrine: Working Change from Within*, 15 SE. ENVTL. L.J. 223, 226 (2006) ("[E]ven the core trust uses, such as fishing and navigation, can present significant risks to ecological resources.").

146 *See* Christie, *supra* note 138, at 427.

147 *See, e.g.*, Outer Continental Shelf Lands Act, 43 U.S.C. § 1332(3) (2006) ("[T]he outer Continental Shelf is a vital national resource reserve held by the Federal Government for the public, which should be made available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs."); Coastal Zone Management Act of 1972, 16 U.S.C. § 1452 (2006) ("[I]t is the national policy . . . to preserve, protect, develop, and where possible, to restore or enhance, the resources of the Nation's coastal zone for this and succeeding generations.").

148 *See, e.g.*, Mary Turnipseed et al., *The Silver Anniversary of the United States' Exclusive Economic Zone: Twenty-Five Years of Ocean Use and Abuse, and The Possibility of a Blue Water Public Trust Doctrine*, 36 ECOLOGY L.Q. 1, 2, 9 (2009) (arguing application of the public trust doctrine would lead reform of fragmented offshore management).

a unifying incentive in the promotion of cooperation in regional ocean governance, as "the similarities between the states' public trust resources are more significant than the subtle (and sometimes not so subtle) differences between state doctrines."[149] Indeed, some would contend a federal public trust doctrine already applies to the EEZ.[150]

What would it mean to recognize that the oceans are a special kind of property—property that is subject to the public trust? We have long recognized the relationship between possession and property rights.[151] Even pursuant to the public trust doctrine, states have issued leases and bestowed other limited property interests (nonpossessory) to private individuals for improvements within areas covered by the trust, such as outfall leases for power plants discharging water to the oceans, wharves for commerce or other industrial activity, and marine oil terminals bringing crude oil to refining locations onshore.[152]

In fact, offshore oil drilling is one example of how the government uses limited possessory interests to further national goals—the extraction of oil and gas from the OCS, pursuant to the Outer Continental Shelf Lands Act, through an area leasing system. Similarly, the Minerals Management Service proposes to use leases, easements and rights-of-way to facilitate alternative energy development, as authorized by section 388 of the EPAct.[153] The MMS final rulemaking, while recognizing the role of other agencies in offshore energy projects, asserts that it "possesses the exclusive authority to issue leases, easements, and rights-of-way for renewable energy projects on the OCS."[154] It further asserts that "no FERC license or exemption for hydrokinetic projects on the OCS shall be issued before MMS issues a lease, easement, or right-of-way."[155]

It becomes evident that the concern is not only that property interests (although limited in scope and duration, such as with MMS limited leases)[156]

149 Kristen M. Fletcher, *Regional Ocean Governance: The Role of the Public Trust Doctrine*, 16 DUKE ENVTL. L. & POL'Y F. 187, 199–200 (2006) (noting that "[i]t is the nature of this specific land, not who manages the land, which makes it subject to the Public Trust" to emphasize this point (internal quotation marks omitted) (quoting Kelly McGrath, *The Feasibility of Using Zoning in the EEZ*, 11 BUFF. ENVTL. L.J. 183, 191 (2004)).

150 Stephen E. Roady, *The Public Trust Doctrine*, *in* OCEAN AND COASTAL LAW AND POLICY 39, 57–58 (Donald C. Baur et al. eds., 2008).

151 Richard A. Epstein, *Possession as the Root of Title*, 13 GA. L. REV. 1221, 1221 (1979).

152 *See generally* Richard J. Lazarus, *Changing Conceptions of Property and Sovereignty in Natural Resources: Questioning the Public Trust Doctrine*, 71 IOWA L. REV. 631, 641 (1986) (describing the expansion of public trust principles to permit uses promoting economic development); Carstens v. Cal. Coastal Comm'n, 227 Cal. Rptr. 135, 143 (Cal. Ct. App. 1986) (noting, while upholding the issuance of a permit for a power plant, several instances where California courts sanctioned commercial coastal development under the public trust doctrine).

153 Energy Policy Act of 2005, 43 U.S.C. § 1337(p)(1) (2006).

154 Renewable Energy and Alternative Uses of Existing Facilities on the Outer Continental Shelf, 74 Fed. Reg. 19,638, 19,638 (Apr. 29, 2009) (to be codified at 30 C.F.R. pts. 250, 285, 290).

155 *Id.*

156 MINERALS MGMT. SERV., U.S. DEP'T OF THE INTERIOR, GUIDELINES FOR THE MINERALS MANAGEMENT SERVICE RENEWABLE ENERGY FRAMEWORK 15 (2009), *available at* http://www.mms.gov/offshore/RenewableEnergy/PDFs/REnGuidebook_03August2009_3_.pdf.

are at all conveyed to private parties, but that the identity of the recipient of such interests, and the way the rights that are granted are used, is of utmost importance to the maintenance of the public trust. Both the public trust doctrine and sustainable development principles engage us in consideration of current and future generations and the preservation of options for beneficial enjoyment of the oceans. The identity of the transferee, what rights are transferred, and how those rights will be exercised must be transparent and equitable. To accomplish this, MMS and FERC contemplate that competitive bidding may be used (although not always) for wave energy and measures imposed to ensure transferees are not simply blocking other users or uses, and have sufficient financial responsibility.[157]

