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Is Marine Renewable Energy a Viable Industry in the United States? Lessons Learned from the 7th Marine Law Symposium

Megan Higgins*

The 7th Marine Law Symposium entitled *A Viable Marine Renewable Energy Industry: Solutions to Legal, Economic, and Policy Challenges*, explored the means to achieve a viable marine renewable energy industry for the United States with a focus on offshore wind, hydrokinetics, and ocean thermal energy conversion. The challenges facing the emerging offshore renewable energy industry in the United States include jurisdictional issues, various permitting and licensing schemes, limited financial incentives, the pace and availability of funding for research and development, and concerns regarding environmental and human community impacts.

This paper introduces ocean renewable energy technologies and reviews the current challenges for the siting, regulation, and implementation of these technologies in the United States as identified by the Symposium participants. Other challenges not identified by the Symposium participants, such as protecting and advancing Public Trust rights and responsibilities of siting in-water structures and uses, are not within the scope of this article.[1]

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* Research Counsel, Rhode Island Sea Grant Legal Program and Marine Affairs Institute at Roger Williams University School of Law. For more information on the 7th Marine Law Symposium *see* http://law.rwu.edu/sites/marineaffairs/symposia/seventhMLS.aspx. For general information on marine renewable energy *see* Appendix A: Resources on Marine Renewable Energy Projects.

1. See, *e.g.*, Mary Turnipseed, et al., *The Silver Anniversary of the United States' Exclusive Economic Zone: Twenty-Five Years of Ocean Use and*

INTRODUCTION

According to the Intergovernmental Panel on Climate Change (IPCC), international scientists concur that carbon dioxide emissions are causing and will continue to cause global warming.[2] The IPCC also stated it is "unequivocal"[3] that most of the warming in recent decades can be attributed to "human activities [which] result in emissions of four principal greenhouse gases: carbon dioxide, methane, nitrous oxide and the halocarbons (a group of gases containing fluorine, chlorine and bromine)."[4] Primarily, "[c]arbon dioxide has increased from fossil fuel use in transportation, building heating and cooling, and the manufacture of cement and other goods."[5] Due to the effects of global climate change and volatile energy prices there is greater attention on renewable energy in the United States. Traditional sources, such as coal, oil, and natural gas, are finite, and political leaders are promoting "alternative" energy to achieve energy independence for the future of national economic stability and security.

Of the various sources of renewable energy, hydroelectric generation (through the damming or other alteration or

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Abuse, and the Possibility of a Blue Water Public Trust Doctrine, 36 ECOLOGY L. Q. 1 (2009).

2. Intergovernmental Panel on Climate Change (IPCC), *Third Assessment Report, Climate Change 2001: Synthesis Report, Summary for Policymakers, 4,* http://www.ipcc.ch/ipccreports/tar/vol4/english/pdf/spm.pdf (last visited Apr. 22, 2009).

3. *See id.* at 5 ("There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities."); *see generally* Intergovernmental Panel on Climate Change (IPCC), *Contribution of Working Group I to the Fourth Assessment Report of the IPCC, Climate Change 2007 – The Physical Science Basis, Summary for Policymakers,* at 3, http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1=spm.pdf (last visited Apr. 22, 2009) ("The understanding of anthropogenic warming and cooling influences on climate has improved since the TAR [Third Assessment Report], leading to *very high confidence* [levels of confidence have been used to express expert judgments on the correctness of the underlying science: *very high confidence* represents at least a 9 out of 10 chance of being correct] that the global average net effect of human activities since 1750 has been one of the warming").

4. Intergovernmental Panel on Climate Change (IPCC), *Working Group I: The Physical Science Basis of Climate Change, Frequently Asked Questions,* http://ipcc-wg1.ucar.edu/wg1/FAQ/wg1_faq-2.1.html (last visited Apr. 22, 2009).

5. *Id.*

harnessing of waterway flows), burning of crop fuels, and landfill gas have historically seen wide use and are often the most cost-effective renewable option, but their future growth potential is limited due to site or fuel availability or environmental constraints. Wind is a well proven technology but also one that continues to see technological improvement. As a result of this continuous improvement and the numerous development opportunities, wind has been the fastest growing source of energy in the world since 1990 and is generally considered a "mainstream" renewable source of energy as opposed to an "alternative" source.[6] Solar and marine hydrokinetics (wave, current, and tidal) and ocean thermal energy conversion technologies[7] are less developed, but a growing interest in expanded use of renewable energy is driving rapid technology development and manufacturing capacity growth of these technologies.

Similarly, offshore wind technology began to be developed approximately twenty-five years ago as European nations sought greater wind capacity in the face of limited land-based resources. Today, Europe has over 30 offshore wind installations in operation, consisting of 611 turbines, for a total installed capacity of 1,480 MW and the rate of installation is increasing rapidly.[8]

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6. U.S. Dep't. of Energy, Energy Efficiency and Renewable Energy - Distributed Energy Program, http://www.eere.energy.gov/de/wind_power.html (last visited Apr. 22, 2009) [hereinafter *U.S. DOE Distributed Energy Program*].

7. *See* Edward P. Meyers, et al., THE POTENTIAL IMPACT OF OCEAN THERMAL ENERGY CONVERSION (OTEC) ON FISHERIES, (1986), *available at* http://spo.nwr.noaa.gov/tr40opt.pdf (Ocean thermal energy conversion (OTEC) uses the difference in temperature between warm ocean surface waters and cold deep ocean waters to produce electricity. If a difference of ~ 40° F exists between warm and cold water, net power can be generated. There are three types of OTEC projects: (1) **Closed-cycle** — warm surface water causes a working fluid (*e.g.*, ammonia, which boils at -28°F at atmospheric pressure) to turn to vapor, driving a turbine attached to a generator producing electricity. Cold deep water passing through condenser turns the vaporized working fluid back into a liquid, which is recycled through the system; (2) **Open-cycle** — warm surface water itself is the working fluid. The vapor loses its salt and is condensed back to liquid by exposure to cold deep water. The condensed water can be used for drinking water, irrigation or aquaculture; and (3) **Hybrid** systems use parts of both open- and closed-cycle systems).

8. Wind Service Holland, http://home.planet.nl/~windsh/offshore.html (last visited Apr. 22, 2009); Steve Sawyer, Secretary General, Offshore Wind

Over the last five to ten years, offshore wind has received growing attention in the United States where, while there are substantial land-based wind development opportunities in many areas, there are large population centers (*i.e.* coastal cities) that could presumably be well served by offshore wind and otherwise have few opportunities to make use of other renewable sources.

A comprehensive and efficient regulatory framework to permit marine renewable energy projects is crucial if these nascent technologies are to continue to be developed and deployed in the United States. One example of a planning model that has been implemented successfully in the United Kingdom is by the Crown Estate, who owns the seabed out to 12nm and leases submerged land for wind farm development in furtherance of the European Union's goal of 20% renewable energy production by 2020.[9] The Crown Estate established a steering group - Collaborative Offshore Wind Research into the Environment (COWRIE) - comprised of offshore wind industry members and conservations agencies, whose function is to prioritize and identify research projects and administer a trust established with money contributed by successful developers.[10]

In accordance with the Energy Policy Act of 2005, the

Council, Address at the Roger Williams University School of Law 7th Marine Law Symposium (Oct. 24, 2008), *Offshore Wind: Pioneering a New Industry*, PowerPoint presentation *available at* http://law.rwu.edu/sites/marineaffairs/content/pdf/Steve_Sawyer.pdf; *see also* Appendix B: International Renewable Energy Figures.

9. *See* Dr. Carolyn Heeps, Fred. Olsen Renewables Ltd., Address at the 7th Marine Law Symposium (Oct. 23, 2008). *U.K. Regulation: Challenges, Risks and Lessons*, PowerPoint presentation *available at* http://law.rwu.edu/sites/marineaffairs/content/pdf/Carolyn_Heeps.pdf (referring to the EU target of 20% of the EU's energy from renewable sources by 2020). This target is outlined in the forthcoming "*UK Renewable Energy Strategy 2009.*" Department for Business Enterprise and Regulatory Reform, UK Renewable Energy Strategy Consultation, http://www.berr.gov.uk/consultations/page46797.html (last visited May 25, 2009).

10. The Crown Estate, COWRIE: Collaborative Offshore Wind Research into the Environment, http://www.thecrownestate.co.uk/cowrie (last visited Apr. 18, 2009). For more information on marine spatial planning initiatives in the U.K., visit The Department of Energy & Climate Change, Strategic Environmental Assessment (SEA): U.K. Public Consultation for Offshore Energy Licensing—Wind Power, http://www.offshore-sea.org.uk/site/scripts/category_info.php?categoryID=23 (last visited May 16, 2009).

Department of the Interior's Minerals Management Service (MMS) finalized a much anticipated framework for renewable energy production on the U.S. Outer Continental Shelf (OCS), "Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf."[11] The rule was published in the Federal Register on April 22, 2009 and will be finalized on June 29, 2009.[12] Prior to finalizing the rule, the MMS prepared a lengthy Final Environmental Assessment (EA) analyzing and assessing any impacts of the rule. The rule establishes a "program to grant leases, easements, and rights-of-way (ROW) for renewable energy project activities on the Outer Continental Shelf (OCS), as well as certain previously unauthorized activities that involve the alternate use of existing facilities located on the OCS."[13] Additionally, the framework establishes the methods by which revenues (generated by the Program issued leases) will be shared with the affected coastal states located near the offshore projects.[14] While it remains to be seen how this recent national policy will be implemented, federal agencies, such as the MMS, Federal Energy Regulatory Commission (FERC), U.S. Army Corps of Engineers (USACE), the National Oceanic and Atmospheric Administration (NOAA), and U.S. Coast Guard (USCG), have been addressing the issue with increasing attention.

Meanwhile, some U.S. coastal states have implemented or are considering policies to support development of offshore renewable energy (*e.g.*, Delaware and New Jersey), and some states have undertaken marine spatial planning that is driven in large part by the desire to regulate these projects in an effective manner (*e.g.*, New York, Rhode Island, and Massachusetts). In some instances, states are working closely with Federal agencies to streamline the permitting process.[15]

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11. Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf, 74 FED. REG. 19638 (April 29, 2009) (to be codified at 30 C.F.R. pts. 250, 285, 290) *available at* http://www.mms.gov/offshore/AlternativeEnergy/PDFs/AD30RenewableEnergy04-22-09.pdf.

