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Emerging from the Deep: Pacific Coast Wave Energy

Occasionally hindsight allows us to pinpoint a particular opportunity that existed because of a unique confluence of circumstances. Sometimes we appreciate that there was a sufficient intersection of collective recognition and political will to ensure a special opportunity was taken. However, too often we regret a lost opportunity.

I began this Article at a century-old desk in the basement of a house in Washington, D.C. The house was built in 1928, on the eve of a national (and international) economic disaster that would take the United States over a decade and a world war to emerge from. That disaster was, of course, the stock market crash of 1929 and the onset of the Great Depression. In 1928, my father (age seven) and his brothers ran behind the local coal delivery truck on its daily route, scooping up the coal that bounced from the truck to take home and burn in the coal furnace.

Although it is rarely used directly for heating today, coal is still indirectly the greatest source of energy in the United States, as it fires the plants that generate electricity.[1] The use of coal and other fossil

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1 *See* ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, ELECTRIC POWER ANNUAL 2007, at 2–3 (2009), available at http://www.eia.doe.gov/cneaf/electricity/epa/eoa.pdf. In

fuels that powered the industrial revolution, and the electronic revolution it made possible, may seem anachronistic to us today. We are a step removed from coal, unless we live in the developing world or states like Pennsylvania, West Virginia, Utah, or Wyoming where coal is mined and its cost in terms of human suffering is more palpable. During the summer of 2008, light sweet crude oil (coal's fossil sister) reached $147 per barrel on the world market.[2] This unprecedented jump increased the difficulty for people around the globe to afford not just petrol but every necessity dependent on it, such as food.[3]

For decades, nations have discussed the effect of society's production of carbon (in the form of CO_2)[4] and other greenhouse emissions on the atmosphere and the oceans. There has been some attempt to reduce or eliminate these emissions. Our success has been spotty, mainly due to political infighting and deferring of hard choices until another day but also because of increased population and industrialization in places like China and India.[5] Habituated to a mindset from the past century, we keep chasing the coal truck. The time we have wasted (and the opportunities lost) have narrowed our options.

In June 2008, one-third of the geographic area of Iowa was under water as a result of what was labeled a five-hundred-year flood.[6] The increased severity of storms such as these may or may not be attributable to global climate change. Broken Iowa levees submerged thousands of acres of corn, the loss of which threatened to raise

2007, coal provided forty-nine percent of the 4.16 trillion kilowatt hours consumed in the United States. *Id.*

2 Kathryn Hopkins, *Iran Missile Launches Send Oil to $147 a Barrel Record*, GUARDIAN (London), July 12, 2008, at 38. For comparison, the average price for a barrel of oil in 2004 was $41.47. Brad Foss, *Oil Prices End 2006 Where They Started*, ASSOCIATED PRESS, Dec. 29, 2006, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2006/12/29/AR2006122900165.html.

3 James Kanter & Stephen Castle, *Rising Food Prices Sharpen a European Debate*, N.Y. TIMES, May 20, 2008, at C2.

4 According to the EPA, "approximately 4 metric tons of carbon dioxide (CO2)" is emitted from homes in the United States, equivalent to almost nine thousand pounds per person. EPA, Climate Change—Greenhouse Gas Emissions: In the Home, http://www.epa.gov/climatechange/emissions/ind_home.html (last visited May 5, 2009). This consumption equates to about seventeen percent of total U.S. emissions. *Id.*

5 Global Carbon Project 2008, Carbon Budget and Trends 2007 (Sept. 26, 2008), http://www.globalcarbonproject.org/carbontrends/index.htm.

6 *500 Year Flood Submerges Iowa*, ENV'T NEWS SERVICE, June 16, 2008, http://www.ens-newswire.com/ens/jun2008/2008-06-16-01.asp.

already high corn prices.[7] Ironically, the quantity of acres planted in corn has been trending upward because corn can be converted to ethanol, a gasoline substitute that may someday help reduce foreign fossil fuel consumption.[8]

Will we recognize the opportunities in our own complex, historic moment, and will we take them? About forty years ago, a quiet revolution began as scientists and inventors began experimenting with methods of obtaining energy from alternative sources such as the sun and wind.[9] Once thought the domain of nonmainstream dreamers, alternative energy in 2008 is more mature and has gained both acceptance and a growing market share. Even the average homeowner likely has choices offered by her utility company for purchasing blocks of energy produced by wind or solar technologies.

In such an era, marine (hydrokinetic)[10] energy from waves, tides, and currents has reemerged as a viable power source. A recent Reuters news article reported that there was a sense in the industry that marine energy will be as successful as wind energy a mere five years from now.[11] This Article discusses the early stages of wave energy development on the Pacific Coast of the United States, particularly in Oregon.

You do not have to be a dreamer to appreciate that wave energy is fascinating and its prospects exciting. During the past year, Internet resources about wave energy have expanded greatly. However, it is a challenge to find substantive information. The vast majority of websites are from industry consortia. Scholarly literature—whether on the science, environmental effects, or legal aspects of wave energy—is scarce, but growing. It is my hope that this Article contributes to the national dialogue.

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7 Kent Garber, *Midwest Floods Ruin Crops*, U.S. NEWS & WORLD REP., June 18, 2008, http://www.usnews.com/articles/news/national/2008/06/18/midwest-floods-ruin-crops.html.

8 *Id.*

9 The histories of solar and wind energy are longer than forty years. Bell Labs developed the first photovoltaic technology in 1954. *See* ENERGY EFFICIENCY & RENEWABLE ENERGY, U.S. DEP'T OF ENERGY, THE HISTORY OF SOLAR 3 (2002), http://www.eere.energy.gov/solar/pdfs/solar_timeline.pdf.

10 42 U.S.C. § 17211 (2006) (defining the term "marine and hydrokinetic renewable energy").

11 Chris Wills, *Marine Power Lags Wind by Only Five Years—Triodos*, REUTERS, June 6, 2008, *available at* http://www.planetark.com/dailynewsstory.cfm/newsid/48674/story.htm.

I
WAVE ENERGY COMES TO OREGON

Hydrokinetic energy (from waves, currents, and tides) joins the approximate seven percent of America's traditional hydropower sources that are carbon neutral.[12] In a diversified energy portfolio, wave energy could be a good investment in the long run. In Oregon, we have mottos welcoming dreamers and often make the observation that "things look different here."[13] With a long and proud history as a laboratory of progressive ideas, and new patents to back those ideas up,[14] Oregon is a natural place for wave energy to come of age.

In 2005, a group of forty Oregon industry, education, and government representatives known as the Oregon Innovation Council[15] was convened to craft a plan to grow and diversify Oregon's economic future and to make the state more globally competitive. At that time, state leaders identified wave energy[16] as one of seven statewide industries for potential research and investment.[17] The Oregon Innovation Council proposed to the Oregon Legislature to invest $4.2 million for developing wave energy

12 ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, RENEWABLE ENERGY TRENDS IN CONSUMPTION AND ELECTRICITY 2006, at 6, 23 (2008), http://www.eia.doe.gov/cneaf/solar.renewables/page/trends/trends.pdf. Traditional hydropower made up forty-one percent of the seven percent of the nation's renewable energy portfolio in 2006. *Id.* In Oregon, seventy percent of the energy annually derived is from hydroelectric sources. U.S. Department of Energy, State of Oregon, http://www.energy.gov/oregon.htm (last visited May 5, 2009).

13 *See, e.g.*, 2009 Oregon Governor's Conference on Tourism, http://www.oregontourismconference.com (last visited May 5, 2009) ("Oregon. Things Look Different Here. . . . Oregon. We Love Dreamers.").

14 Press Release, Stoel Rives LLP, Oregon Patent Growth Skyrockets Over National Average for Past Two Decades (Aug. 11, 2005), http://www.stoel.com/showrelease.aspx?Show=721.