Finally, there must be confirmation that the issuance of property rights to the seabed and OCS will provide assurance of environmental protections. Indeed, the MMS final rule acknowledges the congressional charge in the EPAct that MMS authority to issue licenses, easements, and rights-of-ways must be carried out with attention to the protecting the environment, conserving natural resources of the OCS, and ensuring public benefit.[158]

B. Degradation of Ocean Health and Potential Wave Energy Impacts

Scientists paint a dreary picture of the health of our oceans. Two national reports by the Pew Ocean Commission and the U.S. Commission on Ocean Policy highlight the serious need for change in the way we approach management and use of the oceans.[159] While concurrently trumpeting the benefits of the oceans to all of mankind, we are at a crisis in crashing fisheries; marine mammal fatalities; and horrific marine pollution, including land and sea pollution, transboundary movement of toxic materials, and a growing "garbage patch" of plastic debris twice the size of Texas.[160] There is wide consensus that the efforts under our existing environmental protection laws have been ineffectual to safeguard fisheries, corals, marine mammals, and water quality.[161] Based on scientific literature, some have characterized the state of marine systems as having reached a "tipping point."[162] Thus, marine systems may have reached a point where it would be impossible to help repair degraded systems. This is the context in which many are viewing the potential impacts of wave energy.

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157 Renewable Energy and Alternative Uses of Existing Facilities on the Outer Continental Shelf, 74 Fed. Reg. at 19,665–66.

158 *Id.* at 19,638–39.

159 PEW OCEANS COMM'N, *supra* note 87, at i, x; BLUEPRINT, *supra* note 88, at 4.

160 Brian Handwerk, *Giant Ocean-Trash Vortex Attracts Explorers*, NAT'L GEOGRAPHIC NEWS, July 31, 2009, http://news.nationalgeographic.com/news/2009/07/090731-ocean-trash-pacific.html (last visited Nov. 15, 2009).

161 *See* PEW OCEANS COMM'N, *supra* note 87, at 59, 65.

162 Elliot A. Norse, *Ending the Range Wars on the Last Frontier: Zoning the Sea*, *in* MARINE CONSERVATION BIOLOGY 422, 423 (Elliot A. Norse & Larry B. Crowder eds., 2005).

1. Potential Impacts

As the following specific environmental impacts are discussed, it is a cross-cutting challenge that data on baseline conditions is often sparse or nonexistent. This remains a problem identified generally as a shortcoming in marine ecosystem management—we know too little about this environment, and we are using it more intensely.[163] For instance, we have developed a greater understanding of habitat needs for some fish and marine mammals, but many species of concern still remain a mystery in their patterns of migration and habitat needs.[164] The problem is particularly acute where impacts will be most disruptive to essential feeding, breeding, and juvenile rearing activities.

Part of the solution could come from coastal habitat mapping and marine zoning or marine spatial planning. When sites are identified as possible locations for wave arrays, preliminary information should be available to evaluate potential conflicts with other users and rule out the possibility that the site contains a sensitive environment.

It is a benefit that the central Oregon coast near-shore and intertidal environments have been the subject of study by the Partnership for Interdisciplinary Science in the Coastal Ocean (PISCO) program for over a decade.[165] This research could provide an important basis for evaluating changes in the environment caused by the introduction of wave energy projects.

There is a significant body of literature on artificial reefs, and to the extent that structures placed in the ocean to capture wave energy will be serving as artificial reefs, the accompanying findings on environmental impacts are reasonably applicable. Artificial reefs are human-introduced structures that are believed to either aggregate or produce marine life.[166] Fish are known to be attracted to fixed structures, or to "associate" with objects in the ocean.[167] Thus, the use of artificial reefs in fishing efforts has been undertaken for multiple generations in many parts of the world, but the impact on fisheries and other marine life of these devices is only recently the

163 PEW OCEANS COMM'N, *supra* note 87, at 88; BLUEPRINT, *supra* note 88, at 4 (recommending increased research on marine environment).

164 *See* PEW OCEANS COMM'N, *supra* note 87, at 88.

165 NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 21, at 7, 12. As Bill Peterson elaborates,

> Because of these long-term studies we have a good understanding of the local hydrography and the ecology of zooplankton, small pelagic fishes, juvenile salmonids, and predatory fishes. Moreover, we have a good understanding of seasonal and interannual variability, important if we are to evaluate the long-term impacts of wave energy facilities.

Id.

166 Jeffrey J. Polovina, *Artificial Reefs: Nothing More than Benthic Fish Aggregators*, 30 CAL. COOPERATIVE OCEANIC FISHERIES INVESTIGATIONS REP. 37, 37 (1989), *available at* http://www.calcofi.org/newhome/publications/CalCOFI_Reports/v30/pdfs/CalCOFI_Rpt_Vol_30_1989.pdf; John M. MacDonald, Note, *Artificial Reef Debate: Habitat Enhancement and Waste Disposal?*, 25 OCEAN DEV. & INT'L L. 87, 92–93 (1994).