12. *Id.*

13. *Id.*

14. Renewable Energy and Alternate Uses, *supra* note 12; 30 CFR §§ 285.540-285.543 (where eligible states share 27% of the revenues for a qualified project).

15. Robert LaBelle, Deputy Associate Director, Offshore Minerals

OCEAN RENEWABLE ENERGY TECHNOLOGIES

A. Offshore Wind

Offshore wind turbines harness the kinetic energy of air moving over oceans and convert it to electricity.[16] Offshore winds are typically less turbulent than those onshore, allowing the turbine to harvest the energy more effectively. Offshore winds also tend to flow at higher speeds than nearby onshore winds and these two factors allow offshore turbines to produce more electricity than onshore turbines in the same region.[17] Wind farms consist of multiple turbines that are sited to minimize turbulence created by nearby turbines, while also minimizing installation costs. Until recently, technology limited the installation of offshore wind turbines to water depths of about 70 feet using driven monopole installation, limiting installations to distances no greater than 20 miles from shore.[18] Shallow water projects were developed first, but projects in deeper water are viable contingent on a commitment to the development and improvement of new technology.

The world's first offshore wind farm was built in 1991, off the coast of Vindeby, Denmark.[19] The European Union (EU) has set a goal of 12% of its energy from renewable sources by 2010 and 20% renewable energy by 2020; given the current trends, 12-16% of global electricity generated by wind is expected by 2020.[20]

Management Service, Address at the Roger Williams University School of Law 7th Marine Law Symposium (Oct. 24, 2008), *Alternative Energy on the Outer Continental Shelf*, PowerPoint presentation *available at* http://law.rwu.edu/sites/marineaffairs/content/pdf/Robert_LaBelle.pdf.

16. American Wind Energy Association, http://www.awea.org/faq/wwt_basics.html (last visited Apr. 22, 2009).

17. American Wind Energy Association, http://www.awea.org/faq/wwt_offshore.html (last visited Apr. 22, 2009).

18. Chris Brown, former CEO of Deepwater Wind, Address at the Roger Williams University School of Law 7th Marine Law Symposium 7 (Oct. 23, 2008), *A Viable Marine Renewable Energy Industry: Solutions to Legal, Economic and Policy Challenges*, PowerPoint presentation *available at* http://law.rwu.edu/sites/marineaffairs/content/pdf/Chris_Brown.pdf.

19. *See* Danish Wind Energy Association, http://www.windpower.org/en/pictures/offshore.htm (last visited Apr. 22, 2009).

20. Sawyer, *supra* note 9 (noting that the largest development of offshore wind for at least the next five years will be in the U.K.).

Internationally, wind energy has seen a growth of 25% over the last seven years and one projection is for the capability of providing 30% of the world's electricity by the middle of the century.[21] There is further potential in areas within the North Sea, Baltic Sea, and Irish Sea due to shallow waters, high wind speeds, and location near the energy load. Furthermore, these sites are surrounded by countries with high energy use and active environmental policy.[22] Other new markets currently being pursued include Holland, Denmark, Belgium, France, Ireland, Chile, Brazil, and South Africa.[23]

In the United States, the viability of wind energy has been proven on land but no current functional offshore wind facilities exist.[24] North America has been identified as having the greatest offshore wind power potential, particularly within the shallow waters off the east coast from Massachusetts to North Carolina, where the average potential resource is approximately four times the total energy demand.[25] The area off of the east coast is "one of the most urbanized, densely populated and highest-electricity consuming regions of the world;"[26] a total of twenty-eight coastal states use 78% of electricity in the United States.[27]

The U.S. could install up to 70,000 MW of wind generating capacity by 2025, with slightly more than 10% of that potential available using current technology in federal waters.[28] To date,

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21. Global Wind Energy Council and Greenpeace International, Global Wind Energy Outlook 2008, http://www.gwec.net/index.php?id=30&no_cache=1&tx_ttnews[tt_news]=168&tx_ttnews[backPid]=4&cHash=1d5ff1e0e7 (last visited May 26, 2009).

22. *Id.*

23. Taylor Roark, Mainstream Renewable Power, Address at the Roger Williams University School of Law 7th Marine Law Symposium (Oct. 24, 2008), *Offshore Wind: An International Perspective*, PowerPoint presentation *available at* http://law.rwu.edu/sites/marineaffairs/content/pdf/Roark.pdf.

24. *See* Energy Information Administration, http://www.eia.doe.gov/fuelrenewable.html (last visited May 26, 2009) (Currently, the U.S. produces 7% of its energy from renewable resources with wind energy accounting for less than 1% of total energy consumed).

25. *Id.* citing Kempton, W., et al, "Large CO_2 Reductions via Offshore Wind Power Matched to Inherent Storage in Energy End Uses," Geophys. Res. Lett., 34, L02817, doi:10.1029/ (2007).

26. *Id.*

27. *U.S. DOE Distributed Energy Program*, *supra* note 6.

28. Minerals Mgmt. Serv., Renewable Energy and Alternate Use Program, U.S. Dep't of the Interior, *Technology White Paper on Wind Energy Potential on the U.S. Outer Continental Shelf*, 3 (2006)

there are well developed proposals for offshore wind projects off the coasts of Delaware, Massachusetts, New Jersey, New York, and Rhode Island.[29] Earlier stage development or conceptual proposals have been made for the coasts of Texas, Georgia, Washington, and in the Great Lakes region.

Whether a project is located within state or federal waters, or both, presents different regulatory issues for permitting offshore wind projects. For example, the Cape Wind Energy Project, located exclusively in federal waters off Massachusetts (except for the underground electric transmission lines through Massachusetts waters which the Massachusetts Energy Facilities Siting Board will review and permit), needs to comply with primarily federal law. Projects proposed exclusively for state waters, such as those off of Galveston, Texas, will face compliance requirements with state law, but may also be subject to federal regulation. Projects that may include both federal and state jurisdiction, such as those considered off Rhode Island[30] and New Jersey, present a complicated grouping of both state and federal authorities.

Potential environmental impacts from marine wind power facilities include noise and vibrations from construction and operational activities; alterations to benthic habitats and associated effects on living marine resources; and possible impacts on bats, birds, and marine mammals caused by additional light, noise, and sediment disturbance. The impacts may be direct or may result in behavioral changes such as changes to migration or feeding patterns. Other potential impacts include interference with other maritime uses, such as commercial shipping, fishing, recreational boating, and aesthetic impacts on existing vistas, as well as potential impacts to submerged historic properties and structures.

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http://ocsenergy.anl.gov/documents/docs/OCS_EIS_WhitePaper_Wind.pdf (last visited May 17, 2009).

29. Willett Kempton, Director, Center for Carbon-Free Power Integration, College of Marine and Earth Studies, University of Delaware, Address at the Roger Williams University School of Law 7th Marine Law Symposium (Oct. 23, 2008), *A Viable Marine Renewable Energy Industry: Introduction*, PowerPoint presentation *available at* http://law.rwu.edu/sites/marineaffairs/content/pdf/Willett_Kempton.pdf.

30. C. Eugene Emery Jr., *R.I. offshore wind farm to be first in nation*, PROVIDENCE J.-BULL., Jan. 9, 2009, at C1, *available at* 2009 WLNR 466211.

B. Hydrokinetics

Hydrokinetics include wave, ocean current, and tidal energy projects. Wave energy projects convert energy from the motion of ocean waves while ocean current and tidal technologies convert energy from the motion of ocean currents or tides using submerged turbines. The highly predictable or stable nature of tides and currents may create additional value for these technologies relative to less predictable wind and wave sources.

Hydrokinetic projects are in early stages of development both nationally and internationally, with at least eighty different devices being tested and deployed globally as of 2007.[31] Wave energy projects capture wave energy by various technologies, including point absorbers, oscillating water columns, overtopping terminators, and attenuators that vary in size, anchoring, spacing, interconnection, array patterns, and depth limitations.[32] Offshore wave energy potential is estimated to be 250-260 TWh/year given 15% resource use, while tidal and ocean current is estimated to be half that amount.[33] The Electric Power Research Institute (EPRI) estimates hydrokinetic projects have the potential to meet 10% of national demand.[34]

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31. Ed Feo and Marco McClees. *The Emergence of a New Contender*, 2 North American Clean Energy 4, http://www.milbank.com/NR/rdonlyres/3674C7D9-8FB9-4AF6-97B9672638357E2F/0/NACE_Milbank_Issue_2_No_4.pdf (last visited May 25, 2009).

32. For an overview of marine renewable energy technologies and projects, *see* George Hagerman, Virginia Tech Advanced Research Institute, Oceanographer, EPRI Ocean Energy Team, Director of Research, Virginia Coastal Energy Research Consortium, Address at the Global Marine Renewable Energy Conference (Apr. 17, 2008), *U.S. Marine Renewable Energy Resource Potential and Technology Status*, PowerPoint presentation *available at* http://www.globalmarinerenewable.com/presentations/GMREC_ExecOverview_Pres01_Hagerman17Apr2008.pdf.

33. Roger Bedard, Electric Research Power Institute, *Overview of Wave and Current Energy: Resource, Technology, Environmental and Business Issues*, Address at Alternative Energy 2007: Seizing Opportunity in an Expanding Energy Marketplace, Conference at LSU Center for Energy Studies 3 (2007) PowerPoint presentation *available at* http://www.enrg.lsu.edu/Conferences/altenergy2007/bedard.pdf.

34. Roger Bedard et al., North American Ocean Energy Status – March 2007 (2007), Address at the 7th European Wave and Tidal Energy Conference, PowerPoint presentation *available at*http://oceanenergy.epri.com/attachments/ocean/reports/7th_EWTEC_Paper_FINAL_071707.pdf).