15 Oregon Innovation Council, http://www.oregoninc.org (last visited May 5, 2009) ("[The Oregon Innovation Council's] mission is to expand markets for Oregon companies, create jobs across the state and leverage Oregon's strengths to compete in the global economy.").

16 As the sun radiates the Earth's surface, the temperature differential gives rise to winds. As winds blow across a "fetch" of ocean surface, they generate waves. Wave energy is energy that is derived from the physical rising and falling of a device that floats on the ocean's surface.

17 Press Release, Governor Ted Kulongoski, Governor Kulongoski Signs the 2007 Oregon Innovation Plan (July 26, 2007), http://www.governor.state.or.us/Gov/P2007/press_072607.shtml.

off the coast of Oregon, where wave energy potential has been estimated at 13,800 megawatts (MW).[18]

To oversee the funds, the Oregon Innovation Council and the Oregon Economic and Community Development Department convened a body known as the Oregon Wave Energy Trust (OWET or the Trust), a diverse group of Oregon leaders from industry, government, academia, and coastal organizations.[19] The Trust spent the latter half of 2007 creating a vision statement, bylaws, a budget, and funding priorities. The Trust's mission is to "build and share the expertise needed to support and accelerate the development of Oregon's wave energy industry in a responsible manner."[20]

OWET's creation signified a substantial state commitment to promoting wave energy development as part of Oregon's planned energy diversification to meet the goals of Oregon 2025, a mandate requiring one-quarter of the state's utility demand to be met by renewable energy by the year 2025.[21] OWET is implementing a communication and outreach strategy for working closely with coastal communities. The group is also identifying scientific and economic research needs and coordinating research efforts in support of a state coastal environmental baseline assessment. OWET will work with Oregon's research institutions on efforts to address environmental and regulatory issues, stakeholder and community concerns, and informational needs related to wave energy development.

Notably, at least ten different groups have played roles in wave energy planning, stakeholder outreach and involvement, and in the broader context of creating a vision for the future of Oregon's coastal zone and its resources. These efforts were led by groups that include People of Oregon for Wave Energy Resources, the Ocean Policy Advisory Council, the Oregon Regulatory Agency Work Group, Fishermen Involved in Natural Energy, the Oregon Innovation Council, the Oregon Coastal Zone Management Association, the

18 DAVID ELWOOD ET AL., ASSESSMENT OF THE U.S. WAVE ENERGY RESOURCE USING IN-SITU DATA, ENERGY OCEAN (2008) (on file with Annette Von Jouanne at Oregon State University).

19 Oregon Wave Energy Trust, http://www.oregonwave.org/index.php/home.html (last visited May 5, 2009).

20 Oregon Wave Energy Trust, Research and Development Projects, http://www.oregonwave.org/index.php/faq.html (last visited May 5, 2009).

21 *See* 2007 Or. Laws 845; OR. DEP'T OF ENERGY, SUMMARY OF OREGON'S RENEWABLE PORTFOLIO STANDARD 1 (2007), *available at* www.poweringoregonsfuture.org/PoweringOregonsFuture/PDFs/ODOE_Oregon_RPS_Summary_June2007v2.pdf.

Wave Energy Effects Workshop Steering Committee, OWET, Oregon Sea Grant, and Oregon Solutions.

Each coastal community is culturally, economically, and geographically distinct. Therefore, building relationships and informational resources within these communities takes a customized approach. For example, in October 2006, a process known as "the Oregon Solutions Process" was initiated to promote early stakeholder involvement in the regulatory process for the Reedsport Wave Energy Park proposed by Ocean Power Technologies.[22] The goal was to apply the Oregon Solutions Process to produce a memorandum of understanding signed by all parties to provide a coordinated, well-integrated permitting and licensing process. The memorandum of understanding provided for an assessment of and an agreement regarding the regulatory approach to support timely permitting of a single power buoy during the summer of 2007. The result is commonly referred to as the Reedsport Settlement Agreement.[23]

Consequently, a project scoping and study plan was undertaken to support a license application from the Federal Energy Regulatory Commission (FERC) for commercial sale of the energy output from an array of buoys (originally by the summer of 2008).[24] The memorandum of understanding also included an agreement for ongoing stakeholder coordination. The Oregon Solutions effort included representatives from over thirty different organizations that included local residents, recreational and environmental organizations, the federal and state government, and various county governments. The model is designed to ensure that all issues are identified and addressed proactively and collaboratively.

Multiple Oregon state agencies are working with coastal communities and federal agencies on planning and permitting for pilot wave energy projects, environmental considerations, and licensing requirements. These include the Oregon departments of (1) State Lands, (2) Land Conservation and Development, (3) Energy, (4)

22 *See* Oregon Solutions, http://www.orsolutions.org (last visited May 5, 2009).

23 At the time of this writing, the agreement is still a draft and its contents are confidential. *See* Onno Husing, *Special Report: Wave Energy Development Off Oregon Sparks Strong Community Concerns*, OR. COASTAL NOTES (Or. Coastal Zone Mgmt. Ass'n, Newport, Or.), June 2008, at 14–15, *available at* http://www.oczma.org/pdfs/FinalWaveEnergyNewsl_361581_1.pdf (summarizing the process).

24 Notice of Intent and Preliminary Application Document, Reedsport OPT Wave Park, FERC No. 12713 (July 2, 2007), *available at* http://elibrary-backup.ferc.gov/idmws/common/opennat.asp?fileID=11385917.

Environmental Quality, (5) Fish and Wildlife, (6) Parks and Recreation, and (7) Water Resources.

From 2006 to 2008, wave energy development was nothing short of tumultuous. During this period, one of a handful of experimental devices unexpectedly became a controversial symbol of the tumult. The Canadian firm Finavera Renewables launched a test buoy on September 6, 2007.[25] Its purpose was to gather data for approximately a month, not to generate power.[26] The device, a two million dollar buoy that was seventy-two feet long and weighed forty tons,[27] came to be known in coastal circles as "Bob," for reasons to be explained.

On October 1, 2007, there was a symposium held at Lewis & Clark College in Portland, Oregon, dedicated to wave energy for developers, citizens, investors, and the regulatory community.[28] Commissioner Philip Moeller from FERC presented a highly charged keynote lecture conveying support and enthusiasm for wave energy and commending Oregon's farsighted vision in helping to initiate the new industry.[29] The next day, a public hearing called the "Hydrokinetic Pilot Project Workshop" was led by Commissioner Moeller at the Bonneville Power Administration in Portland.[30] FERC's purpose in holding the workshop was to unveil and solicit feedback on its expedited permit process for test projects. The atmosphere was convivial, and the audience was energized. It was widely acknowledged from the beginning of the projects that the device designs[31] ultimately selected would have to stand up to some

25 *Id.*

26 *Id.*

27 Miriam Widman, *While Finavera's Buoy Sinks, Hopes of Harnessing Ocean Energy Survive*, RENEWABLE ENERGY WORLD, Nov. 8, 2007, http://www.renewableenergyworld.com/rea/news/article/2007/11/while-finaveras-buoy-sinks-hopes-of-harnessing-ocean-energy-survive-50510.

28 Lewis & Clark Law School, Symposium on Ocean Energy Law & Policy, http://www.lclark.edu/dept/elaw/2007_ocean_conf.html (last visited May 5, 2009).

29 Philip D. Moeller, Commissioner, FERC, Welcome and Keynote Address at the Lewis & Clark Law School Symposium: Ocean Energy Law & Policy (Oct. 1, 2007).

30 Philip D. Moeller, Commissioner, FERC, Statement at the Hydrokinetic Technologies Pilot Project Workshop (Oct. 2, 2007), *available at* http://www.ferc.gov/news/statements-speeches/moeller/2007/10-02-07-Moeller.pdf.