167 *See* MacDonald, *supra* note 166, at 92.

subject of scientific study.[168] Structures can provide hard-bottom surfaces where none were previously available, but may also disrupt migration patterns and increase predation.[169] Therefore, it is questionable whether the artificial reef effect will have a positive or negative impact, and may be dependent on the particular species of concern.[170]

A prominent environmental concern is the impact on marine life by the generation of an electromagnetic field (EMF).[171] The existing research on EMFs is not conclusive, and scant direct research has applied the theory of EMF harm to the marine environment.[172] The concern voiced in the scientific community is that there is the potential for direct negative effects through behavioral changes, as well as indirect effects through increased predation and decreased fish density in proximity to devices.[173] Moreover, because wave energy structures might not be designed to "turn off," there would be a continuous EMF surrounding these structures offshore.[174]

Similar to the concerns voiced about EMFs, the deployed wave devices may be either an attractor or an aversion. Noise will likely change behavior because fishes and mammals respond to noise in different ways depending on the species in question.[175] If the devices are attractors this could result in greater predation near the sites. It is already recognized that low-frequency noise is likely to have an impact on animals such as baleen whales and fish.[176] Noise that is more variable is more likely to impact other marine mammals such as cetaceans.[177]

168 The aggregation of fish around offshore drilling platforms led to study of the artificial reef effect in the 1980s, with mixed results. *See* Rachael E. Salcido, *Enduring Optimism: Examining the Rig to Reef Bargain*, 32 ECOLOGY L.Q. 863, 888, 898–99 (2005). The National Fishing Enhancement Act of 1984 (NFEA), Pub. L. No. 98-623, 98 Stat. 3394 (codified at 16 U.S.C. § 1220 (2006) and 33 U.S.C. §§ 2101–2106 (2006)), supported the conversion of offshore platforms to artificial reefs for increased recreational fishing opportunities. *See generally* Salcido, *supra*, at 887 (discussing the "removal of platforms for 'artificial reefs'"). The federal government is also instituting a plan to turn retired naval vessels into artificial reefs. MICHAEL V. HYNES ET AL., ARTIFICIAL REEFS: A DISPOSAL OPTION FOR NAVY AND MARAD SHIPS 1 (2004), *available at* http://www.rand.org/pubs/documented_briefings/2005/DB391.pdf. Moreover, the interest in restoring degraded marine ecosystems more generally has also led to experimenting with artificial reefs to increase breeding and sheltering habitat for targeted fish species. L.M. Chou, *Artificial Reefs of Southeast Asia: Do They Enhance or Degrade the Marine Environment?*, 44 ENVTL. MONITORING & ASSESSMENT 45, 45 (1997).

169 *See* NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 21, at 76.

170 MILTON S. LOVE & DONNA M. SCHROEDER, U.S. DEP'T OF THE INTERIOR, ECOLOGICAL PERFORMANCE OF OCS PLATFORMS AS FISH HABITAT OFF CALIFORNIA, at ix (2006), *available at* http://www.lovelab.id.ucsb.edu/Eco%20Performance.pdf (concluding that for certain fish stocks, oil platforms serve as artificial reefs and de facto marine reserves and provide important regional habitat).

171 H.T. HARVEY & ASSOC., *supra* note 82, at 126; NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 21, at vi.

172 *See* NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 21, at 133, 134.

173 H.T. HARVEY & ASSOC., *supra* note 82, at 100.

174 NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 21, at 137.

175 H.T. HARVEY & ASSOC., *supra* note 82, at 129.

176 NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 21, at 115.

177 *Id.*

There may also be impacts above the surface of the water. Impacts to birds may occur from encounters with exposed wave energy devices, and lighting that might be required could attract birds that might collide with devices.[178] Entanglement is an issue primarily for larger fish, seabirds, and marine mammals.[179] Research by Scottish scientists cite significant uncertainty, and suggest that we will not have substantial data until deployment occurs and we can consider additional mitigation features, such as device design, visual or acoustic avoidance measures, or both.[180]

If wave energy has the potential to "green" the grid, it is because it provides a relatively better trade-off of costs and benefits compared to other energy sources. Until further research proves it benign, it is difficult to argue that yet another use of the ocean, and one involving significant and permanent (or at least semipermanent) occupation is not going to come at an environmental cost.

The definition of cumulative impacts pursuant to NEPA is:

> [T]he impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.[181]

The scale of potential cumulative impacts is driven in part by how large the wave farm will be, as well as the number of farms in proximity to one another. Because ocean systems are complex, not linear, the challenge of assessing the incremental impact of the deployment of wave energy devices will be great.

Finally, it is important to note that there are several ways to avoid harmful impacts by thoughtful placement in areas that do not conflict with conservation objectives. Measures such as avoidance and acoustic devices have been proposed.[182] Because the potential impacts are still largely unknown, adaptive management is most likely to be used to incorporate these elements.

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178 H.T. HARVEY & ASSOC., *supra* note 82, at 135, 137; NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 21, at vi.

179 H.T. HARVEY & ASSOC., *supra* note 82, at 125, 127.

180 Gregory McMurray, *Wave Energy Ecological Effects Workshop Ecological Assessment Briefing Paper*, *in* NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 21, at 25, 57. The European Marine Energy Centre targets acoustic impacts as a research priority. The European Marine Energy Ctr., Tidal Site Projects, http://www.emec.org.uk/tidal_site_projects.asp (last visited Nov. 15, 2009) (discussing acoustic characterization and monitoring of tidal devices).

181 40 C.F.R. § 1508.7 (2008).