C. Federal Power Act

To obtain sufficient property rights to site a wave or tidal project on the Outer Continental Shelf (OCS),[35] a developer must obtain a lease from MMS. However, MMS' authority only extends to federal waters beyond the 3-mile limit (9 miles for Texas, Puerto Rico and the Gulf coast of Florida). FERC acknowledges MMS's authority in federal waters, but has maintained that wave and tidal developers outside the 3-mile limit also need a license from FERC and can comply with both regimes by: first, obtaining a lease from MMS and subsequently, obtaining a license from FERC.[36] A recently issued Memorandum of Understanding signed by both FERC and MMS delineates both federal agencies' regulatory authority[37] which is further outlined by the final rule.[38]

FERC states that it has power to license wave and tidal projects located less than 12 miles from shore (or fifteen miles for states abutting the Gulf of Mexico).[39] Pursuant to the Federal Power Act (FPA), FERC is authorized to issue preliminary permits and licenses for hydropower projects in two situations: first, when the project is located on waters (navigable or non-navigable) over which Congress has jurisdiction under its authority to regulate interstate commerce and, second, when the project is located on

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35. 43 U.S.C.A. § 1331(a) (West 2009) (the term "outer Continental Shelf" means all submerged lands lying seaward" of state coastal waters (3-miles offshore) which are under U.S. jurisdiction).

36. Federal Energy Regulatory Commission, Licensing Hydrokinetic Pilot Projects, (2008) http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/pdf/white_paper.pdf (last visited May 26, 2009); *see also* Hon. Jon Wellinghoff, James Pederson, and David L. Morenoff, Facilitating Hydrokinetic Energy Development Through Regulatory Innovation, 29 ENERGY L. J. 397 (2008) *available at* http://www.eba-net.org/docs/elj292/397_-_hydrokinetics-clean_final_print_11-3-08.pdf?PHPSESSID=be01eb09f2c104b551fea63831db6004.

37. Memorandum of Understanding Between the U.S. Department of the Interior and Federal Energy Regulatory Commission (Apr. 9, 2009) *available at* http://www.mms.gov/offshore/AlternativeEnergy/PDFs/DOI_FERC_MOU.pdf.

38. Renewable Energy and Alternate Uses, *supra* note 11.

39. 16 U.S.C.A. § 796(8) (West 2009) ("'navigable waters' means those parts of streams or other bodies of water over which Congress has jurisdiction under its authority to regulate commerce with foreign nations and among the several States ...").

federal lands.[40] The FPA authorizes FERC to issue licenses for the purpose of constructing, operating, and maintaining hydroelectric projects "for the development, transmission, and utilization of power across, along, from, or in any streams or other bodies of water over which Congress has jurisdiction under" the Commerce Clause.[41] However, FERC's authority for wave/tidal licenses out to the 12-mile limit conflicts with the legislative history of the FPA. According to the United States Supreme Court, the FPA's legislative history "conclusively demonstrates" a congressional intent to regulate only hydroelectric generating facilities.[42] Furthermore, FERC analysis of wave/tidal projects conflicts with FERC's own definition: "[h]ydroelectricity generation begins at a *dam* where the power plant converts the force of falling water into electricity."[43]

One example of a jurisdictional conflict over wave and tidal projects occurred on December 21, 2007 when FERC issued the nation's first conditional hydrokinetic license to AquaEnergy Group Ltd, an Ocean Energy division of Finavera Renewables [hereinafter Finavera], for a 4-buoy wave energy pilot project (Makah Bay Offshore Wave Energy Pilot Project) off Washington State in the Olympic Coast National Marine Sanctuary.[44] Finavera filed its original declaration of intent to FERC in 2002 for its 1.0-megawatt (MW) wave project asserting that the project was exempt from the regulatory provisions of the FPA primarily

40. 16 U.S.C.A. § 817(1) (West 2009) ("It shall be unlawful for any person, State, or municipality, for the purpose of developing electric power, to construct, operate or maintain any dam...reservoir, power house or other works...across...any of the **navigable waters of the United States,** or upon any part of the public lands or **reservations of the United States**...except under and in accordance with the terms of a permit or valid existing right-of-way...or a license [issued by FERC]") (emphasis added).

41. 16 U.S.C.A. § 797(e) (West 2009).

42. Chemehuevi Tribe of Indians v. Fed. Power Comm'n, 420 U.S. 395, 401 (1975).

43. Fed. Energy Regulatory Comm'n, *What is hydropower?*, http://www.ferc.gov/students/energyweregulate/whatishydro.htm (last visited May 26, 2009).

44. Fed. Energy Regulatory Comm'n, 121 FERC ¶ 61,288, Order Issuing Conditioned Original License (December 21, 2007) *available at* http://www.ferc.gov/whats-new/comm-meet/2007/122007/H-1.pdf (AquaEnergy, Ltd. changed its name to Finavera Renewables Ocean Energy, Ltd. or "Finavera").

due to its location and "providing locally generated electricity."[45]

FERC found that the project, located approximately three miles offshore in the Olympic Coast National Marine Sanctuary did require a license because FERC had licensing authority over such "navigable waters" as defined by Section 3(8) of the FPA. Moreover, FERC held that the scope of its power over wave and tidal power went beyond the traditional 3-mile limit of navigable waters applied by other agencies (such as the U.S. Army Corps of Engineers) and extended 12-miles out, to the limits of the territorial sea. Lastly, by relying on FPA § 23(b)(1), FERC determined that the wave project satisfied the definition of a "hydroelectric project" by finding that the project buoys operated as a "powerhouse" because it housed a generator.[46]

In January 2007, MMS protested the Makah Bay Ocean Wave Energy pilot project license stating that the jurisdictional authority of the FPA does not extend to projects located outside the traditional 3-mile boundary, FERC overstepped its jurisdiction, and the project did not fit within the meaning of the FPA.[47] The FPA provides for cooperation between FERC and other federal agencies, including resource agencies, in licensing and relicensing power projects.[48]

To alleviate jurisdictional conflict, encourage cooperation between the federal agencies, and promote the development of offshore renewable energy projects, FERC and MMS executed a memorandum of understanding (MOU) regarding jurisdiction over renewable energy projects on the OCS.[49] The MOU outlining the agreement between FERC and MMS recognized that (1) the Interior's authority pursuant to the EPAct of 2005 does not weaken the responsibilities of other agencies with regard to

45. *See* Fed. Energy Regulatory Comm'n., 102 FERC ¶ 61,242, Order Denying Rehearing *available at* http://www.his.com/~israel/loce/fercdec.pdf [hereinafter *Order Denying Rehearing*]

46. Renewables Offshore, MMS-FERC Jurisdictional Smackdown!, http://carolynelefant1.typepad.com/renewablesoffshore/2007/02/mmsferc_juri sdi.html (last visited May 26, 2009); *Order Denying Rehearing*, *supra* note 45. Note: Finavera surrendered its license in April 2009.

47. Minerals Management Service, *Protest of the United States Minerals Management Service* filed in *AquaEnergy Group Ltd.*, FERC Docket P-12752-000 (January 30, 2007).

48. 16 U.S.C.A §797(c) (West 2009).

49. Memorandum of Understanding, *supra* note 37.

issuing licenses for hydrokinetic projects on the OCS; (2) MMS has exclusive jurisdiction to issue leases for non-hydrokinetic projects on the OCS; (3) FERC has the statutory responsibility to oversee the development of hydrokinetic projects in navigable waters, pursuant to FPA; and (4) FERC will issues licenses and exemptions for hydropower projects offshore (using procedures developed for hydropower licenses and with the active involvement of relevant federal agencies, including MMS).[50] The regulatory framework should better inform both agencies regarding the licensing and leasing of offshore renewable energy projects on the OCS.[51]

LEGAL ISSUES IDENTIFIED AT THE 7TH MARINE LAW SYMPOSIUM FOR INCREASED ENERGY DEVELOPMENT IN THE OCEAN[52]

A. Jurisdiction and Permitting Challenges

In general, marine renewable energy projects are considered on a case-by-case basis, with the proposed location and project type determining which regulatory regime(s) apply. An applicant may need a license or permit from FERC, MMS, USACE, Environmental Protection Agency, NOAA, and various state environmental and energy agencies, depending upon project location.[53] For many of the marine alternative energy projects, applicants would also need a USACE permit under Section 10 of the Rivers and Harbors Act of 1899 for the placement of structures in the water, as well as a state water quality certification, pursuant to Section 401 of the Clean Water Act.[54] A better

50. *Id.*

51. Federal Energy Regulatory Comm'n, *FERC asserts jurisdiction over Outer Continental Shelf Hydroelectric Projects*, Oct. 16, 2008, http://www.ferc.gov/news/news-releases/2008/2008-4/10-16-08-h-2.asp (last visited Feb. 20, 2008).

52. Other legal issues, such as the varied jurisprudence and financial incentives of each state in relation to proposed federal in-water facilities, do exist and are beyond the scope of this article.

53. *See generally* Department of the Interior, Minerals Management Service, Cape Wind Energy Project Final EIS 54-62 (2009) http://www.mms.gov/offshore/AlternativeEnergy/PDFs/FEIS/Cape%20Wind%20Energy%20Project%20FEIS.pdf (last visited May 26, 2009).

54. *Id.*

coordinated legal and regulatory framework is necessary to expedite the permitting process.

Along with licenses and permits issued by the various agencies, a project must comply with other applicable laws, such as environmental review under the National Environmental Policy Act (NEPA). Consultations or permits may also be required under the Endangered Species Act, Magnuson-Stevens Fishery Conservation and Management Act, Marine Mammal Protection Act, National Marine Sanctuaries Act, the Ocean Thermal Energy Conversion Act, the Fish and Wildlife Coordination Act, and the Migratory Bird Treaty Act. U.S. Coast Guard and Federal Aviation Administration regulations regarding navigation and airspace issues may also apply.[55]

States may also have the opportunity to review federal projects under the Coastal Zone Management Act's (CZMA) federal consistency provision. An activity is subject to the consistency provision if it will "directly, indirectly, or cumulatively affect any natural resources, land uses, or water uses in the coastal zone."[56] Section 307 of the CZMA requires that federal actions be consistent with enforceable policies of a State's federally-approved coastal zone management program if effects to any land or water use or natural resource of the State's coastal zone are reasonably foreseeable.[57] States vary tremendously in their readiness to differ with federal agency decisions, and many states require that their "federal consistency statement" be the last approval obtained for a proposed project, which makes the permitting project a challenge for project proponents with limited funds available for permitting and planning.