31 As not all designs are buoys, the proper generic term for the technology is hydrokinetic devices. Although there are several common types of devices, the most common ones currently used off the Pacific Coast of the United States are in fact varieties of buoys that are tethered to the sea floor by multiple, massive cables.

of the harshest conditions on the planet: corrosive saltwater, temperature fluctuations, and a range of physical forces unleashed by enormous waves.[32] Despite this awareness, no one seemed prepared for what happened just a few weeks after the Portland gatherings.

Shortly before Bob was scheduled to be retrieved from the sea, the buoy took on water faster than its bilge pump could release it.[33] Bob sank around two and one-half miles off Agate Beach on October 27, 2007.[34] Being naturally skeptical and practical, many coastal residents (and fishermen in particular) nicknamed the sunken buoy for its imagined repose: "buoy on bottom."[35] Coastal residents wanted to have the buoy removed as soon as possible so that it would not pose a navigational hazard for fishing vessels.[36] However, as a very rough winter set in and with only one salvage vessel searching (the Salvage Chief, located in Astoria), the device could not be found.[37] Even if it had been found, raising it would not have been possible.[38]

Bob was finally located and retrieved at 2:00 a.m. on July 24, 2008,[39] with the help of a large side scan image taken by the coastal services staff from the Department of Land Conservation and Development, a salvage vessel, and a team of technical divers. Bob

32 Markus Mueller & Robin Wallace, *Enabling Science and Technology for Marine Renewable Energy*, 36 ENERGY POL'Y 4376, 4380–81 (2008), *available at* http://www.esm.ucsb.edu/academics/courses/254/Readings/Mueller%20and%20Wallace%202008.pdf (describing the challenges for wave energy technology).

33 Widman, *supra* note 27.

34 Terry Dillman, *Sunken Buoy Rescue Under Way*, NEWPORT NEWS-TIMES (Or.), July 25, 2008, *available at* http://www.newportnewstimes.com/articles/2008/07/25/news/news01.txt.

35 E-mail from Dr. Flaxen Conway, Extension Community Outreach Specialist, Oregon Sea Grant, to Holly V. Campbell (Feb. 1, 2009, 12:26:00 PST) (on file with author).

36 *Id.*

37 Dillman, *supra* note 34.

38 For example, on December 5, 2007, a storm, with the first ever recorded hurricane force winds in the Pacific Northwest, devastated five coastal counties to the point where the President declared them a federal disaster area. *See* STEVE TODD ET AL., DECEMBER 2007 DAMAGING WIND STORM AND FLOODING IN NORTHWEST OREGON AND SOUTHWEST WASHINGTON (2007), http://www.wrh.noaa.gov/pqr/paststorms/20071203/FEMAExecSummary_Dec1_4.pdf.

39 Finavera Buoy Recovery, http://www.surfrider.org/oregon/2008/07/finavera-buoy-recovery.html (July 28, 2008, 12:06 PST).

lay partly submerged in 110 feet of water.[40] It was towed to a location on the Yaquina River to be taken apart for salvage.[41]

Despite Finavera's upbeat statements to the press that the test had served its purpose and yielded important data, the news of the loss of the buoy spread quickly. The temporary set back was taken by some as proof that wave energy was not technically feasible. But the industry took it in stride.[42]

As of this writing, there are five permitted pilot wave energy test sites off the Oregon Coast and one permitted pilot hydrokinetic test site embedded in a jetty (Douglas County, Oregon). From south to north, the locales and their target energy output are (1) Coos Bay (two projects, each at 100 MW), (2) Douglas County (20 to 180 MW), (3) Reedsport (50 MW), (4) Newport (100 MW), (5) Lincoln County (20 to 180 MW), and (6) Tillamook County. Three development companies and two public entities (counties) are involved.

On March 7, 2008, Ocean Power Technologies (OPT) submitted to FERC a notice of intent to take the next step; that is, to file an application for an original license for one of the two Coos Bay projects. The purpose of the document filed is

> to provide a description of the existing and proposed project facilities and operations, and any proposed changes to the project. The PAD also is intended to be a source of relevant existing information and data related to the project area and the environment affected by the project. Further, the PAD is intended to enable resource agencies and interested parties to identify potential resource issues and related information needs, develop study reports, and prepare study plan requirements.[43]

The OPT pre-application describes the placement of two hundred power buoys (in four groups of fifty, each rated to have the generating capacity of 500 kW for a total of 100 MW) up to 2.7 miles off the coast of Coos Bay, Oregon.[44] This project will occupy a space of

40 Lori Tobias, *$2 Million Wave Energy Buoy that Sank Off Agate Removed*, OREGONIAN, July 30, 2008, at D02.

41 Finavera Buoy Recovery, *supra* note 39.

42 Quotes in the media following the loss indicated that Finavera had considered the test buoy deployment a success. *See, e.g.*, *Test Buoy for Wave Energy Sinks Off Oregon Coast*, ASSOCIATED PRESS, Nov. 1, 2007, *available at* http://seattletimes.nwsource .com/html/localnews/2003987587_webbuoy01.html.

43 Notice of Intent and Preliminary Application Document, Coos Bay OPT Wave Park, FERC No. 12749, at 2-1 (Mar. 7, 2008), *available at* http://elibrary.ferc.gov/idmws/ common/opennat.asp?fileID=11607321.

44 *Id*. at 4-3.

0.93 square miles or 593 acres.[45] The group sponsoring the project, Oregon Wave Partners Limited, will gather information and conduct studies during 2008 and 2009, and it plans to submit a full license application sometime in 2009.[46]

Three weeks after the OPT filing, on March 27, 2008, FERC announced that it had reached an agreement with the State of Oregon regarding coordination of wave energy activities in Oregon's territorial sea (Oregon state waters out to three nautical miles).[47] The agreement (through a memorandum of understanding) "establishes Oregon's support of FERC's procedures for a shorter-term, experimental pilot license that ensures environmental, economic and social protections."[48] In the memorandum of understanding, FERC and Oregon agree that

> • [e]ach will notify the other when one becomes aware of a potential applicant for a preliminary permit, pilot project license or license. This will allow for the start of coordinated efforts to review the project.
>
> • They will agree upon a schedule for processing applications as early as possible. The schedule will include specific milestones for FERC and Oregon to complete their respective processes. They also will encourage other federal agencies and stakeholders to comply with the schedules.
>
> • They, along with the prospective applicant and other participants, will work together to identify potential issues, and to determine what information is needed and what studies must be conducted to permit the Commission and Oregon to undertake required reviews of proposed projects.
>
> • Oregon intends to prepare a comprehensive plan for the siting of wave energy projects in state waters off the coast of Oregon. FERC agrees to consider, to what extent, proposed projects are consistent with the plan.
>
> • Any pilot project license or other license issued by FERC must include conditions to protect and mitigate potential damage to fish and wildlife resources.[49]

45 *Id.* at 4-5.

46 *Id.* at 3-1, 3-2.

47 Press Release, FERC, FERC, Oregon Sign Memorandum of Understanding for Wave Energy Projects (Mar. 27, 2008), http://www.ferc.gov/news/news-releases/2008/2008-1/03-27-08.asp.

48 *Id.*

49 *Id.*

On May 23, 2008, Douglas County filed with FERC a notice of intent and preliminary application document in support of its prospective full license application for an oscillating water column device near Winchester Bay that is expected to generate 3 MW.[50] Unlike floating hydrokinetic devices,[51] such as buoys, the Douglas County oscillating water column device is stationary and built into the existing structure of a jetty.[52]

50 Notice of Intent and Preliminary Application Document, Douglas County Wave & Tidal Energy Project, FERC No. 12743, at 2 (May 23, 2008), *available at* http://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=11691067.