182 H.T. HARVEY & ASSOC., *supra* note 82, at 123.

2. Applicability of Existing Laws: Why the Patchwork Is Insufficient

Significant attention has been directed at the failure of our patchwork of environmental laws to address our most serious ocean impacts.[183] The two recent national reports on ocean management urge coordination,[184] and the Ocean Task Force established by President Obama is a step toward such coordination.[185] At this time, several laws might be implicated by the foregoing environmental concerns with ocean wave technology.

Laws that address environmental concerns through enhanced planning include NEPA, CZMA, and the EFH provisions. NEPA requires a detailed environmental impact statement for any major federal action significantly affecting the environment.[186] The EIS, which is the heart of NEPA and its goal of informed federal decision making, will serve as a tool to ensure compliance with the host of other applicable environmental statutes.

A second planning law, CZMA, provides an incentive to states to manage the coastal environment, in part by adopting coastal management plans.[187] The CZMA then requires that projects approved by the federal government be consistent with the enforceable provisions of a state coastal management plan, which is known as the consistency requirement.[188]

Part planning, part wildlife focused, the EFH protections were adopted in the 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act.[189] This Act is designed to conserve ocean fisheries. Regional Fishery Management Councils and the Secretary of Commerce are required to identify and designate EFH in fishery management plans proactively to minimize adverse effects on EFH and promote their conservation and enhancement.[190] In 1999, the Secretary of Commerce designated EFH on the Atlantic Coast, in the Gulf of Mexico, the West Coast, Alaska, Hawaii, and other U.S. territories.[191] EFH is defined as "those waters

183 See Robin Kundis Craig, *Taking the Long View of Ocean Ecosystems: Historical Science, Marine Restoration, and the Oceans Act of 2000*, 29 ECOLOGY L.Q. 649, 658, 662, 666 (2002), for an overview of the fragmentation of ocean laws.

184 PEW OCEAN COMM'N, *supra* note 87, at 107; BLUEPRINT, *supra* note 88, at 9–10.

185 Memorandum on National Policy for the Oceans, Our Coasts, and the Great Lakes, 74 Fed. Reg. 28,591 (June 17, 2009).

186 National Environmental Policy Act of 1969, 42 U.S.C. § 4332(C) (2006).

187 Coastal Zone Management Act of 1972, 16 U.S.C. § 1455 (2006).

188 *Id.* § 1456(c).

189 Sustainable Fisheries Act, 16 U.S.C. § 1855(b) (2006).

190 *Id.*

191 *See, e.g.*, NAT'L MARINE FISHERIES SERV., NAT'L OCEANIC & ATMOSPHERIC ADMIN., ESSENTIAL FISH HABITAT: A MARINE FISH HABITAT CONSERVATION MANDATE FOR FEDERAL AGENCIES, GULF OF MEXICO REGION (2008), *available at* http://www.safmc.net/Portals/0/EFH/EFHMandate.pdf; Pacific Coast Groundfish Fishery, 64 Fed. Reg. 43,092 (Sept. 10, 1999) (to be codified at 50 C.F.R. pt. 660); Amendments for Addressing Essential Fish Habitat Requirements for Fisheries of the Exclusive Economic Zone off Alaska, 64 Fed. Reg. 20,216, 20,216 (Apr. 26, 1999) (codified at 50 C.F.R. pt. 679); Notification of Agency Decision for Fisheries off West Coast States and in the Western Pacific, 74 Fed. Reg. 19,067, 19,068 (Apr. 19, 1999); Fisheries of the Caribbean, Gulf of Mexico, and South Atlantic; Essential Fish Habitat Generic Amendment to the Fishery Management Plans of the U.S. Caribbean, 64 Fed. Reg. 14,884 (Mar. 29, 1999).

and substrate necessary to fish for spawning, breeding, feeding or growth to maturity."[192] Federal agencies must consult with the National Marine Fisheries Service (NMFS) for any action authorized, funded, or carried out by the agency that may adversely affect EFH.[193] EFH provisions apply to all federal permitting activities and federally funded activities.[194] Because there are a number of areas of EFH along the Pacific coast, EFH provisions will play an important role in ensuring wave energy impacts are limited.

Laws that focus specifically on water quality are also implicated. The CWA regulates discharges to waters of the United States, including chemicals used to operate or maintain equipment.[195] While many proposed wave energy device designs require limited use of chemicals, the CWA provisions are potentially implicated by some projects.[196]

Finally, several laws are focused on the direct impacts to wildlife, such as the MBTA, the ESA, and the MMPA. The MBTA implements U.S. treaty commitments.[197] It applies to all migratory birds protected by international conventions with Canada, Mexico, Japan, and Russia.[198] As is relevant to potential wave energy impacts, pursuant to MBTA provisions it is unlawful to kill or capture protected species without a permit.[199]

The Endangered Species Act applies to listed species.[200] It prohibits the "taking" of listed species, including hunting or killing, harassing, or modifying critical habitat that harms species. [201] Furthermore, species listed pursuant to the Act also receive protection through the designation of critical habitat. Critical habitat of a listed species, once designated as such, receives the benefit of the consultation requirement of section 7.[202] Under section 7 of the ESA, federal agencies must consult with the wildlife agencies (NMFS or the United States Fish and Wildlife Service) to ensure their actions, such as permitting decisions, are not likely to adversely modify or destroy critical habitat.[203] Numerous marine species have been listed under the ESA, and critical habitat has been designated for a number of those species.[204]

192 Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. § 1802(10) (2006).