B. Licensing Agencies and Statutory Authority

Regulatory authority for the siting, development, and decommissioning of renewable ocean energy projects is complex, and, only until recently, has been made more comprehensible. Prior to 2005, there was no clear statement of authority for issuing such permits. NOAA had licensing authority for OTEC projects (and still does), but for projects in federal waters, the

55. *Id.*
56. 16 U.S.C.A § 1456(c)(1)(A) (West 2009).
57. 16 U.S.C.A. § 1456 (West 2009); 15 C.F.R. pt. 930 (2009).

principal federal authorization was a Section 10 permit under the Rivers and Harbors Act of 1899 by the USACE. In 1980, discrete authority was given to NOAA for licensing the construction, ownership, location and commercial operation of OTEC plants under the Ocean Thermal Energy Conversion Act.[58] However, in 1996, no OTEC license applications had been received, so in order to meet the directive that all agencies eliminate or modify obsolete regulations, NOAA repealed the OTEC licensing regulations and eliminated the OTEC office.[59]

In 2005, Congress amended Section 8(p) of the Outer Continental Shelf Lands Act, 43 U.S.C. §§ 1331 et seq, in the Energy Policy Act of 2005, giving MMS authority to issue a lease, easement, or right-of-way on the OCS for the production, transportation or transmission of energy from sources other than oil and gas, except for certain protected areas, including national marine sanctuaries.[60] In response to this directive, MMS developed and proposed an Alternative Energy and Alternative Use (AEAU) Program. In November, 2007, MMS issued its "Final Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf" (Final Programmatic EIS) pursuant to NEPA.[61] The Final Programmatic EIS analyzed the environmental impacts of the new AEAU program over the next 5-7 years. In addition, this document focused on wind, wave,

58. Ocean Thermal Energy Conversion Act, 42 U.S.C.A §§ 9101-9168 (West 2009).

59. Written Testimony of Timothy R.E. Keeney, Deputy Assistant Secretary for Oceans and Atmosphere, National Oceanic and Atmospheric Administration, U.S. Department Of Commerce, Legislative Hearing on H.R. 2337: Energy Policy Reform and Revitalization Act of 2007 (May 23, 2007) *available at* www.ogc.doc.gov/ogc/legreg/testimon/110f/keeney0523.doc.

60. Energy Policy Act of 2005, 42 U.S.C.A. § 15801, Pub. L. No. 109–58, (2005).

61. *See generally* Minerals Management Service, Offshore Alternative Energy Programs, The Role of MMS in Alternative Energy, http://www.mms.gov/offshore/AlternativeEnergy/index.htm (last visited May 27, 2009); Minerals Management Service, Renewable Energy Program, Program Overview, http://www.mms.gov/offshore/AlternativeEnergy/PDFs/AEPFactSheet.pdf (last visited May 27, 2009); NEPA requires the cooperating federal agency to undertake an EA or EIS in the case of any "major Federal actions significantly affecting the quality of the human environment" 42 U.S.C.S. § 4332(C).

and ocean current energy projects, describing the state of the art for these technologies, the environment in which they might be implemented, and the resulting environmental impacts.[62] Notably, a site-specific NEPA review will still be required for each proposed offshore project.

The program (known as the "Preferred Alternative" in the Final Programmatic EIS) established two stages. First, during an interim period between the Final Programmatic EIS and the promulgation of a Final Rule governing AEAU projects, MMS was able to issue leases, easements, and rights-of-way on a case-by-case basis. In its Record of Decision for the Final Programmatic EIS, MMS outlined an Interim Policy that provides for coordination with other federal and state agencies. Additionally, MMS describes a number of Best Management Practices that may be used as initial mitigation measures. In January 2008, after a public comment period, MMS adopted an Interim Policy that allows limited alternative energy leases for five years for data collection facilities to assess offshore energy resources, or for the purpose of testing alternative energy technology. The final rule has been promulgated; MMS will issue leases, easements, and rights-of-way for alternative energy and alternate use projects on the OCS in accordance with this set of new, comprehensive regulations.[63] The rule establishes processes for MMS to monitor the project through the lease period and for decommissioning the site if the project comes to termination.[64]

Another authority is that of FERC. As described previously, FERC is the principal federal agency for issuing licenses for all non-federal hydroelectric projects under the Federal Power Act, 16 U.S.C. §§ 791a, et seq. To date, FERC has granted one license on December 21, 2007, to Finavera Renewables Ocean Energy, Ltd. for the Makah Bay Wave Energy Project, located about 1.9

62. OCS Alternative Energy and Alternative Use Programmatic EIS Information Center, *Guide to the OCS Alternative Energy and Alternative Use Programmatic Environmental Impact Statement (EIS)*, http://www.ocsenergy.anl.gov/eis/guide/index.cfm (last visited June 4, 2009).

63. OCS Alternative Energy and Alternative Use Programmatic EIS Information Center, *OCS Alternative Energy Final Programmatic Environmental Impact Statement (EIS) Executive Summary*, http://www.ocsenergy.anl.gov/documents/fpeis/Alt_Energy_FPEIS_Executive Summary.pdf (last visited June 4, 2009).

64. *Id.*

nautical miles off the Washington coast in the Olympic Coast National Marine Sanctuary.[65] As of September 28, 2008, FERC has issued 111 preliminary permits (34 tidal, 9 wave, 0 ocean current, and 68 inland) and there are 93 pending preliminary permits (20 tidal, 4 wave, 3 ocean current, and 66 inland).[66]

A permit from the USACE is required for any work in "navigable waters" that may affect their course, condition, location or capacity. The USACE regulatory authority is given pursuant to Section 10 of the Rivers & Harbors Act of 1899 which prohibits the unauthorized obstruction or alteration of any navigable water of the U.S.[67] Section 4(f) of the Outer Continental Shelf Lands Act of 1953 extends USACE authority under Section 10 of the Rivers and Harbors Act of 1899 for fixed structures and artificial islands to include the OCS.[68] The USACE also has regulatory authority pursuant to Section 404 of the Clean Water Act (CWA) regarding the discharge of dredged or fill material below the mean high tide line within state waters.[69]

In addition to its regulatory authority under the Rivers & Harbors Act and the CWA, the USACE issued Regulatory Guidance Letter (RGL) 05-09 on December 7, 2005 to replace RGL 86-10 Special Area Management Plans (SAMP) and remains in effect to date.[70] The purpose of the RGL is to encourage the

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65. Fed. Energy Regulatory Comm'n, *FERC Allows Wave Power Project to Move Forward* (2008), http://www.ferc.gov/news/media-alerts/2008/2008-1/03-20-08-H-2-factsheet.pdf (last visited May 31, 2009).

66. Ann F. Miles, F.E.R.C., Address at the Roger Williams University School of Law 7th Marine Law Symposium (Oct. 23, 2008), *FERC's Regulatory Framework for Hydrokinetics Projects*, PowerPoint presentation *available at* http://law.rwu.edu/sites/marineaffairs/content/pdf/Ann_Miles.pdf.

67. 33 U.S.C.A. § 403; 33 U.S.C.A. § 329.4 ("navigable waters" of the United States are "those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. A determination of navigability, once made, applies laterally over the entire surface of the waterbody, and is not extinguished by later actions or events which impede or destroy navigable capacity").

68. Robert J. DeSista, Chief, Permits & Enforcement Branch, U.S. Army Corps of Engineers, Address at the Roger Williams University School of Law 7th Marine Law Symposium (Oct. 23, 2008), PowerPoint presentation *available at* http://law.rwu.edu/sites/marineaffairs/content/pdf/Robert_DeSista.pdf.

69. 33 C.F.R. pts. 320-330 (2009).

70. U.S. Army Corps of Engineers, Special Area Management Plans,

participation of district engineers in the SAMP process while reducing the problems associated with the traditional case-by-case review of projects within a geographic area of special sensitivity in both coastal and non-coastal areas. The main objective for implementing SAMPs is twofold: developmental interests may plan with predictability and environmental impacts (both individual and cumulative) are analyzed based on broad ecosystem needs.[71] According to RGL 86-10, an ideal SAMP concludes with local/state approvals and USACE general permit or abbreviated processing procedure.[72]

STATE LEVEL MARINE SPACIAL PLANNING

As described above, the regulatory framework in the United States governing ocean energy projects is still developing. It remains to be seen how the federal rule governing the siting, development, and decommissioning of offshore renewable energy projects on the OCS will be implemented by the MMS. While MMS attempted to complete and publish the final rule for permitting renewable energy projects on the OCS in a timely manner,[73] coastal states have made varying degrees of progress in

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Regulatory Guidance Letter No. 05-09 (Dec. 7, 2005), *available at* http://www.usace.army.mil/CECW/Documents/cecwo/reg/rgls/rgl05-09.pdf [hereinafter *Regulatory Guidance Letter No. 05-09*] (replacing U.S. Army Corps of Engineers, Special Area Management Plans (SAMPs); Regulatory Guidance Letter No. 86-10 (Oct. 2, 1986), *available at* http://www.usace.army.mil/CECW/Documents/cecwo/reg/rgls/rgl86-10.pdf [hereinafter *Regulatory Guidance Letter No. 86-10*]).

71. *Regulatory Guidance Letter No. 05-09, supra* note 70, at § 3(a).

72. *Regulatory Guidance Letter No. 86-10, supra* note 70, at § 4; "Regulatory Guidance Letters (RGL's) were developed by the Corps as a system to organize and track written guidance issued to its field agencies. RGL's are normally issued as a result of evolving policy; judicial decisions and changes to the Corps regulations or another agency's regulations which affect the permit program. RGL's are used only to interpret or clarify existing Regulatory Program policy, but do provide mandatory guidance to the Corps district offices. RGL's are sequentially numbered and expire on a specified date. However, unless superseded by specific provisions of subsequently issued regulations or RGL's, the guidance provided in RGL's generally remains valid after the expiration date. The Corps incorporates most of the guidance provided by RGL's whenever it revises its permit regulations." U.S. Army Corps of Engineers, Regulatory Guidance Letters, http://www.usace.army.mil/cecw/pages/rglsindx.aspx (last visited Apr. 24, 2009).