51 The range of energy efficiency of current technologies varies from fifty percent to ninety-five percent, with the latter degree of efficiency reported by Oregon State University's Wave Energy Linear Test Bed at the generation level of nineteen kilowatts. Oregon State University, Wave Energy Opportunities and Developments, at slide 9, http://eecs.oregonstate.edu/wesrf/ (follow "Wave Energy Presentation" hyperlink).

The four main technologies being tested are (1) point absorbers (such as those designed by Ocean Power Technologies and Finavera Renewables), (2) oscillating water column devices (such as the ones designed by Oceanlinx, formerly Energetech), (3) the wave attenuator (such as the Pelamis), and (4) a device that captures energy as waves overtop the device (such as the Wave Dragon). *Id.* at slide 6. An additional type of device does not float off the coast, but instead is imbedded in the shoreline (as on a jetty) and from a stationary position captures waves in a high-energy location and converts their kinetic motion to electricity. *See, e.g.*, Wavegen, Wave Energy Wave Power, http://www.wavegen.co.uk (last visited May 5, 2009).

52 Notice of Intent and Preliminary Application Document, *supra* note 50, at 5.

As of this writing, the following wave energy preliminary permits (and one license) have been issued.

FERC Project No.	Location	Company	Filed	Issued	Power
P-12713	Reedsport, OR	OPT, Inc.	3/29/2006	2/16/2007	50 MW
P-12749	Coos Bay, OR	Wave Partners	3/27/2006	3/9/2007	100 MW
P-12743	Douglas County, OR	Douglas County	6/15/2006	4/6/2007	3 MW
P-12752	Coos County, OR	Aqua Energy	4/17/2006	4/26/2007	100 MW
P-12751	Makah Bay, WA	Finavera[53]	11/6/2006	12/21/2007	1 MW (LIC.)
P-12779	Humboldt County, CA	PG&E	2/27/2007	3/13/2008	5-40 MW
P-12781	Mendocino County, CA	PG&E	2/27/2007	3/13/2008	5-40 MW
P-13047	Tillamook County, OR	OR CWE	10/1/2007	5/22/2008	20-180 MW
P-13075	Centerville, CA	CA WEP	11/9/2007	6/27/2008	20 MW
P-13058	Grays Harbor, WA	WA WC	11/5/2007	7/31/2008	45 MW
P-12750	Newport, OR	OR WEP II	11/2/2006	1/29/2009[54]	100 MW

53 During the writing of this paper, Finavera announced that it would cease wave energy activities and turn fully to wind, its main business. Mendo Coast Current, http://mendocoastcurrent.wordpress.com/2009/02/06/finavera-sinks-their-own-wave-energy-projects/.

54 FERC granted the permit for the Newport project on January 29, 2009. Susan Chambers, *Feds OK Wave Energy at Newport*, WORLD (Or.), Feb. 3, 2009, http://www.theworldlink.com/articles/2009/02/03/news/doc4988bc32a417894263916.txt. However, OPT stated that they would withdraw the permit, citing projects that are higher priorities. E-mail from Kaety Hildenbrand, Oregon Sea Grant, to Holly V. Campbell (Feb. 4, 2008) (on file with author) ("OPT is in the process of withdrawing from the Newport site. We remain committed to responsible development of wave power off the Oregon coast and feel this is best served by focusing on Reedsport and Coos Bay. We will circulate a formal announcement once we complete the withdrawal process with FERC.").

As of this writing, the following wave energy preliminary permits are pending.

FERC Project No.	Location	Company	Filed	Issued	Power
P-13052	San Luis Obispo, CA	Greenwave	10/19/2007	Pending	5 MW
P-13053	Mendocino, CA	Greenwave	10/19/2007	Pending	5 MW
P-13308	San Francisco Ocean Energy Project	Gray's Harbor Ocean Energy Company	10/22/2008	Pending	100 MW
P-13309	Ventura Ocean Energy Project	Gray's Harbor Ocean Energy Company	10/22/2008	Pending	100 MW

During the spring and summer of 2008, the U.S. Department of Energy (DOE) initiated a request for proposals to foster research partnerships between ocean energy developers and the public sector, including universities. It is through such federal support of innovation that renewable energy will reach peak development and application.[55] In September 2008, Oregon State University received funding ($1.25 million, renewable for up to five years) from the DOE to establish a national wave energy test center in Newport, Oregon.[56] The purposes of the new Northwest National Marine Renewable Energy Center include testing various device designs (for both wave and tidal energy) and obtaining data on environmental effects.[57]

II
JURISDICTIONS AND THE LEGAL LANDSCAPE

Coastal and ocean waters and the lands beneath them are not subject to private ownership. They are held in trust for the public under a common law doctrine as old as the Institutes of Justinian (Roman law) which continued through the English common law and was inherited by the United States when it became a nation. The

55 Sanya Carleyolsen, *Tangled in the Wires: An Assessment of the Existing U.S. Renewable Energy Legal Framework*, 46 NAT. RESOURCES J. 759, 790 (2006).

56 Press Release, Or. State Univ., Oregon Selected for Northwest Marine Renewable Energy Center (Sept. 18, 2008), http://oregonstate.edu/dept/ncs/newsarch/2008/Sep08/waves.html; *see also* Oregon State University, *supra*, note 51, at slide 27.

57 Oregon State University, *supra* note 51, at slide 2.

public trust is based on the common sharing by all people of air, running water, and the sea and its shore.[58] The early republic granted the coastal lands and waters to the first thirteen American colonies to hold in trust for their citizens.[59] As new states joined the Union, they were granted identical rights and privileges as the first thirteen under the Equal Footing Doctrine.[60] The traditional triad of rights of the public in trust lands and waters are navigation, commerce, and fishing.[61] States' management of their coastal lands and waters takes place subject to the U.S. Constitution and the public trust interest.[62] In effect, state waters are managed collaboratively among the state and federal governments. The public trust requires the managers to balance different marine uses that are beneficial to the public and requires consideration not just for the present population but for future generations as well.[63]

The operation of the federal interest in managing the public trust can be most easily seen in the federal navigation servitude over navigable waters, which is derived from the Commerce Clause of the Constitution.[64] Two major examples of federal management are the management of the U.S. Army Corps of Engineers' jurisdiction and duties regarding navigable waters under the Rivers and Harbors and Clean Water Acts and the National Marine Fisheries Service's management duties. Within the three-mile coastal zone (and within nine miles in Florida and Texas), states may lease out submerged lands and adjacent area waters for various purposes such as fishing, oystering, and other aquaculture,[65] but the private property interest that results (the lease itself) is always subject to the state's duty to the public as trustee.[66] Were the states to abdicate their trust

58 J.B. Ruhl & James Salzman, *Ecosystem Services and the Public Trust Doctrine: Working Change from Within*, 15 SOUTHEASTERN ENVTL. L.J. 223, 224 (2006).

59 Shively v. Bowlby, 152 U.S. 1, 16 (1894).

60 Pollard v. Hagan, 44 U.S. 212, 216 (1845).

61 *See* Arnold v. Mundy, 6 N.J.L. 1, 9 (1821).

62 *See* George P. Smith II & Michael W. Sweeney, *The Public Trust Doctrine and Natural Law: Emanations Within a Penumbra*, 33 B.C. ENVTL. AFF. L. REV. 307, 314–21 (2006); Charles F. Wilkinson, *The Headwaters of the Public Trust: Some Thoughts on the Source and Scope of the Traditional Doctrine*, 19 ENVTL. L. 425, 453–64 (1989) (discussing state management of coastal lands and water).

63 Gail Osherenko, *New Discourses on Ocean Governance: Understanding Property Rights and the Public Trust*, 21 J. ENVTL. L. & LITIG. 317, 366–67 (2006).

64 U.S. CONST. art. I, § 8, cl. 3.

65 43 U.S.C. § 1301(b) (2006).