193 *Id.* § 1855(b)(2).

194 *Id.*

195 Federal Water Pollution Control Act, 33 U.S.C. §§ 1251(a)(1), 1311(a), 1342, 1362(7) (2006). The definition of "pollutant" includes "chemical wastes." *Id.* § 1362(6).

196 MCMURRAY, *supra* note 71, at 42. The workshop noted the potential for chemical discharges from antifouling paints, metals, and organics used for hydraulic fluids. *Id.*

197 *See* Migratory Bird Treaty Act, 16 U.S.C. § 712 (2006).

198 *Id.* §§ 703(a), 705.

199 *Id.* § 703(a).

200 *See* Endangered Species Act of 1973, 16 U.S.C. §§ 1531(b), 1538 (2006).

201 *Id.* §§ 1532(19), 1538(a).

202 *Id.* § 1536(a)(2).

203 *Id.*

204 See 50 C.F.R. §§ 17.11, .95 (2008), for a list of all listed species, including fish and other marine species and critical habitat designations. *See also* U.S. Fish & Wildlife Serv., U.S. Dep't of the Interior, Species Reports: Listed Species with Critical Habitat, http://ecos.fws.gov/tess_public/pub/criticalHabitat.jsp?nmfs=1 (last visited Nov. 15, 2009) (providing a

The Marine Mammal Protection Act has two goals: protection of marine mammals and the ecosystem upon which those species depend.[205] As enunciated in the MMPA, section 2(6) states, "the primary objective of [marine mammal] management should be to maintain the health and stability of the marine ecosystem."[206] The Act applies to all marine mammals, those adapted to the marine environment, or those that primarily inhabit the marine environment.[207] The MMPA, section 101(a) prohibits the taking of marine mammals, with specified exceptions.[208] The Act also established an optimum sustainable population objective.[209] Many marine mammals could be impacted by the placement of wave energy devices.

C. Ocean Industrialization

Cumulative impacts of increased ocean use must be a central consideration of ocean renewable energy policy. Ocean ecosystems are complex, nonlinear systems with multiple inputs. As those advocating for more attention to this crisis assert, it is increasingly evident that we are overtaxing the marine environment.[210] Elliot A. Norse writes, "One reason that countless indicators of marine 'health' are declining is the still-widespread belief that the sea is an inexhaustible cornucopia, and that society, therefore, should give primacy to supporting consumptive users."[211]

It is hardly a time to take ocean ecosystem health for granted. The host of environmental laws that apply to any particular wave project testify to the fact that we have been regulating human impacts to ocean ecosystems. Nonetheless, we are experiencing an industrialization of the oceans by the increase in intensity of traditional uses as well as the addition of new uses. Regardless of regulation, impacts from overuse are taking their toll. For example, the fishing industry has become "industrialized" by the use of sonar to track fish, trawling, and other equipment that literally allows fish nowhere to hide.[212] Adding to this, aquaculture facilities that farm fish in enclosed pens have been approved in some states with accompanying state regulation.[213] New wind power projects will soon occupy areas off the shore

comprehensive list of species with critical habitat including links to additional information about each species).

205 Marine Mammal Protection Act of 1972, 16 U.S.C. § 1361 (2006).

206 *Id.* § 1361(6).

207 *Id.* § 1362(6).

208 *Id.* § 1372(a). "Take" is defined in the Act and is further elaborated by FWS and NMFS regulations. *Id.* § 1362(13); 15 C.F.R. § 216.4 (2008).

209 16 U.S.C. § 1361(6) (2006).

210 Norse, *supra* note 162, at 423.

211 *Id.*

212 CALLUM ROBERTS, THE UNNATURAL HISTORY OF THE SEA 305–16 (2007).

213 See Melissa Schatzberg, Note, *Salmon Aquaculture in Federal Waters: Shaping Offshore Aquaculture Through the Coastal Zone Management Act*, 55 STAN. L. REV. 249, 271–73 (2002), for a discussion of conflicts in regulation. See HAROLD F. UPTON & EUGENE H. BUCK, CONG. RESEARCH SERV., OPEN OCEAN AQUACULTURE (2008), *available at* http://www.nationalaglaw center.org/assets/crs/RL32694.pdf, for a more general overview of offshore aquaculture issues.

of the Eastern Seaboard.[214] And finally, we have begun the process of field testing wave and tidal energy projects in U.S. waters.[215] While new uses are added, we continue old uses, at times, with renewed vigor.[216]

D. Balancing Wave Energy with Other Uses

The question of how to prioritize a variety of uses offshore must be answered by the recognition that not all uses at ever-increasing intensities can be sustained. This is not a new process. We have recognized that ocean fisheries must be relied on to serve world food needs and have questioned whether other uses that impact the health of fisheries must be curtailed to meet that demand. A similar question must be asked about ocean renewable energy.