73. According to § 388(p)(8) of the Energy Policy Act of 2005, "[n]ot later

reforming state ocean management and initiating ocean planning.[74] No state or territory, to date, has zoned all of its state waters although approximately twelve states have developed plans on an area-based scale (*e.g.*, watershed) as authorized by the Coastal Zone Management Act.[75]

This discussion on state planning efforts is not intended to be comprehensive, but will focus on a few examples, namely Rhode Island, Massachusetts, New York (responsive actions, due in part, to proposals for offshore wind farms), and California.[76] Marine

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than 270 days after the date of enactment of the Energy Policy Act of 2005, the Secretary [of the Interior], in consultation with the Secretary of Defense, the Secretary of the Department in which the Coast Guard is operating, the Secretary of Commerce, heads of other relevant departments and agencies of the Federal Government, and the Governor of any affected State, shall issue any necessary regulations to carry out this subsection." The estimated date of completion for the final rule ("Renewable Energy and Alternate Uses of Existing Facilities on the OCS") was 10/28/06. Department of the Interior, Energy Policy Act of 2005 Direct Tasks and Results, 20, http://www.interior.gov/iepa/2005_results.pdf (last visited May 31, 2009).

74. *See* U.S. Offshore Wind Collaborative, *Status of U.S. Offshore Wind Development Activity by State* (2008), http://www.usowc.org/pdfs/Stateoffshorewind.pdf (last visited Feb. 20, 2009) (summarizing public sector initiatives and responses to development proposals); *see also* Mass. Tech. Collaborative, U.S. Dep't of Energy & Gen. Electric, *A Framework for Offshore Wind Energy Development in the United States 3* (2005), http://www.usowc.org/pdfs/final_09_20.pdf (last visited Feb. 20, 2009) (providing a comprehensive agenda for the development of a sustainable offshore wind industry).

75. Coastal Zone Management Act of 1972, 16 U.S.C.A. § 1452 (3) (West 2009); *see* 16 U.S.C.A. § 1453 (17) (West 2009) (definition of a "special area management plan" means a "comprehensive plan providing for natural resource protection and reasonable coastal-dependent economic growth containing a detailed and comprehensive statement of policies; standards and criteria to guide public and private uses of lands and waters; and mechanisms for timely implementation in specific geographic areas within the coastal zone").

76. *See* Fara Courtney & Jack Wiggin, OCEAN ZONING FOR THE GULF OF MAINE: A BACKGROUND PAPER 16 (2003), *available at* http://www.mass.gov/czm/oceanzoningreport.pdf (the report offers a baseline of information, to highlight key questions in the area of spatial management in the marine environment and presents sources for further investigation); see *also* Morgan Gopnik, INTEGRATED MARINE SPATIAL PLANNING IN U.S. WATERS: THE PATH FORWARD 4 & 41 (2008) *available at* http://www.massoceanaction.org/docs/Report-IntegratedMarineSpatialPlanninginUSWaters.pdf (discussing state and regional level strategies); *see generally* Blue Ribbon Panel on Dev. of Wind Turbine Facilities in Coastal Waters, STATE OF N.J. FINAL REPORT TO GOVERNOR JON S. CORZINE (2006), *available at*

spatial planning, also commonly referred to as ecosystem based management (EBM) or marine zoning, is based on the premise of "a comprehensive and integrated area-based marine governance system" and an ocean governance policy implemented by regulators who "must manage marine public trust resources in the best long-term interests of the larger community."[77]

In Rhode Island, the Ocean Special Area Management Plan (SAMP) process will develop a zoning plan for the state's waters, an effort which is being lead by the state's coastal zone management agency, the Rhode Island Coastal Resources Management Council (CRMC), with several partners providing scientific, legal, and data support, and includes a stakeholder and state and federal agency advisory bodies.[78] The Ocean SAMP is "zoning" the states waters in anticipation of future uses of offshore activities, including marine renewable energy projects among others.[79] The SAMP project investigators are collecting data within state waters (out to 3nm), as well as including a boundary area of approximately 1,547 square miles (1,168 square nautical miles), in cooperation with federal agencies in order to streamline the federal permitting process.[80] The SAMP is scheduled to be completed, after a series of stakeholder meetings, by June 2010.

Marine spatial planning in Massachusetts has been underway

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http://www.state.nj.us/njwindpanel/docs/finalwindpanelreport.pdf; N.J. Dep't of Envt'l. Prot., Div. of Science, Research & Tech., Solicitation for Research Proposals, Ocean/Wind Power Ecological Baseline Studies, http://nj.gov/globalwarming/pdf/srp-wind-ocean.pdf (last visited Feb. 20, 2009) (soliciting bids for further research under the Final Wind Panel Report); R.I. Ocean Special Area Mgmt. Plan (SAMP), What is the Ocean SAMP?, http://seagrant.gso.uri.edu/oceansamp/index.html (last visited May 31, 2009).

77. Deborah A. Sivas & Margaret R. Caldwell, *A New Vision for California Ocean Governance: Comprehensive Ecosystem-Based Marine Zoning*, 27 STAN. ENVTL. L.J. 209, 212 & 227 (2008).

78. Grover Fugate, Executive Director, Rhode Island Coastal Resources Management Council, Address at Roger Williams University School of Law the 7th Marine Law Symposium (Oct. 23, 2008), *Rhode Island Ocean SAMP*, Powerpoint presentation *available at* http://law.rwu.edu/sites/marineaffairs/content/pdf/Fugate.pdf.

79. Timothy C. Barrman, *N.J. Firm Picked to Build Rhode Island's Wind Farm*, PROV. J. BULL., Sept. 25, 2008, at A1, *available at* 2008 WLNR 18220560 (describing the marine renewable energy projects underway in Rhode Island).

80. R.I. Ocean Special Area Mgmt. Plan (SAMP), *supra* note 76.

for a number of years, beginning in 2003 with the Ocean Management Initiative, the first phase of which was the appointment of the Massachusetts Ocean Management Task Force by then Secretary of Environmental Affairs, Ellen Roy Herzfelder. The Task Force issued a report, *Waves of Change*, (completed in 2004) consisting of ocean use trends and existing governance mechanisms; recommendations for administrative, regulatory, and statutory changes; and ocean management principles that address the pace and complexity of today's opportunities and challenges.[81] The recommendations by the Task Force provided the foundation for The Oceans Act of 2008, which charged the Secretary of the Massachusetts Executive Office of Energy and Environmental Affairs to develop a comprehensive ocean management plan in eighteen months, with scientific and stakeholder input, by the summer of 2009, and the final promulgation of the plan by December 31, 2009.[82] An Ocean Advisory Commission will advise the Secretary as the Executive Office of Energy and Environmental Affairs develops the ocean plan.

As for New York, in 2006, the Ocean and Great Lakes Ecosystem Conservation Act was passed and it established the New York Ocean and Great Lakes Ecosystem Conservation Council, whose duties, among others, were to integrate EBM into existing state agencies and regional programs and launch an internet-based atlas designed to monitor the health of the state's resources.[83] The Council, chaired by the Department of Conservation Commissioner with support from the NY Department of State, takes into account environmental and human interrelationships in an effort "to chart a course for New York State to achieve healthy, productive, and resilient coastal ecosystems by coordinating State agencies and programs in implementing EBM."[84] A report was due to the Governor and the

81. Mass. Ocean Mgmt. Task Force, MASS. OFFICE OF COASTAL ZONE MGMT., WAVES OF CHANGE (2004), http://www.mass.gov/czm/oceanmanagement/waves_of_change/pdf/wavesofchange.pdf (last visited Apr. 24, 2009).

82. 2008 Mass. Acts ch. 114.

83. New York Ocean and Great Lakes Ecosystem Conservation Council, http://www.nyoglecc.org/ (last visited Apr. 18, 2009).

84. Pete Grannis & Lorraine Cortés-Vázquez, N.Y. OCEAN & GREAT LAKES ECOSYSTEM CONSERVATION COUNCIL, NEW YORK OCEAN AND GREAT LAKES COUNCIL UPDATES, (New York, N.Y.) Aug. 9, 2007, *available at*

state Legislature by November 1, 2008 but was recently submitted on April 8, 2009.[85]

No formal effort is taking place in California to plan for the development of offshore wind farms. However, in 2006 the state passed the California Ocean Protection Act which established the California Ocean Protection Council (OPC) to implement a five-year strategic plan.[86] Among other objectives, the strategic plan set goals of adopting EBM approaches by 2011 and the OPC is cooperating with other agencies on a number of ecosystem protection and management projects throughout the state.[87] A comprehensive legal and policy analysis completed by Sivas and Caldwell advocates for the "creation of a comprehensive set of zones based on long-term ecosystem health and the establishment of a system of presumptive compatible uses within those zones" in order for the state to address the future policy challenges related to ocean and coastal resources.[88]

INTEGRATION, COMMUNITY, AND FINANCIAL ISSUES

A. Integration to the Grid

Connecting to existing power grids poses challenges for the marine renewable energy industry in terms of location and capacity. The electricity generated from offshore projects must be cabled to shore. Therefore, proximity to shore stations is important both financially and environmentally. In addition, by their nature, renewable resources such as wind, wave, and tidal are variable and cannot be dispatched. A number of studies have found that the variable nature of renewable energies can be readily addressed with more accurate supply and production

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http://www.nyoglecc.org/media/OGLECC_Newsletter_2007-8-9.pdf.

85. *Id.*; Press Release, *Final Report Detailing How Best to Protect New York's Ocean and Great Lake Ecosystems Delivered to Governor and Legislature*, http://www.nyoglecc.org/media/PressRelease-ReporttoGovernor&Legislature-8April2009.pdf (last visited May 31, 2009).

86. The California Ocean Protection Act (COPA), CAL. PUB. RES. CODE §§ 35500 – 35650 (West 2009).

87. California Ocean Protection Council - Five Year Strategic Plan, Action Status 2 (2008) http://www.opc.ca.gov/webmaster/ftp/pdf/docs/0811_strategic_plan_update.pdf (last visited May 31, 2009).

88. Sivas & Caldwell, *supra* note 77 at 227.

forecasting. Such forecasting comes with modest cost, and has benefits aside from greater integration of renewable sources. As with any other generation source, renewable energy generators (and equipment in general) must meet grid voltage, frequency, and waveform purity requirements, and must be able to quickly isolate faulty equipment from the rest of the grid.[89] The wind industry appears to have adequately addressed these issues over the last five to ten years.