66 Ill. Cent. R.R. Co. v. Illinois, 146 U.S. 387, 450–51 (1892).

responsibilities in state waters, the federal trust would still hold. From the three-mile line out to the two-hundred-nautical-mile exclusive economic zone boundary, the ocean and seabed are arguably held in trust for the people by the sovereign, the U.S. government.[67]

Whether literally true in the legal sense or popularly ascribed, the public trust character of the ocean has infiltrated not only the public's imagination but also that of the authors of the U.S. Ocean Commission's 2004 landmark report. In describing the ocean region beyond state waters, the Commission wrote:

> This area, which extends from 3 to 200 nautical miles offshore, contains an enormous diversity of resources, many of which are used or affected by human activities. Within federal waters, the United States has sovereign rights for the purpose of exploring, exploiting, conserving, and managing the living and nonliving natural resources of the seabed and subsoil and the surface and subsurface of the waters. The federal government also has jurisdiction over the establishment and use of artificial structures, islands, and installations that have economic purposes, and the protection and preservation of the ocean environment. Associated with these authorities is the federal government's responsibility *to ensure that ocean activities are managed for the benefit of the public*.[68]

Stand on almost any beach in America and look seaward; the view may seem open and uncomplicated. However, upon close inspection of a map of uses and jurisdictions such as the one found on the website of Oregon's Department of Land Conservation and Development, one might be struck by how complex and systematic

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67 *See* Biliana Cicin-Sain & Robert W. Knecht, *The Problem of Governance of U.S. Ocean Resources and the New Exclusive Economic Zone*, 15 OCEAN DEV. & INT'L. L. 289 (1985); Casey Jarman, *The Public Trust Doctrine in the Exclusive Economic Zone*, 65 OR. L. REV. 1 (1986). Some legal scholars are skeptical regarding whether the ocean beyond three miles may technically be characterized as held in the public trust due to the historic details of the annexation of the exclusive economic zone and the fact that formal extension of the public trust to these lands and waters has not taken place via the Supreme Court. Arguably, however, our laws (for example the Outer Continental Shelf Lands Act and the Magnuson-Stevens Fisheries Conservation Act) require, in letter and spirit, management of resources on behalf of the American people within a conceptual framework that strongly resembles that of the public trust, regardless of whether it is labeled as such. *See, e.g.*, 43 U.S.C. § 1332(3) (2006).

68 U.S. COMM'N ON OCEAN POLICY, AN OCEAN BLUEPRINT FOR THE 21ST CENTURY 98 (2004) (emphasis added), *available at* http://oceancommission.gov/documents/full_color_rpt/000_ocean_full_report.pdf.

our ocean governance is.[69] As beneficiaries of the lands and waters held in trust on our behalf, we enjoy the freedom of recreation and fishing. We also enjoy the products that come from the sea; we have a need for the fisheries managed on our behalf both as a food and an economic resource. Regarding the presence of energy installations, some states have oil and gas platforms off their continental shelves. However, Oregon and Washington do not.[70]

While Oregon enjoys clean hydropower (comprising about seventy percent of its energy annually),[71] it is like many states where energy is produced in geographically remote locations (in this case, eastern Oregon) far from the urban centers (western Oregon) where the energy is primarily consumed, causing high transmission costs. One of the attractions of wave energy in Oregon is its ability to help supplement the energy grid within easy reach of the coast to population centers such as Portland. Moreover, the highest levels of energy harnessed from waves off the coast occur in winter, corresponding to the highest energy consumption.

Hydrokinetic energy developers will need to work with a variety of government entities in order to develop off the coast of Oregon. The jurisdiction is determined according to geography and activity. States manage the seabed within three nautical miles under the Submerged Lands Act.[72] However, activities involving the construction or placement of objects in the nation's navigable waters are overseen under the Rivers and Harbors Act[73] and the Clean Water Act[74] by the

69 OR. DEPT. OF LAND CONSERVATION & DEV., AGENCY PROGRAMS AND AUTHORITIES IN OREGON'S TERRITORIAL SEA AND OCEAN SHORE, http://www.oregon.gov/LCD/OCMP/docs/Ocean/OP_agncy-diag.pdf (last visited May 5, 2009).

70 Following the Santa Barbara oil spill in January 1969, California tried a number of strategies to ban oil and gas leasing and finally succeeded in obtaining a congressional moratorium on drilling in 1982. James Lima, Minerals Mgmt. Serv., Presentation at the Social and Economic Planning Conference (Aug. 24, 1999), *available at* http://www.mms.gov/itd/files/pc.pdf. On September 18, 2006, California, Oregon, and Washington banded together via the West Coast Governors' Agreement on Ocean Health and put in place a moratorium on OCS leases. CHRISTINE GREGOIRE, THEODORE R. KULONGOSKI & ARNOLD A. SCHWARZENEGGER, WEST COAST GOVERNORS' AGREEMENT ON OCEAN HEALTH (2006), *available at* http://westcoastoceans.gov/docs/WCOceanAgreementp6.pdf.

71 U.S. Dep't of Energy, State of Oregon, *supra* note 12.

72 43 U.S.C § 1312 (2006).

73 33 U.S.C. § 401 (2006).

74 33 U.S.C. § 1344 (2006).

U.S. Army Corps of Engineers as well as by the U.S. Coast Guard.[75] For example, in order to lay the cable that will bring the power ashore, the developer will work with the two entities that protect and govern activities that involve the seabed, the Oregon Department of State Lands and the Corps. The developer will also need to satisfy the Coastal Zone Management Act's federal consistency requirements[76] and the Clean Water Act's water quality certification requirements.[77]

Thus, multiple permits are necessary before putting a project in the water.[78] FERC is the main federal energy agency that oversees wave energy permitting and licensure. On March 17, 2009, the previous dispute regarding jurisdiction on the outer continental shelf (OCS) between FERC and the Minerals Management Service (MMS), which manages offshore oil, gas, and wind energy,[79] was resolved by the two agency heads.[80] Congress delegated authority to FERC almost ninety years ago in the Federal Power Act.[81] FERC is an independent regulatory agency comprised of a chairman and four other commissioners who are appointed by the President and confirmed by the Senate.[82] Originally known as the Federal Power Commission, FERC was established in 1920 to provide federal coordination of hydroelectric power.[83] FERC's scope of authority has grown to

75 One of the U.S. Coast Guard's missions is to maintain safe navigation by making sure that obstructions in the ocean are properly marked for mariners (using specific lighting, sonar, or other technologies).

76 16 U.S.C. § 1456(c)(1) (2006).

77 33 U.S.C. § 1341.

78 At the author's last count (for another research project), for the purposes of wave energy involvement, there are nine possible federal agencies administering up to nineteen different United States laws, with many agency jurisdictions overlapping. In many cases on the Pacific Coast, there is the legal requirement to consult with the region's affected tribal governments. Notably, the U.S. Oceans Commission's count of federal authorities dedicated to some aspect of marine affairs included forty-six different bureaus within an umbrella group of fifteen main agencies or cabinet-level offices. These authorities are of course in addition to those within each applicable coastal state. U.S. COMM'N ON OCEAN POLICY, *supra* note 68.

79 Minerals Management Service, U.S. Department of Interior, About the MMS, http://www.mms.gov/aboutmms/ (last visited May 5, 2009).

80 Edward Felker, *Infighting Knocks Wind from Energy Plans*, WASH. TIMES, Mar. 12, 2009, at A01; *see also* Stephen Power, *Accord Opens Doors for Rules on Offshore Energy*, WALL ST. J., Mar. 17, 2009, at A4.

81 16 U.S.C. § 792 (2006).