Actually making the types of tradeoffs that will maximize overall welfare is the difficulty being faced in ongoing planning efforts to date, which have primarily been undertaken at the state rather than the federal level. Planning for the entire EEZ would better accomplish long-term goals. Political borders offshore do not correspond to ecosystem borders. Responding to this reality, interest in employing regional governance mechanisms to address the challenges posed by transboundary impacts is increasing.[217] Regional governing organizations can incorporate the interests of a broader group of stakeholders. Experiences in using regional fisheries management organizations to manage allowable catch illustrate the benefits of bringing together stakeholders, while emphasizing data needs and the precaution necessary when making predictions based on uncertain ecological impacts. The West Coast Governors Agreement on Ocean Health (WCGA) between California, Oregon, and Washington is one example of how regional collaboration is galvanized by identifying common interests

See also Delaware Aquaculture Act, DEL. CODE ANN. tit. 3, §§ 401–411 (2001); Florida Aquaculture Policy Act, FLA. STAT. ANN. § 597.001–.020 (West 2003 & Supp. 2009); HAW. REV. STAT. § 219-1 to -9 (2001 & Supp. 2008); New Jersey Aquaculture Development Act, N.J. STAT. ANN. §§ 4:27-1 to -25 (West 1998 & Supp. 2009); Aquaculture Development Act, N.C. GEN. STAT. §§ 106-756 to -764 (2007); Aquacultural Development Law, 3 PA. CONS. STAT. ANN. §§ 4201–4223 (West 2006), for examples of state statutes regulating aquaculture.

214 Scott Malone, *Offshore Wind Could Be Next Wave for U.S.*, REUTERS, July 27, 2009, http://www.reuters.com/article/GCA-GreenBusiness/idUSTRE56Q5VO20090727 (last visited Nov. 15, 2009).

215 *See* ROBINSON, *supra* note 24.

216 For instance, to relieve congestion on national highways and to address energy needs, the EISA encouraged further use of short sea shipping to transport goods. See Sean D. Kennedy, Comment, *Short Sea Shipping in the United States—The New Marine Highways*, 33 TUL. MAR. L.J. 203, 203–04 (2008), for a discussion of the incongruence of the short sea shipping initiative of the EISA and existing maritime laws. Thus, the Department of Transportation, through the short sea shipping initiative, is encouraging further use of our nation's waterways as traditional "highways" of commerce. *See id.* at 204.

217 Fletcher, *supra* note 149, at 187 (discussing potential for regional governance to operate through shared interests—either an interest in conservation or in use). Fletcher concludes that finding incentives for regional governance based on shared interests remains a challenge. *Id.* at 203–04.

and putting forth efforts to attain shared goals.[218] The WCGA identifies that the gathering of ecological data is a shared interest, as is a shared vision to exclude offshore drilling in exchange for siting alternative energy projects.[219] Among other tools, lessons from regional governing mechanisms must be applied to the difficult task of implementing the prioritization among competing stakeholders for ocean uses.[220]

V. POLICY PRESCRIPTIONS AND THE "ROAD" AHEAD

In fact, many of the nitty-gritty, legal detail questions about wave energy are being answered: 1) which agency must issue rights for possession of the location for wave projects, 2) which agency authorizes the production and transmission of energy, 3) what is the order in which these permissions must be obtained, 4) how does one navigate environmental review processes, and 5) through which agencies, what types of plans, and at what stage of development are environmental assessment or environmental impact review conducted?

More at issue are many of the big picture, translegal, and nonlegal questions still being explored, such as what technology works, how, where, and under what conditions? For sustaining and restoring ocean ecosystems, what impacts does the technology have, and in what relation to trade-offs with other methods to generate needed energy? Getting wave energy to the grid will require more decisive action in putting wave energy into a national energy policy context, proving its green credentials, and planning its compatibility in a larger system of ocean management.

A. Role of Ocean Renewables in Energy Policy

The development of offshore wave energy projects is occurring among a transformation in the energy world. A focus on noncarbon sources of energy is imperative as we move to combat global warming. Before reasoned offshore ocean renewable energy siting is implemented, an indication of how much of a role ocean energy will play in the overall national energy supply is necessary.

For example, the recent budget proposals by President Obama sought to shift priority from wave energy research toward solar, wind, and geothermal.[221] This reflects a preference for forms of alternative energy that are closer to commercialization and competition with traditional fossil fuel

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218 OFFICE OF THE GOVERNORS, WASH., OR., & CAL., WEST COAST GOVERNORS' AGREEMENT ON OCEAN HEALTH: ACTION PLAN 7 (2008), *available at* http://westcoastoceans.gov/Docs/WCGA_ActionPlan_low-resolution.pdf.

219 *Id.* at 8.

220 *See generally* Salcido, *supra* note 53, at 1358 (relating to a discussion of reconciling federal and state interests in the EEZ).

221 Les Blumenthal, *Obama Seeks Funding Cuts for Wave, Tidal Energy Research*, MCCLATCHY NEWSPAPERS, May 31, 2009, http://www.mcclatchydc.com/226/story/69108.html (last visited Nov. 15, 2009).

sources. While this might not reflect a long-term strategy for a diversified alternative energy portfolio, it will prevent more rapid development of wave energy technology.