Grid modernization is necessary for the incorporation of greater amounts of renewable energy, for example investment in new transmission capacity and, more importantly, for a new configuration for the transmission grid (*i.e.*, Extra High Voltage (EHV) Super Highway or EHV Overlay).[90] Infusing the power grid, and ultimately the entire power system, with modern Information Technology is known as the Smart Grid concept and is also expected to play an important role in the integration of greater amounts of renewable energy.[91]

The current grid is not an efficient way to move electricity over long distances. To permit greater reliance on remotely located resources, like most renewables and new and traditional base load plants, the development of a strategy (political incentives to obtain baseline data) is necessary. Power system operations require careful balancing of supply and demand. However, a "Super Grid," a proposal to modernize the grid both geographically and operationally, and a "Smart Grid" to route electricity efficiently would promote and integrate renewable energy projects.[92]

Transmission upgrades are necessary in order to utilize renewable energy sources, yet how these upgrades are paid for can affect how energy companies are positioned in the future. Currently, companies that invest in a transmission upgrade can

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89. Hugh Outhred, et al., MEETING THE CHALLENGES OF INTEGRATING RENEWABLE ENERGY INTO COMPETITIVE ELECTRICITY INDUSTRIES 19 (2007), *available at* http://www.ferc.gov/about/com-mem/kelly/gridintegration.pdf.

90. Rahim Amerkhail, Fed. Energy Regulatory Comm'n, Address at the Roger Williams University School of Law 7th Marine Law Symposium (Oct. 23, 2008), *Grid Modernization and the Integration of Renewables*, PowerPoint presentation *available at* http://law.rwu.edu/sites/marineaffairs/content/pdf/ Rahim_Amerkhail.pdf.

91. *Id.*

92. *Id.*

ultimately be at a competitive disadvantage when another company competes with them utilizing the upgraded system. Canada and several U.S. states are discussing the creation of an upgraded transmission backbone and distributing the cost among all users to eliminate such competitive disadvantages.[93] Denmark responded to this issue by granting open and guaranteed access to the grid, requiring Transmission System Operators to finance, construct, connect, and operate the infrastructure to integrate renewables into the existing power grid.[94]

One example of improved interconnection is the California Independent System Operator Corporation (California ISO) Board of Governor's approval of a "process that will accelerate the development of generation needed to meet California's Renewables Portfolio Standard and greenhouse gas (GHG) reduction goals."[95] In response to and in support of the state's priority of reducing GHG emissions and its dependence on fossil fuels, renewable power developers are flooding the interconnection queue while the California ISO is reviewing 361 interconnection requests (totaling more than 105,000 MW) pending in the interconnection study process.[96] Of these, more than 68,000 MW are from renewable resources.[97] However, none of the renewable sources are located offshore.[98] Because renewable generation is typically located in areas with inadequate transmission infrastructure, the initial entrants are too few to fund a long-distance transmission line of sufficient capacity to capture potential new renewable energy generation.

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93. Chi-Jen Yang, Eric Williams & Jonas Monast, WIND POWER: BARRIERS AND POL'Y SOLUTIONS 10-11, 21 (2008) http://www.nicholas.duke.edu/ccpp/wind_web.pdf (last visited Feb. 20, 2009).

94. Benjamin K. Sovacool, et al., *Is the Danish Wind Energy Model Replicable for Other Countries?* 21 THE ELECTRICITY J. 2, 27-38, 30-31 (Mar. 2008).

95. Stephanie McCorkle, California *ISO Board Approves Generation Queue Reforms*, (July 10, 2008) http://www.reuters.com/article/pressRelease/idUS170320+10-Jul-2008+BW20080710 (last visited Apr. 24, 2009).

96. *Id.*

97. *Id.*

98. *Id.*; Personal communication with Clyde Loutan, California ISO (Dec. 16, 2008).

B. Human Dimension/Community Challenges

Marine renewable energy projects potentially impact local coastal communities near the project site or within the project's view shed. Some parties believe that a federal agency's NEPA analysis for a marine renewable energy project must evaluate these impacts to coastal communities.[99]

Issues raised by siting near shore marine renewable projects include aesthetics, potential decline of coastal property values, public safety, and environmental impacts. The most notable example of these concerns has been expressed by opponents of the Cape Wind Energy Project, proposed within federal waters on Horseshoe Shoal, in Nantucket Sound, off of Cape Cod, Massachusetts, where aesthetic historic preservation concerns raised by the specter of wind turbines visible from the shore has galvanized opposition to the project. This opposition has, in turn, generated equally vocal support for the project, creating a politically charged situation that has extended beyond the one project.[100]

Another key community issue is the potential effects (both short- and long-term) that a renewable energy project site will have on existing uses such as marine transportation, fishing (both commercial and recreational), and recreational and commercial navigation. Many of these pre-existing uses are protected to some extent by "Public Trust Rights" going back hundreds of years, such as that in Massachusetts to "fish, fowl and navigate" tidelands.[101] How each project proposes to mitigate interference with these rights, such as through avoidance of or compensation for imposition of exclusionary security zones, remains to be seen. The economic impacts to a coastal community are also a major concern, for it is unknown whether a project will provide local employment, increase tourism and recreation opportunities for the local community, and otherwise successfully integrate into existing communities. In addition, there are potential cultural

99. National Environmental Policy Act of 1969 § 102, 42 U.S.C.A. § 4332(C) (West 2009).

100. *See generally* Alliance to Protect Nantucket Sound v. U.S. Army Corps of Engineers, 288 F.Supp.2d 64 (D.Mass. 2003).

101. Codified in modern times at M.G.L. Ch. 91 and the regulations promulgated at 310 C.M.R. § 9.00 et seq.

impacts to historic properties or archaeological sites, including American Indian tribal sites and traditional uses.

A Danish study on Denmark's two largest offshore wind farms, Horns Rev Offshore Wind Farm and Nysted Offshore Wind Farm, used fifteen years of environmental monitoring data on both pre- and post-construction effects of these projects on the surrounding environment and communities. The report showed virtually no negative impacts on birds, seals or fish.[102] Neighboring coastal communities as a whole supported and positively reacted to the turbines once they were constructed and in view.[103] While communities in the U.S. may react differently, the Danish study provides useful information for stakeholders and regulators to consider on topics ranging from socioeconomic effects to changes in diversity and higher biomass of infauna, epifauna, and vegetation.[104]

A survey conducted in Delaware revealed that 77.8% of respondents support the development of a wind farm six miles offshore.[105] A project proposed by Bluewater Wind will be developed approximately twelve miles offshore.[106] Those in support of wind power favored the development of renewable energy because of high electricity rates (but were willing to pay approximately $1-30 more per month for wind energy versus oil or coal), air quality, environmental impacts, aesthetics, and fishing impacts/boating safety.[107] Another survey conducted in Rhode Island used photo-simulations, site selection drawings, wind measuring, and a PowerPoint presentation on wind energy to

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102. DONG Energy, Vattenfall, Danish Energy Authority & Danish Forest and Nature Agency, DANISH OFFSHORE WIND: KEY ENVIRONMENTAL ISSUES, 9 (2006) http://www.ens.dk/graphics/Publikationer/Havvindmoeller/havvindmoellebog_nov_2006_skrm.pdf (last visited Feb. 20, 2009).

103. *Id.* at 16.

104. *Id.* at 13-20.

105. Jeremy Firestone, Ctr. For Carbon-Free Power Integration, Univ. of Delaware, Address at Roger Williams University School of Law 7th Marine Law Symposium, *Lessons from Delaware: A Story in Three Acts*, 3 (Oct. 24, 2008), PowerPoint presentation *available at* http://law.rwu.edu/sites/marineaffairs/content/pdf/jfirestone.pdf.

106. Bluewater Wind, Delaware Project Facts, http://www.bluewaterwind.com/facts.htm?cat=delaware (last visited May 31, 2009).

107. Firestone, *supra* note 105, at 9.

determine the public's perception of wind energy projects, located both onshore and offshore.[108] The Rhode Island study found that the community's "overall stance on wind turbine power" was 99% in favor.[109]

C. Financing and Economic Challenges

Because it is an emerging industry, marine renewable energy developers require investment capital to develop both pilot and to-scale projects and the market for them.

1. Power Purchase Agreements

Power Purchase Agreements (PPAs) are tools used on a project finance basis by energy developers to get the funding needed to build and operate a power facility (usually with high electricity output) negotiated with a willing utility purchaser. Simply put, the PPA "confirms the stream of payments needed to borrow money to build the project."[110] The parties of a PPA include the seller, the buyer, and a credit support provider. Typically, a developer of a power facility is the seller and will generate energy and, in the case of renewable energy sources, environmental attributes. The buyer is a utility company that purchases the project's output, enabling the owner to finance the power plant. The PPA will require the buyer to purchase the seller's output and may require the seller to pay the buyer if the project is delayed or fails to meet certain standards.[111] Both the buyer and seller must demonstrate the ability to meet payment obligations by providing a guarantee, a letter of credit, or other

108. Lefteris Pavlides, Roger Williams University, Address at the Roger Williams University School of Law 7th Marine Law Symposium (Oct. 24, 2008), PowerPoint presentation *available at* http://law.rwu.edu/sites/marineaffairs/content/pdf/RI_Wind_Alliance.pdf.

109. *Id.* at 11.

110. University of Delaware College of Marine and Earth Studies, Offshore Wind Power: Delaware Offshore Wind Project, http://www.ocean.udel.edu/Windpower/deproject.html (last visited May 31, 2009).

111. *Id.* (For example, on June 24, 2008, Delaware's utility company, Delmarva Power and Bluewater Wind "signed a renegotiated PPA, with Delmarva buying only 200 MW of capacity, and Bluewater allowed sell up to and (sic) additional 400 MW, for a total project size of up to 600 MW, if contracts are made").

security.[112]

PPAs include a development timeline, an effective date, a duration period, an output estimate, and a delivery point for the power. Typically, the industry bases its financing on twenty year PPAs.[113] Long-term contracts are important when a project is financed with a significant amount of debt because repayment of loan obligations will be scheduled over a period of time. A secure source of revenue (from energy production) over that time period is necessary to repay the loan over time.