82 FERC, Commission Members, http://www.ferc.gov/about/com-mem.asp (last visited May 5, 2009).

83 FERC, Students' Corner, History of FERC, http://www.ferc.gov/students/whatisferc/history.htm (last visited May 5, 2009).

include oversight of electric power, natural gas and oil pipelines, and hydroelectric projects, including hydrokinetic.[84] FERC's mission is to regulate and "oversee[ ] energy industries in the economic, environmental, and safety interests of the American public."[85]

The U.S. Department of Interior interpreted language in the Energy Policy Act of 2005 to grant exclusive authority over energy installations on the OCS to the MMS (one of Interior's bureaus); yet, the Act contained the phrase that nothing in the law disturbed preexisting jurisdiction under other statutory authorities.[86] Despite months of work during early 2008 by the MMS and FERC on a draft memorandum of understanding regarding the issue, negotiations broke down in late spring. Citing the Energy Policy Act of 2005, the MMS contested FERC's jurisdiction in the three- to twelve-nautical-mile zone and issued a notice of proposed rulemaking for a future lease program for hydrokinetics on the OCS.[87] In April 2008, the Department of Interior requested rehearing of two FERC preliminary hydrokinetic permits for Pacific Gas and Electric wave energy project sites that straddled the three-nautical-mile line in California waters.[88] On October 16, 2008, FERC issued an order asserting jurisdiction out to the two-hundred-mile U.S. Exclusive Economic Zone.[89] On November 3, 2008, the U.S. Department of Interior filed a notice of intervention and protest regarding the Commission's assertion.[90] The controversy was resolved by FERC taking primary jurisdiction over hydrokinetic energy and the MMS taking primary jurisdiction over wind energy on the OCS.

84 *Id.*

85 FERC, About FERC, http://www.ferc.gov/about/about.asp (last visited May 5, 2009).

86 *See* 16 U.S.C. §§ 797(e), 817 (granting FERC jurisdiction over navigable waters); Energy Policy Act of 2005 § 388, 43 U.S.C. § 1337(9) (2006).

87 Alternative Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf, 73 Fed. Reg. 39,376 (July 9, 2008).

88 *See* Pac. Gas & Elec. Co., 125 F.E.R.C. ¶ 61,045, at 1, 30 (2008) (order on rehearing).

89 *Id.* at 1–2. Basically, the Commission's assertion rests on two interpretations of the Federal Power Act regarding the OCS lands as "reservations" and the waters out to the exclusive economic zone as "navigable waters." *Id.*

90 Notice of Intervention and Protest of the U.S. Department of the Interior, Ocean Renewable Power Co., FERC Nos. P-12498, P-12500 (Nov. 3, 2008), *available at* http://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=11845881. As of January 26, 2009, the MMS itself filed a protest before FERC. *See* Protest of the Minerals Management Service, Grays Harbor Ocean Energy Co., FERC Nos. P-13306 to P-13312 (Jan. 26, 2009), *available at* http://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=11913894.

Perhaps the MMS-FERC jurisdiction dispute points to another opportunity. The two agencies' strengths and expertise are quite complementary. If we were to engage in a sustained national discussion of energy policy and design an integrated, modern framework for energy, alternative energy in particular, we might make far more efficient use of our financial and human resources. State and federal agencies should collaborate to devise coordinated, unified policies and a solid strategy capable of promoting action instead of reaction. Several scholars and observers have called for such a framework.[91] One suggestion has been to elect a single agency system, which sounds attractive and resonates with the U.S. Oceans Commission's 2004 recommendation for a National Ocean Council.[92] However, because of the cost, difficulty of implementation (overhauling multiple federal agencies' missions), and territorial, "turf" politics, a single energy agency might not realistically be expected anytime soon. What is more plausible in the short term is an adaptable, flexible single permit that is administered collaboratively by the agencies that are required to sign off on a project. Like the universal environmental impact statement of the National Environmental Policy Act, the permit could be procedurally grounded in the Council on Environmental Quality. The collaborating agency representatives could file, review, and sign off on the permit online, with their comments. Such a project would be available online full-time and supported by a listserv of all participating parties. The permit conditions would be assigned in a single phase, by agreement of the parties after thorough discussion, and resemble a contract with provisions. Each development would be visible online, just as every step in a FERC docket is now.[93] In instances where there was a cluster of similar projects in a small region, the projects could be reviewed together in a single review stream.

The concept of a single permit, in which all federal regulators participated, including the Coastal Zone Management Act federal consistency review with the affected state(s), would perhaps be an innovative experiment approaching the U.S. Ocean Commission's recommendation for greater coordination. In the following excerpt, the authors might as well have been referring to ocean energy:

91 Carleyolsen, *supra* note 55, at 765.

92 U.S. COMM'N ON OCEAN POLICY, *supra* note 68, at 78–82.

93 One way of achieving this is an online meeting and document service. *See* Cisco WebEx, www.webex.com (last visited May 5, 2009).

> The challenge for policy makers will be to unlock the ocean's potential while minimizing conflicts among users, safeguarding human and marine health and cultural resources, and fulfilling the federal government's obligation to manage public resources for the maximum long-term benefit of the entire nation.
>
> While legal, policy, and institutional frameworks exist for managing some ocean uses, there remain increasingly unacceptable gaps. The nation needs a coordinated offshore management regime that encompasses traditional and emerging uses and is adaptable enough to incorporate uses not yet clearly foreseen.[94]

FERC's system for regulating hydrokinetic projects has been adapted from its long experience with conventional hydropower. The process begins when a developer applies for a preliminary permit to test a pilot hydrokinetic project.[95] FERC applies a strict scrutiny standard of review of preliminary permits.[96] The preliminary permit maintains priority of application for three years during which the developer conducts feasibility studies and pre-license filing activities.[97] The preliminary permit does not authorize construction and projects may be tested but not connected to the power grid.[98]

A subsequent FERC license authorizes project construction and operation.[99] FERC requires that all licenses conform to the relevant state comprehensive plan for developing a waterway for beneficial public purposes.[100] Beneficial public purposes may include providing power or providing protection, mitigation, and enhancement of fish and wildlife. Thus, the FERC licensing process confers deference to the state with regard to its own local planning and methods.[101] FERC is required to give equal consideration to both power and

94 U.S. COMM'N ON OCEAN POLICY, *supra* note 68, at 98.

95 FERC, Hydropower—Industry Activities, http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/energy-pilot.asp (last visited May 5, 2009).

96 *See* Reedsport OPT Wave Park, LLC, 118 F.E.R.C. ¶ 61,118 (2007) (order issuing preliminary permit).

97 FERC, Hydropower—Licensing, http://www.ferc.gov/industries/hydropower/gen-info/licensing/pre-permits.asp (last visited May 5, 2009).

98 Preliminary Permits for Wave, Current, and Instream New Technology Hydropower Projects, 118 F.E.R.C. ¶ 61,112 (2007) (notice of inquiry and interim statement of policy).

99 *Id.*

100 Federal Power Act, 16 U.S.C. §§ 797(e), 803(a)(1) (2006); *see also* FERC State and Federal Comprehensive Plans Policy, 18 C.F.R. § 2.19 (2008).

101 It is important to note that the initial, but crucial, decision regarding the precise ocean location for the project siting is one for the state to determine in consultation with coastal communities, environmental scientists, and affected stakeholders such as fishermen.

environmental values.[102] A developer may apply for a license for up to fifty years, followed by a relicense for up to another fifty years.[103] There are three types of licenses available: a traditional, an integrated, and an alternative license.[104] The default is the integrated license, which frontloads cross-agency and stakeholder environmental considerations early in the process (beginning with the study determination phase) so parties more quickly agree on which studies may be necessary.[105]

In general, regardless of license type, prefiling planning and activities take up to three years, during which the project proponent submits a notice of intent and a pre-application document that contain information about the project.[106] During this stage, public meetings take place and a study plan is developed and implemented. After the public meetings, the actual license application is drawn up and submitted. The license application contains the proposed project description and mitigation measures. The post-filing stage takes up to one and one-half years. FERC reviews the application and opens it to public comment. Following this step, FERC prepares an environmental document and accepts public comment on that document. Finally, FERC makes a decision as to whether to authorize the project; if it does, the Commission issues an order for a new license. The license for a hydrokinetic project will likely be conditioned upon the developer receiving all other necessary permits (from the Corps, from the state water quality agency, and so forth).