B. Sustainable Wave Energy—Proving the Green Credentials

There is a sense that wave energy is potentially being held to a higher standard as it concerns environmental impacts. While hard to prove or disprove this perception, there are some reasons as to why that view may have validity. The intense eye turned toward wave energy specifically, and renewable ocean energy generally, is fixed due to the claim that it is a relatively benign intrusion that would replace harmful sources of energy.[222] The industry and its supporters are clamoring for direct (grant) and indirect (tax treatment) financial support from the government.[223] And for many, the oceans still conjure an image of vast, untouched wildness that should be protected from human misuse. Finally, given the crisis that we are experiencing with the impacts of global warming, in a risk-risk assessment some would certainly favor bringing all forms of nongreenhouse gas energy sources online as quickly as possible.[224] The time is right to establish an ocean renewable energy industry with a foundation of environmental stewardship, and there is every possibility to do so without actually holding wave energy to a different sustainability standard than other forms of energy.

The agreement between various stakeholders on the principles of wave energy reflects the public's expectation that environmental standards and preservation of public trust resources for future generations to enjoy is nonnegotiable. Pilot test protocols must include environmental benchmarks and require adaptive management to meet those benchmarks.[225] The principles of sustainable development urge an abandonment of past practices. Allowing significant environmental harm and legally requiring (and only sometimes conducting) restorative measures after the fact is no

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222 *See, e.g.*, David Stauth, *Oregon Moving to Center of Wave Energy Development*, OR. ST. U. ELECTRICAL ENGINEERING & COMPUTER SCI. NEWS, Feb. 2, 2005, http://eecs.oregonstate.edu/news/story/1317 (last visited Nov. 15, 2009).

223 *See, e.g.*, *Developing Untapped Potential: Geothermal and Ocean Power Technologies: Hearing Before the Subcomm. on Energy and Environment of the H. Comm. on Science and Technology*, 110th Cong. 63 (May 17, 2007) (statement of Sean O'Neill, President, Ocean Renewable Energy Coalition) ("Incentives could include investment tax credits for investment in offshore renewables . . . ."); Reed, *supra* note 117.

224 *See* SIERRA CLUB, ENERGY RESOURCES POLICY 5 (2009), *available at* http://www.sierraclub.org/policy/conservation/energy.pdf. Nuclear energy is another example of where such a calculation is occurring. *See* Bentley Mitchell, *Diffusing the Problem: How Adopting a Policy to Safely Store America's Nuclear Waste May Help Combat Climate Change*, 28 J. LAND RESOURCES & ENVTL. L. 375, 383 (2008) (noting that the concern for climate change is encouraging development of new nuclear power plants).

225 This may mean requiring changes to production or design to actually accomplish set benchmarks. *See* Richard Roos-Collins, *Lessons from the Mono Lake Cases for Effective Management of Public Trust Resources*, 15 SE. ENVTL. L.J. 171, 186 (2006) (encouraging the use of adaptive management to accomplish environmental restoration goals).

longer a feasible strategy to maintain the health of the marine environment. It will be necessary to measure the direct, indirect, and cumulative impacts of wave energy, use siting decisions to limit those impacts, and draw a line where environmental impacts would be unacceptable.

C. Marine Spatial Planning and Marine Protected Areas

Finally, wave energy must be situated among competing ocean uses within a zoning system that is proactive in avoiding user conflicts and actively conserving and restoring degraded ocean ecosystems. Marine protected areas (MPAs) are geographically defined areas of the ocean that are set apart for identified environmental management goals, and enjoy legal protections to promote those goals.[226] While no consistent definition of an MPA has been developed, Presidential Executive Order Number 13,158 on MPAs provides a useful set of criteria.[227] Executive Order Number 13,158 defines an MPA as "any area of the marine environment that has been reserved by Federal, State, territorial, tribal or local laws or regulations to provide lasting protection for part or all of the natural or cultural resources therein."[228]

The benefits of using marine protected areas or marine reserves to conserve living ocean resources have been well documented.[229] This tool for ecosystem management is not yet in wide use, although its proponents have made progress in getting environmental managers, policymakers, and legislators apprised of the use of MPAs as a best hope for the recovery of overburdened and degraded ocean ecosystems.[230]

There are legitimate concerns that undue delay will result if comprehensive planning is a prerequisite to begin pilot demonstrations and small-scale deployment.[231] Moreover, some cite the resistance to projects as a possibility for "zoning out" any wave energy projects.[232] A project proposed off the California coast at Cape Mendocino may be instructive of how local

226 *See* Exec. Order No. 13,158, 3 C.F.R. 273 (2001), *reprinted in* 16 U.S.C. § 1431 (2006).

227 *See id.*

228 *Id.* at 274.

229 *See, e.g.*, COMM. ON THE EVALUATION, DESIGN, & MONITORING OF MARINE RESERVES & PROTECTED AREAS IN THE U.S., NAT'L RESEARCH COUNCIL, MARINE PROTECTED AREAS: TOOLS FOR SUSTAINING OCEAN ECOSYSTEMS 174–80 (2001) (noting the body of literature documenting the effectiveness of marine reserves for conserving habitats and recommending implementation of marine reserves to protect biodiversity, improve fisheries management, balance costs and benefits, and protect an adequate amount of marine habitats).

230 *See generally* AARON M. FLYNN, CONG. RESEARCH SERV., MARINE PROTECTED AREAS: FEDERAL LEGAL AUTHORITY 7–30 (2004) (surveying existing legal tools for ocean zoning such as the National Marine Sanctuaries Act, 16 U.S.C. §§ 1431–1445c-1 (2006), and Coastal Zone Management Act).

231 *See generally* STERNE ET AL., *supra* note 18, at 4–6 (arguing for more favorable policies that reduce transaction costs for developers).