A company purchasing retail electricity may be willing to pay more for renewable energy to promote itself as a "green company."[114] Other incentives such as tax cuts may encourage entities to enter into a PPA because it will benefit both the seller and the buyer by reducing total production costs and increasing revenue. Environmental attributes or green tags can also be attained through the use of a PPA.[115] In negotiating the PPA the buyer and the seller must decide whether the credits, emissions reductions, air-quality credits, emissions-reduction credits, and offsets or allowances will be conveyed to the buyer in the agreement.[116] These environmental attributes may act as an incentive for the buyer to enter into a PPA because they will be able to attain these environmental benefits.

2. Research and Development

In this nascent industry, raising capital for research is one major obstacle for all entrants into the market. Recognizing this challenge, the U.S. Department of Energy (DOE) appropriates $50 million per year to "establish a robust program of research,

112. John M. Eriksson & William H. Holmes, THE LAW OF WIND: POWER PURCHASE AGREEMENTS AND ENVIRONMENTAL ATTRIBUTES, (2008) *available at* http://www.agmrc.org/media/cms/WindPowerPurchaseAgreements_E4AEB5E96D0B5.pdf (last visited Feb. 20, 2009).

113. Arnold W. Reitze, Jr., *Federal Control Of Carbon Dioxide Emissions: What Are The Options?*, 36 B.C. ENVTL. AFF. L. REV. 1, 49 (2009).

114. Europa, Green Paper on Public-Private Partnerships, http://europa.eu/scadplus/leg/en/lvb/l22012.htm (last visited Apr. 18, 2009).

115. Jessica A. Shoemaker, Christy Andersen Brekken, Karen R. Krub, FARMERS' GUIDE TO WIND ENERGY: LEGAL ISSUES IN FARMING THE WIND, ch 9, at 14 (Farmers' Legal Action Group 2007), *available at* www.flaginc.org/topics/pubs/wind/fgwe09.pdf.

116. Eriksson & Holmes, *supra* note 112.

development, demonstration and commercial application activities to expand marine and hydrokinetic renewable energy production."[117] Water power is one of the two research areas managed by the DOE's Wind and Hydropower Technologies Program. In fiscal year 2008, Congress appropriated funds to DOE for research on a wide range of advanced water power technologies.[118] As part of its commitment to develop clean, domestic energy sources, DOE is collaborating with industry, regulators, and other stakeholders to investigate emerging water power technologies and further improve conventional hydropower systems.

The new effort was authorized by the Energy Independence and Security Act of 2007, signed by President Bush in December 2007.[119] "DOE announced on May 5, 2008 that it [would] make up to $7.5 million available to U.S. industries and universities to support the research and development of advanced water power systems, including systems that draw on free-flowing water; ocean waves, tides, or currents; and other water-based resources. Technologies that generate power from free-flowing water are often referred to as 'hydrokinetic' technologies. Funding is available for industry-led projects involving in-water testing, development, and deployment of advanced water power technologies."[120]

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117. U.S. Dep't of Energy, Grants.gov, Advanced Water Power Projects, http://www.grants.gov/search/search.do?oppId=17475&mode=VIEW (last visited Apr. 24, 2009) [hereinafter *Advanced Water Power Projects*]; *see also* U.S. Dep't of Energy, DOE Selects Projects for Up to $7.3 Million for R&D Clean Technology Water Power Projects, http://www.energy.gov/news/6554.htm (last visited Apr. 27, 2009).

118. *Advanced Water Power Projects*, *supra* note 117.

119. Energy Independence and Security Act of 2007, Pub. L. No. 110-140, 121 Stat. 1492 (sections 633 and 634 direct the Secretary to "establish a program of research, development, demonstration, and commercial application to expand marine and hydrokinetic renewable energy production and to award grants to institutions of higher education. . . for the establishment of . . . National Marine Renewable Energy Research, Development, and Demonstration Centers. . . ."

120. *Advanced Water Power Projects*, *supra* note 119; *see also* Patrick Gilman, Program Analyst, Dep't of Energy, Office of Wind and Hydropower Technologies, Address at the Roger Williams University School of Law 7th Marine Law Symposium (Oct. 24, 2008), PowerPoint presentation *available at* http://law.rwu.edu/sites/marineaffairs/content/pdf/Gilman.pdf.

3. Costs

In addition to the cost of the turbine itself (33% of the total cost for installing an offshore wind turbine), other factors such as operation and maintenance (25%), electrical infrastructure (15%), support structure (24%), and engineering and management (3%) must be considered.[121] Given that offshore wind development companies are looking to site wind farms further from shore and therefore typically in deeper waters (*e.g.*, fifteen miles offshore; over 150 feet deep), the costs of doing so will be higher, thereby requiring an increase in unit output in order to maintain a competitive cost per unit energy output. Projects offshore also require extensive support structures, moorings, floating supports, consideration for access, operation and maintenance, and increased stability due to higher waves the further a project is moved offshore.[122] Capital costs for developing projects offshore are 40-60% higher than for comparable onshore wind generators.[123]

Lessons learned from projects overseas, such as the Beatrice Wind Farm in the North Sea off of Scotland, are that specialized fixtures and vessels are needed for installation of the largest offshore turbine yet (~420 ft rotor diameter), with 5MW turbines in the deepest water (~150 ft).[124] One major consideration is the placement of the turbine on the platform where the vessel and cooperative weather need to occur simultaneously.

Another strategy for achieving further cost reductions is through new and innovative technologies. Acciona Energia, the fourth largest wind farm operator in the world, is leading the EOLIA project involving 16 other firms to develop technology in order to be able to have feasible offshore wind projects in deep waters (> 40 meters).[125] The project is innovative in that its main

121. James Manwell, Professor and Director, R.E.R.L., University of Mass., Address at the Roger Williams University School of Law 7th Marine Law Symposium (Oct. 24, 2008), *Offshore Wind Energy: Experience from Hull and Thoughts for the Future*, PowerPoint presentation *available at* http://law.rwu.edu/sites/marineaffairs/content/pdf/manwell.pdf.

122. *Id.*

123. Sawyer, *supra* note 8.

124. *Id.*

125. Jeffrey Hammond, ACCIONA Energía, Address at the Roger Williams University School of Law 7th Marine Law Symposium (Oct. 24,

focus is not solely on energy technology; it is a comprehensive project that covers additional areas such as aquaculture, desalination, and Navy technology.[126]

4. Incentives

An array of financial vehicles is available to support marine renewable technologies. Many of these have been used in other countries in concert with regulations and production goals to support industry development.[127] Federal and state governments have created public funds, loan guarantees, tax credits, and incentives and have set aside earmarked funds for specific renewable energy uses. The production tax credit is the "principal federal incentive for wind, and now marine and hydrokinetic, electricity production and the primary motivation for the tax credit equity for a project," under Section 45 of the Internal Revenue Code.[128] Federal tax incentives may, however, be too restrictive, applying only to limited offshore projects and too limited to support rapid research and development needs. Other financing mechanisms used by some states include renewable portfolio standards, feed-in-tariffs, and offsets.[129]

Some states have established renewable portfolio standards (RPS) that require electric utilities to generate a certain amount

2008), *A Viable Marine Renewable Energy Industry: Pursuing Innovation and Reducing Lifecycle Costs*, PowerPoint presentation *available at* http://law.rwu.edu/sites/marineaffairs/content/pdf/Hammond.pdf (identifying the key elements for achieving such cost reductions include: 1) reliability and availability –unanticipated operation and maintenance costs money; 2) weight reduction per MW installed –lower manufacturing and installation costs; 3) simplify site selection processes to ensure clear regulatory requirements and permitting; 4) new design codes and simulation tools for advanced modeling and analysis; 5) new foundation designs – both fixed and floating, driven by site characteristics; and 6) new specific offshore wind turbines – purpose built).

126. *Id.*

127. *See* Appendix B: International Renewable Energy Figures.

128. James F. Duffy, Nixon Peabody LLP, Address at the Roger Williams University School of Law 7th Marine Law Symposium (October 23, 2008), *Renewable Energy Finance and Production Tax Credit Basics*, PowerPoint presentation *available at* http://law.rwu.edu/sites/marineaffairs/content/pdf/James_Duffy.pdf.

129. For an overview of local, state, and federal incentives promoting renewable energy and energy efficiency *see* Database of State Incentives for Renewables & Efficiency (DSIRE), http://www.dsireusa.org/ (last visited May 31, 2009).

of electricity from renewable sources.[130] The RPSs require a certain percentage of a utility's power plant capacity or energy purchased to come from renewable sources by a given date. However, each state has its own standard, although neighboring states may cooperate and form regional RPSs. For example, Rhode Island's Renewable Energy Standard (RES) requires electricity providers in the state to supply an annually increasing percentage of their electricity sales from renewable resources with an end goal of 16% by the end of 2019.[131] This RES can be fulfilled either by purchasing the required amount through Renewable Energy Credits (RECs) that are supplied by renewable generators in the region (or located in a neighboring region and imported into the New England region), or through an alternative payment to the state's Renewable Energy Development Fund.[132]

RECs are a tradable unit that represents one megawatt-hour of electricity generated from an eligible renewable energy resource.[133] RECs are used to efficiently demonstrate RPS compliance by utilities, and so provide an additional revenue stream to developers from ratepayers supporting RPS policies. RECs can also enhance public participation in renewable energy projects by permitting the purchase of individual REC units by non-utility buyers.[134] Generally, each of the ISO areas has its

130. American Wind Energy Association, State-Level Renewable Energy Portfolio Standards (RPS) (2007), http://www.awea.org/legislative/pdf/State%20RPS%20factsheet%20Nov%202007.pdf (last visited May 31, 2009).

131. R.I. GEN. LAWS § 39-26-4(a)(1)-(5) (2009).

132. R.I. GEN. LAWS § 39-26-4(d) and (e) (R.I. Gen. Laws § 39-26-7 states that the Renewable Energy Development Fund was created for the "purpose of increasing the supply of NE-GIS certificates available for compliance in future years by obligated entities with renewable energy standard requirements").