After the order is issued, post-license monitoring of the project begins. To a developer, the process might seem protracted. But from the standpoint of a fifty-year license and given FERC's safety responsibilities and dedication to environmental and public interests, the time frame may be considered reasonable. Investors should appreciate that a methodical licensing process also reduces risk.

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102 16 U.S.C. §§ 797(e), 803(a)(1); *see also* 18 C.F.R. § 2.19.

103 FERC, HANDBOOK FOR HYDROELECTRIC PROJECT LICENSING AND 5 MW EXEMPTIONS FROM LICENSING 1-1 (2004), http://www.ferc.gov/industries/hydropower/gen-info/handbooks/licensing_handbook.pdf [hereinafter FERC, HANDBOOK]. The length of time for a permit is flexible and is not required to be fifty years. Wave energy may necessitate shorter permits. *See* FERC, LICENSING HYDROKINETIC PILOT PROJECTS FAQS 4 (2008), http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/pdf/white_paper.pdf.

104 FERC, HANDBOOK, *supra* note 103, at 1–3.

105 *Id.* at 3-1 n.5.

106 *Id.* at 3-1.

III
APPLYING EMERGING CONCEPTS FOR MARINE SPATIAL PLANNING

One way that FERC tries to help states develop projects that are consistent with their own state planning goals and priorities is to give strong deference to state comprehensive plans at the outset of licensing.[107] For example, the State of Oregon's memorandum of understanding with FERC mentions a comprehensive plan.[108] Oregon has a group of well-established, enforceable ocean and coastal statutes, including the Territorial Sea Plan[109] and Statewide Planning Goal 19: Ocean Resources,[110] as well as the Rules Governing the Placement of Ocean Energy Conversion Devices On, In or Over State-Owned Land Within the Territorial Sea.[111] In early 2008, Oregon Governor Ted Kulongoski tasked the Department of Land Conservation and Development, Oregon's planning and coastal management agency, with coordinating a comprehensive plan.[112] The Department is amending the Territorial Sea Plan to accommodate new uses such as marine reserves and wave energy installations.[113] Proposed projects that are inconsistent with a state's comprehensive plan have little chance of being accepted by FERC.[114]

In order to arrive at a comprehensive plan for coastal waters, states will need to consider all existing uses off of their coasts. Once again, this requires collaborative efforts between states and multiple federal agencies, including the National Oceanic and Atmospheric Administration, the National Marine Fisheries Service, the U.S. Coast Guard, the U.S. Navy, and the U.S. Army Corps of Engineers, as well

107 16 U.S.C. §§ 797(e), 803(a)(1); *see also* 18 C.F.R § 2.19.

108 Memorandum of Understanding Between FERC and the State of Oregon (Mar. 26, 2008), *available at* http://www.ferc.gov/legal/maj-ord-reg/mou/mou-or-final.pdf.

109 OR. REV. STAT. § 196.471 (2008).

110 OR. ADMIN. R. 660-015-0010 (2009).

111 OR. ADMIN. R. 141-140-0010 (2007).

112 Exec. Order No. 08-07, 47 Or. Bull. 5, 6 (Mar. 26, 2008) (directing state agencies to protect coastal communities in siting marine reserves and wave energy projects); *see also* Memorandum of Understanding Between FERC and the State of Oregon, *supra* note 108.

113 Memorandum from Paul Klarin, Senior Policy Analyst, Or. Dep't of Land Conservation & Dev., to Bob Bailey, Manager, Or. Dep't of Land Conservation & Dev. (Oct. 6, 2008), *available at* http://www.oregon.gov/LCD/docs/rulemaking/101508/Item8_terr_sea_plan_amend_process.pdf.

114 *See* 16 U.S.C. §§ 797(e), 803(a)(1) (2006); FERC State and Federal Comprehensive Plans Policy, 18 C.F.R § 2.19 (2008).

as various port authorities. Comprehensive planning is one way to anticipate and prevent spatial conflicts. Further, it is akin to zoning and marries ecosystem management with public trust principles.[115] Of course, states can influence federal permits for nonfederal projects in state coastal waters utilizing section 307 of the Coastal Zone Management Act.[116]

Widening the scope from more familiar traditional comprehensive planning is the innovative concept of marine spatial planning. It is a place-based method for achieving the goals of ecosystem-based management by more concretely and proactively matching spaces to uses.[117] As one commentator stated:

> Concepts regarding both integrated and ecosystem-based management are often too broad, too abstract and too complex for resource managers to enable effective implementation.
>
> Ecosystem-based management is place- or area-based in focusing on a specific ecosystem and the range of activities affecting it. This emphasis . . . is a marked departure from existing approaches that usually focus on a single species, sector, activity or concern. Where *sectoral management* implies that each sector regulates particular *activities* or projects *taking place at a particular location* (or site) within a certain area, the *management of areas* implies that, after a certain area has been defined, sustainable development and use will be established for *all activities in the whole area*.[118]

This foresight might be difficult to achieve under the pressure of existing and would-be new uses and the political urgency that often accompanies the quest for resources like energy, including alternative

115 Richard G. Hildreth, *Place-Based Ocean Management: Emerging U.S. Law and Practice*, 51 OCEAN & COASTAL MGMT. 659–80 (2008); *see also* Elliot A. Norse, *Ending the Range Wars on the Last Frontier: Zoning the Sea*, *in* MARINE CONSERVATION BIOLOGY: THE SCIENCE OF MAINTAINING THE SEA'S BIODIVERSITY 422 (Elliott A. Norse & Larry B. Crowder eds., 2005); Jeremy Firestone et al., *Regulating Offshore Wind Power and Aquaculture: Messages from Land and Sea*, 14 CORNELL J.L. & PUB. POL'Y 71 (2004); Deborah A. Sivas & Margaret R. Caldwell, *A New Vision for California Ocean Governance: Comprehensive Ecosystem-Based Marine Zoning*, 27 STAN. ENVTL. L.J. 209 (2008); Professor Richard G. Hildreth, Dir., Ocean and Coastal Law Ctr., Univ. of Or. Sch. of Law, Ocean Zoning: Implications for Wave Energy Development (WED), Keynote Address at the Oregon State University Workshop: Ecological Effects of Wave Energy Development in the Pacific Northwest (Oct. 11, 2007).

116 16 U.S.C. § 1456(c)(3)(B)(ii)–(iii) (2006).

117 *See* Fanny Douvere, *The Importance of Marine Spatial Planning in Advancing Ecosystem-Based Sea Use Management*, 32 MARINE POL'Y 762, 763–64 (2008) (citation omitted).

118 *Id.*

energy. However, the success of our era will be judged by whether we were willing to try new tools that might require the kind of slowing down and engagement in serious assessment that marine spatial planning implies. A catch phrase at recent Oregon wave energy conferences encourages regulators and coastal communities alike to "go slow in order to go fast," meaning that we should do our research first in order to lay the proper foundation to get the larger enterprise right.

The ability to accurately site a wave energy device or large wave park and notify the world of its precise location are crucial tasks. The Federal Geographic Data Committee of the Marine Boundary Working Group, a group of representatives from fifteen different agencies, is presently at work on a long-term, state-of-the-art computerized GIS mapping system of all U.S. coastal waters. This system, the Multipurpose Marine Cadastre, is specified in the Energy Policy Act of 2005, although the Marine Boundary Working Group has been together since 2001.[119] The Cadastre is a nascent "one-stop" data portal that will promote integrated approaches to legal and geospatial descriptions of marine boundaries in a standardized format.[120] You can make your own custom maps by selecting only the data you wish to review. Data you may look at currently include offshore energy, shipping lanes, bathymetric data, and National Park Service coastal and marine park units that contain submerged lands. The group is working to gain higher resolution of very small areas within the states' coastal waters.