232 Richard G. Hildreth, Keynote Address at the Ecological Effects of Wave Energy Development in the Pacific Northwest Scientific Workshop: Ocean Zoning: Implications for Wave Energy Development (Oct. 11, 2007), *in* NAT'L OCEANIC & ATMOSPHERIC ADMIN., *supra* note 21, app. 4, at 159, 161.

opposition can be enough to turn off potential investment.[233] Local community members expressed concerns that communication was inadequate and siting decisions were not inclusive of the coastal community.[234] Although it was a prime wave energy location, Ocean Power Technologies decided to abandon plans for the project to focus more seriously on development in Oregon.[235]

As a potential benefit of more holistic zoning efforts, these planning processes could provide the vehicle to set aside areas designed to maximize conservation efforts and provide a means of buy-in to offset concern about the environmental impacts of wave energy projects. Currently, areas that may act as de facto reserve areas must compete with areas in use for energy generation, food production, and recreation.[236] Progress on establishing new marine reserves, if put in place as co-equal objectives, could balance use and nonuse for sustainable long-term ocean health. This approach would automatically incorporate a level of precaution, as some areas are immediately shielded from direct impacts.

Much like the crisis in habitat depletion on land, the introduction of increasing intensity and now multiple fixed-location uses in the oceans parallels the experience of habitat fragmentation and loss on land. This is why, even in the absence of a solid understanding of habitat needs, a precautionary approach counsels toward increasing the use of no-take marine reserves and limited use zones for not only maintenance but restoration of depleted living resources in the ocean. Such areas must be designed for meaningful connectivity among each other, and must constitute sufficient area to serve the designated conservation objective.[237] Although we are not starting with a blank slate as it is, approving wave energy projects in isolation from other zoning processes would complicate future efforts to establish a national network of marine protected areas.[238]

As we recognize the need for conservation onshore, public lands management policy has recognized nonuse as equally important to conserve

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233 *See generally* Maddalena Jackson, *Power Plan Would Tap Wind, Waves: Mendocino Worries About Sea Vista, Fishing Industry*, SACRAMENTO BEE, at A1, *available at* 2008 WLNR 15030951 (describing local concerns of the proposed siting of wave energy projects).

234 *Id.*

235 Frank Hartzell, *Second Developer Dumps Wave Energy*, MENDOCINO BEACON, June 4, 2009 (on file with Environmental Law); *see* Posting of Todd Woody to N.Y. Times Green Inc. Blog, Wave Power Setbacks in California, http://greeninc.blogs.nytimes.com/2009/08/12/wave-power-setbacks-in-california (Aug. 12, 2009, 12:06) (last visited Nov. 15, 2009).

236 *See* MINERALS MGMT. SERV., U.S. DEP'T OF THE INTERIOR, TECHNOLOGY WHITE PAPER ON WAVE ENERGY POTENTIAL ON THE U.S. OUTER CONTINENTAL SHELF 8–9 (2006).

237 For a useful statutory example that sets an objective to connect a network of marine managed areas and designate reserves in a system that works as an integrated whole throughout the state, see California's Marine Life Protection Act, CAL. FISH & GAME CODE §§ 2850–2863 (West 2009).

238 *See generally* Oregon MOU, *supra* note 56, at 1–3 (emphasizing the importance of coordination on the procedures and review process for proposed projects).

biodiversity as well as recreational resources.[239] Noncommodity uses (or nonuses) of the oceans established today will prevent reliance by private interests that on land have led to disputes over expectations and hindered conservation efforts. Experience has shown that conflict resolution may require paying current users for their displacement, more as an issue of fairness than as of right.[240] If this continues as a policy, then it may be more difficult to fund displacement of economically powerful interests and therefore more attractive to choose sites that are not in competition with users, although they provide important ecosystem services.

VI. CONCLUSION

We are at an important time for government to encourage the development of offshore areas as a source of sustainable "green" energy. Yet this means recognizing the unique benefits of wave energy in comparison to the myriad benefits of the oceans to current and future generations. Ultimately, we face the recurring problem of managing the expectations of multiple parties seeking to exploit shared and limited resources. This requires first coming to terms with the fact that the oceans are not a limitless bounty to exploit, and that the reality of scarcity is upon us with mounting evidence of marine ecosystem declines. Marine renewable energy must help in a larger context that is working toward restoring marine ecosystem health, and avoiding the worst that climate change might bring, to be embraced as a sustainable "green" contribution to the grid. It may not come quickly, and will not be without its controversy.

239 Jan G. Laitos & Thomas A. Carr, *The Transformation on the Public Lands*, 26 ECOLOGY L.Q. 140, 192–93 (1999).

240 Compensation occurred in the development of the Northwest Hawaiian Island Marine Monument, which has been renamed Papahanaumokuakea Marine National Monument, and in displacement of fishing activity by trans-Pacific fiber optic cables laid off the coast of Oregon. Hildreth, *supra* note 232, app. 4, at 160; *see* Fisheries in the Western Pacific; Compensation to Commercial Bottomfish and Lobster Fishermen Due to Fishery Closures in the Papahanaumokuakea Marine National Monument, 74 Fed. Reg. 15,685, 15,687–88 (proposed Apr. 7, 2009) (to be codified at 50 C.F.R. pt. 665).