133. *See, e.g.*, 73 PA. CONS. STAT. § 1648.3(e)(4)(ii) (2007) ("one alternative energy credit shall represent one megawatt hour of qualified alternative electric generation, whether self-generated, purchased along with the electric commodity or separately through a tradable instrument and otherwise meeting the requirements of commission regulations and the program administrator"); OHIO REV. CODE ANN. § 4928.65 (LexisNexis 2009) ("one unit of credit shall equal one megawatt hour of electricity derived from renewable energy resources..."); and FLA. STAT. ANN. § 366.92(a)(d) (LexisNexis 2009) ("Renewable energy credit" or "REC" means a product that represents the unbundled, separable, renewable attribute of renewable energy produced in Florida and is equivalent to 1 megawatt-hour of electricity generated by a source of renewable energy located in Florida").

134. Environmental Protection Agency, EPA's Green Power Partnership:

own REC market, and the value of RECs varies considerably across these markets. Factors impacting REC prices include, among others, the number of potential buyers (one utility or many), specific state's RPS requirements, equipment costs, project revenues, and term of REC contracts.[135]

While states have established RPSs, there is no national RPS in place. However, in April 2007, the National Commission on Energy Policy (NCEP) called for a federal RPS aimed at increasing the share of electricity generated by renewable resources nationwide to at least 15 percent by 2020. A national RPS could level the playing field by creating consistent, uniform rules and by allowing utilities to purchase standardized RECs and otherwise pursue the development of renewable resources anywhere they are cost competitive.[136]

Focusing more on incentives than preferential rates, the United Kingdom's current national financial incentive for renewable electricity is the Renewables Obligation (RO). Introduced in 2002, the RO requires electricity suppliers in the UK to obtain a specified and increasing amount of their electricity from renewable sources.[137] The predicted 14% of total electricity from renewable sources by 2020 falls short of the European Union's 20% by 2020 renewable energy target. In an effort to increase this number, the UK is examining alternative financial incentives for renewable energies, including strengthening the RO with an increased obligation and extended end date or introducing a new scheme of feed-in-tariffs.[138]

Renewable Energy Certificates, 3 (2008), http://www.epa.gov/greenpower/documents/gpp_basics-recs.pdf (last visited May 31, 2009).

135. Jaineel Aga and Chris Lau, *Bottom Line on Renewable Energy Certificates* (2008) http://www.wri.org/publication/bottom-line-renewable-energy-certificates (last visited May 31, 2009).

136. Ryan Wiser & Galen Barbose, RENEWABLES PORTFOLIO STANDARDS IN THE UNITED STATES: A STATUS REPORT WITH DATA THROUGH 2007 34 (2008) http://eetd.lbl.gov/ea/ems/reports/lbnl-154e-revised.pdf (last visited Apr. 19, 2009); Press Release, Nat'l Comm'n on Energy Policy, Energy Commission Proposes Plan to Cut Total U.S. Climate Emissions in First Year of Program (Apr. 19, 2007), http://www.energycommission.org/ht/display/ReleaseDetails/i/1548/pid/500 (last visited Apr. 19, 2009).

137. U.K. Dep't. of Trade & Indus., *Renewable Energy: Reform of Renewables Obligation*, (2007) http://www.berr.gov.uk/files/file39497.pdf (last visited May 31, 2009).

138. U.K. Dep't of Trade and Indus., *Meeting the Energy Challenge: A*

Another option is feed-in-tariffs, wherein electric utilities are obligated to purchase electricity from renewable energy companies at above market rates set by the government, providing long-term certainty to renewable energy builders and investors. To date, the U.S. has only seen proposals for a feed-in-tariff system in some states, but internationally, more than forty-five nations have successfully employed feed-in-tariff programs, including Germany, Spain, Ireland (Renewable Energy Feed In Tariff (REFIT)), and Denmark.[139]

Germany introduced the Renewable Energy Law to promote the development of renewable energy projects, through a system of feed-in tariffs with the objective of increasing the amount of renewable energies in the German power supply to 12.5% by 2010. Under the German system, anyone generating electricity from solar PV, wind or hydro is guaranteed a payment of four times the market rate for 20 years.[140] The system encourages development in renewables by reducing the payback times on such investments to less than ten years and provides certainty of long-term revenue stream to make it worthwhile investing in new projects. Denmark created a feed-in-tariff which required companies to buy power produced from renewable resources at a rate equal to 70-85% of the consumer retail price. Denmark[141] also established long-term financing to reduce the risks associated with larger renewable energy projects.

The Regional Greenhouse Gas Initiative (RGGI) is a cooperative effort by ten Northeast and Mid-Atlantic states (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont) to limit greenhouse gas emissions. RGGI is the first mandatory,

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White Paper on Energy, 14 & 23 (2007) http://stats.berr.gov.uk/ewp/ewp_foreword_summary.pdf (last visited May 31, 2009) (available data shows that renewables in the U.K.'s make up 2% of the total energy and 6% for the E.U. as a whole. "Projections indicate that by 2020, on the basis of existing policies, renewables would contribute around 5% of the UK's consumption and are unlikely to exceed 10% of the EU's").

139. Roark, *supra* note 23.

140. Ashley Seager, *Germany Sets Shining Example in Providing a Harvest for the World*, THE GUARDIAN, July 23, 2007 *available at* http://www.guardian.co.uk/business/2007/jul/23/germany.greenbusiness.

141. Benjamin K. Sovacool, et al., Is The Danish Wind Energy Model Replicable For Other Countries?, 21 THE ELEC. J. 2, 27-38, (Mar. 2008).

market-based CO_2 emissions reduction program in the United States. These ten states will cap CO_2 emissions from the power sector, and then require a 10% reduction in these emissions by 2018.[142]

CONCLUSION

Some regulatory framework in the United States governing ocean and tidal energy projects has just recently been finalized, with some remaining to be finalized, to support coordinated federal, state, interstate, and interagency planning for marine renewable energy development. For example, how the final MMS rule will be implemented has yet to be determined as more offshore energy projects are proposed. Reliable resolution of this uncertainty is a crucial underlying matter for attraction of the necessary private capital for creation of in-water renewable energy sources.

As a general policy, 7th Marine Law Symposium concluded that the United States should substantially increase electrical generation from renewable sources if increased energy independence and environmentally sustainable power sources are desired. The United States should commit the resources needed to support a robust evaluation of marine renewable energy technology by supporting pilot projects (not just limited to wave or tidal) and funding research and development to study, monitor and mitigate any potential negative impacts of these nascent technologies.

As our desire for renewable energy increases, so does the need to have a clear, comprehensive system for developing, financing, and evaluating marine renewable energy projects. Technologies in this growing industry are still evolving, and the evolving federal regulatory framework needs to remain flexible enough to accommodate new innovations. Other countries' experiences can provide valuable insight into how a coordinated regulatory, financial, and energy plan can be designed, and the ongoing planning processes in states like Massachusetts and Rhode Island will be valuable case studies in developing comprehensive ocean plans. The prompt implementation of the appropriate legal

142. Regional Greenhouse Gas Initiative, http://www.rggi.org/home (last visited Feb. 10, 2009).

framework and suitable financial incentives will provide a transparent process that will benefit community stakeholders, the emerging industries, and regulators.

APPENDIX A: RESOURCES ON MARINE RENEWABLE ENERGY PROJECTS

http://www.mms.gov/offshore/AlternativeEnergy/index.htm
http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics.asp
http://coastalmanagement.noaa.gov/ene_gov.html
http://www.fws.gov/habitatconservation/wind.html
For additional resources, see "Resources" link at http://law.rwu.edu/sites/marineaffairs/symposia/seventhMLS.aspx

APPENDIX B: INTERNATIONAL RENEWABLE ENERGY FIGURES

Country	Total Renewable Energy Capacity	Renewable energy Target	Incentives	Regulations
Germany	14% total energy consumption	27% renewable energy by 2020	Feed-in tariff, renewable energy sources given grid connection priority	Renewable Energy Sources Act (EEG) – grid operators obligated to buy renewable energy at minimum price. (operators share costs)
U.S.A.	6.8 Quadrillion Btu. 7% total energy consumption	No federal target. 29 states have targets.	Federal production tax credit (PTC), Systems benefit charges (SBC), net metering, Renewable portfolio standards (RPS)(some states)	Federal (MMS, FERC, NOAA and others). State by state.
Spain	20% total	12% renewable	Feed-in tariff	Renewable energy

	energy consumption	energy by 2010		plan – create attractive framework for private investors based on stability and profitability.
India	12.6 GW 8% total energy consumption	200 GW total by 2030	Incentives left up to states. Some have feed-in tariff. Others still developing incentives.	Renewable energy policy left up to states to implement. States are encouraged to make distributors pay renewable energy fee.
China	37 GW 8% total energy consumption	120 GW additional capacity by 2020	Subsidies to investors, producers, and users of renewable energy. "punish and reward" system (fines for not meeting obligations)	Public cost-sharing to develop projects. Government sets targets and develops plans.
Denmark	26% total energy consumption	29% by 2010	Feed-in tariff, tax exemptions to families (wind turbine cooperatives)	Systematic public planning (zoning) regulations. Already met Kyoto goal of 18% renewable energy
Italy	16% total energy consumption	25% total energy consumption by 2010	RPS (uses renewable energy credits ((REC), green certificates.	Fixed amounts of electricity from renewable sources must be fed into grid by distributors
France	12% total energy consumption	21% total energy consumption by 2010	Feed-in tariff, and tendering system, tax credits	Energy Act of 2005: Increase use of renewables and grid access.

UK	2% total energy consumption	10% total energy consumption by 2010	RPS (uses renewable energy credits (REC))	Renewable Obligation (RO) (higher costs for renewables).
Portugal	21% total energy consumption	Expects to generate 31% of all energy from renewable source by 2020. Has already met its 2010 renewable energy targets.	Feed-in tariff, tendering system, tax incentives, municipalities in which a wind farm is located are given money to minimize local opposition	Building codes require certain buildings to install solar systems or other renewable energy source. Environmental impact evaluation required.
Canada	Hydro provides 58% of electricity production. Other renewables provide 3-4% of electricity production.	No federal target. 9 states have targets	Feed-in tariff (Ontario and Prince Edward Island), government incentive to wind energy companies (1 ¢/kW produced), tax incentive for renewable energy equipment.	Regulations to create nation-wide 5% renewable fuels standard in development. [Province by Province]

NOTE: Total worldwide capacity = 240 GW