At a time when many coastal states are striving to find resources to conduct basic seafloor mapping and obtain other baseline data for their waters, the Cadastre is an ambitious project with vast practical applications. It is a powerful example of the benefits of using resource sharing to solve problems. The data currently available, as well as the data that will increasingly become available through the Cadastre, will benefit states conducting energy facility siting in creating comprehensive energy-use plans, including emergency planning.

119 NOAA Coastal Services Center, FGDC Marine Boundary Working Group, http://www.csc.noaa.gov/mbwg (last visited May 5, 2009).

120 NOAA Coastal Services Center, FGDC Marine Boundary Working Group, U.S. Marine Cadastre, http://www.csc.noaa.gov/mbwg/htm/cadastre.htm (last visited May 5, 2009).

IV
CONCLUSION: CHALLENGES AHEAD

The main challenges hydrokinetic developers face are the risks inherent in the development and deployment of this technology and the difficulty in finding investors not averse to that risk. In the second half of 2008, Congress renewed popular tax incentives for renewable energy just as Wall Street had record breaking plunges due to sell-offs. Credit was very tight and, in the face of monumental challenges, the nation prepared to usher in a new president and his administration. At the end of 2008, the financial news did not seem conducive to encouraging mega-investment in an industry that carries an above-average risk. And yet, the nation is undoubtedly concerned with global warming and the need to reduce and offset carbon emissions. It is clear we must change course, and diversification of the energy sector could prove to be an economic stimulus. One of the initiatives discussed proposes a renewal of our national infrastructure. In addition to the oft-discussed restoration of bridges, surely energy infrastructure renewal, beginning with replacing aged and less efficient transmission lines, is high on the list of needs.

The main challenge for state and federal regulators is the need for establishing coherent, reliable, and defensible environmental data for all stages of planning: pre-project, during testing and build-out, and post-project. Because the results of modeling can be refined with real data inputs, it is only through cooperation with the scientific community that answers will begin to emerge. Studies and results will take time. In an ideal world, seafloor mapping would be accomplished well ahead of project siting. However, there is no reason that scientific studies cannot take place simultaneously with test device deployments.

As enticing as the prospects for wave energy are, we have learned that nothing is free. Until independent, systematic, longer duration environmental studies of wave energy are completed, early stage analogs (where they exist) may be useful from offshore wind, tidal, and current studies. In order to begin to comprehend wave energy environmental impacts and their synergistic and cumulative effects, a conference of scientists from a spectrum of relevant marine fields came together in the autumn of 2007 at Hatfield Marine Science

Center in Newport, Oregon.[121] Scientists at the workshop envisioned a model process whereby the ecological effects would be studied during the single device test phases and at each stage forward, through full-scale deployment.[122] Pursuing a combined gathering of data with regulatory monitoring throughout the lifespan of each facility could substantially raise cost effectiveness for industry and regulators, with science and the public as the ultimate beneficiaries. Such a combination would lower risk and aid in preventing harm to the environment, the facility, or both, based on a risk assessment model employed by the EPA.[123]

Oregon State University has already undertaken initial studies of gray whale migration patterns to determine the areas most used by resident populations.[124] However, wave energy extraction on a massive commercial scale could impact larger geologic and geophysical systems on larger time scales than those with which we have experience. Monitoring for sand scouring, beach erosion, changes in current structure and velocity, and dynamic interconnections with the food web (such as migrations) will need to be carefully designed so that we gain data on as many scales as possible. For example, effects such as erosion could take place in a wider geographic area than originally targeted for monitoring—miles away from the wave devices' location. Because the ocean is a naturally vast and dynamic environment, this is no small undertaking. Predictions for global climate change include a sea level rise that may

121 NAT'L MARINE FISHERIES SERV. & NAT'L OCEANIC & ATMOSPHERIC ADMIN., U.S. DEP'T OF COMMERCE, ECOLOGICAL EFFECTS OF WAVE ENERGY DEVELOPMENT IN THE PACIFIC NORTHWEST (George W. Boehlert et al. eds., 2008), *available at* http://spo.nmfs.noaa.gov/tm/Wave%20Energy%20NOAATM92%20for%20web.pdf.

122 The U.S. Department of Energy's office of Energy Efficiency and Renewable Energy is about to release its own report to Congress in late 2008 or early 2009. *See* Wind & Hydropower Technologies Program, http://www.eere.energy.gov/windandhydro/hydro_about.html (last visited May 5, 2009) ("DOE is currently preparing a Report to Congress on the environmental impacts of marine and hydrokinetic technologies, as described in the Energy Security and Independence Act of 2007."). In addition, the International Energy Agency is working with the DOE, FERC, and the MMS to undertake a similar effort at understanding environmental effects. *See* IEA Ocean Energy Systems, Collaborative Annexes, http://www.iea-oceans.org/tasks.asp?id=4 (last visited May 5, 2009).

123 OFFICE OF THE SCI. ADVISOR, EPA, RISK ASSESSMENT PRINCIPLES & PRACTICES (2004), *available at* http://www.epa.gov/OSA/pdfs/ratf-final.pdf.

124 JOEL G. ORTEGA-ORTIZ & BRUCE R. MATE, DISTRIBUTION AND MOVEMENT PATTERNS OF GRAY WHALES MIGRATING BY OREGON (forthcoming 2009) (report submitted to the Oregon Wave Energy Trust in October 2008 by the Marine Mammal Institute, Oregon State University).

significantly alter the U.S. coastline. We must take great precautions so we do not inadvertently amplify effects. No one person, group, or agency has the scope of imagination or expertise necessary to meet the challenges we face. Only by working together and networking tightly, both nationally and internationally, can we achieve success in harnessing ocean energy and other environmental possibilities we have not yet conceived. Law and policy can lead by putting people and resources together faster.[125]

Trying to isolate environmental impacts, determine cumulative impacts, and feed them into a decision-making stream is going to be difficult. Oregon and FERC both have rules requiring decommissioning of a project if it begins to produce significant environmental damage.[126] But consider for a moment whether this is one wave device, a dozen, or two hundred? Given the storms and enormous wave heights off of our coast, wave energy companies will have reasons other than environmental damage to decommission a device. If an entire coastal state with a three-hundred-mile coastline possesses one salvage engineer and one salvage vessel and seas are rough, how immediately would decommissioning occur? What does monitoring mean, unless by unmanned technologies? In regard to shifting baselines, can we tell the effects of global climate change from damage potentially done by changing the energy regimes off of the coast? Once we get used to having the megawatts from ocean power, will we lightly give them up even if there is a compelling reason? If all goes well, how long will it take the developer and its investors to realize a return on their effort and investment? These are only a few questions that seem natural to ask. If we openly ask them and discuss them now, we will be prepared to meet the unique opportunities of our singular moment in history; in fact, we might even make history.

125 *See* Michelle Portman, *Involving the Public in the Impact Assessment of Offshore Renewable Energy Facilities*, 33 MARINE POL'Y 332 (2008); DOE, Marine and Hydrokinetic Technology Database, http://www.eere.energy.gov/windandhydro/hydrokinetic/default.aspx (last visited May 5, 2009). Ideally, the process should unfold from the ground level (citizens) through to top energy agencies.

126 OR. ADMIN. R. 141-140-0010 (2007); *see also* Policy Statement on Conditioned Licenses for Hydrokinetic Projects, 121 F.E.R.C. ¶ 61,221 (2007), *available at* http://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=11516612 ("Staff proposed that licenses include a standard condition requiring project alteration or shutdown in the event that there was an unacceptable level of environmental effect.").