Golden Gate University Environmental Law Journal

Volume 5
Issue 1 *Symposium Edition: Offshore Energy Projects: New Priorities in the Wake of the BP Gulf Disaster*

Article 7

10-10-2011

Riding the Wave: Confronting Jurisdictional and Regulatory Barriers to Ocean Energy Development

Danielle Murray

Christopher Carr

Jennifer Jeffers

Alejandra Núñez-Luna

Recommended Citation
5 Golden Gate Univ. Env. L. J. 159 (2011)

RIDING THE WAVE: CONFRONTING JURISDICTIONAL AND REGULATORY BARRIERS TO OCEAN ENERGY DEVELOPMENT

DANIELLE MURRAY[+]
CHRISTOPHER CARR[‡]
JENNIFER JEFFERS[‡*]
ALEJANDRA NÚÑEZ-LUNA[‡**]

I. INTRODUCTION

Wave energy conversion (WEC) is a burgeoning form of hydrokinetic power[1] which takes advantage of energy carried by ocean waves to generate electricity. The global energy potential from ocean energy resources is truly enormous; the International Energy Agency estimates the theoretical energy potential of wave power at 8,000 to 80,000 terawatt-hours (TWh), compared to the world's yearly electricity demand of 19,855 TWh in 2007.[2] Economically recoverable wave power is estimated to be 140 to 750 TWh/year for existing wave-capturing

[+] Renewable Energy Program Manager, Department of Environment, City and County of San Francisco; B.A., Stanford University, 2004; M.Sc., University of Toronto, 2007.
[‡] Partner, Morrison & Foerster, LLP, Environment & Energy Law Group; B.A., University of California-Berkeley, 1990; J.D., University of California-Berkeley, 1994; Ph.D., University of California-Berkeley, 2004.
[‡*] Associate, Morrison & Foerster, LLP, Environment & Energy Law Group; B.A. University of Colorado-Boulder, 2000; J.D., M.S., University of California-Berkeley, 2009.
[‡**] Associate, Morrison & Foerster, LLP, Environment & Energy Law Group; LL.B., Instituto Tecnológico Autónomo de México, 2000; LL.M., Harvard Law School, 2003; S.J.D. Harvard Law School, 2011.

[1] Hydrokinetic power is the generation of electricity from moving water from waves, tides, ocean currents or inland waterways.

[2] *See* WORLD ENERGY COUNCIL, 2010 SURVEY OF ENERGY RESOURCES 2010 563 (2010), *available at* www.worldenergy.org/documents/ser_2010_report.pdf.

technologies at full maturity, but that number could double or triple with projected long-term technical improvements.[3]

Locations with the greatest wave power potential include the western seaboard of Europe, the northern coast of the United Kingdom, and the Pacific coastlines of North and South America, Southern Africa, Australia, and New Zealand, thanks to long expanses of ocean with exposure to prevailing westerly winds that deliver powerful waves to these coasts.[4] From a national perspective, the National Renewable Energy Laboratory estimates U.S. wave energy extraction potential to be roughly 200 gigawatts (GW).[5] The Electric Power Research Institute (EPRI) approximates total available wave energy flux off of U.S. coastlines at 2,300 TWh per year, though only a fraction of that may be technically and economically recoverable, and over half of the resource is located off Alaska's sparsely populated coasts.[6] Developing fifteen percent of the nation's wave energy resources and converting them to electricity at an average eighty-percent efficiency would generate 255 TWh. This equals approximately six and a half percent of total U.S. electricity generation, or enough electricity to power about twenty-five million homes—not an insubstantial contribution, to say the least.[7]

Renewable energy technologies have garnered increasing support and attention in recent years, largely due to concerns about climate

---

[3] *See id.*; *see also* Tom Thorpe, *An Overview of Wave Energy Technologies: Status, Performance and Costs*, Nov. 30, 1999, *in* WAVE POWER: MOVING TOWARDS COMMERCIAL VIABILITY (2000), *available at* www.wave-energy.net/Library/An%20Overview%20of%20Wave%20Energy.pdf; MINERALS MANAGEMENT SERVICE, WAVE ENERGY POTENTIAL ON THE U.S. OUTER CONTINENTAL SHELF 4 (2006), *available at* ocsenergy.anl.gov/documents/docs/OCS_EIS_WhitePaper_Wave.pdf [hereinafter MMS].

[4] *See* ENGINEERING COMMITTEE ON OCEANIC RESOURCES—WORKING GROUP ON WAVE ENERGY CONVERSION, WAVE ENERGY CONVERSION 7 (John Brooke ed., 2003); *see also* WORLD ENERGY COUNCIL, *supra* note 2.

[5] *See* MICHAEL C. ROBINSON, NAT'L RENEWABLE ENERGY LAB, RENEWABLE ENERGY TECHNOLOGIES FOR USE ON THE OUTER CONTINENTAL SHELF 2 (2006), *available at* ocsenergy.anl.gov/documents/docs/NREL_Scoping_6_06_2006_web.pdf.

[6] The total U.S. available incident wave energy flux is about 2,300 TWh/year in regions with mean wave power density of greater than 10 kW/meter. Resource by region: 1,250 TWh/yr from Alaska, 440 TWh/yr from the West Coast, 300 TWh/yr from Hawaii, and 120 TWh/yr from the East Coast. *See* C. MCGOWIN, ELEC. POWER RESEARCH INST., OCEAN TIDAL AND WAVE ENERGY: RENEWABLE ENERGY TECHNICAL ASSESSMENT GUIDE 2-18 (2005), *available at* hwww.haeturbines.com/PDF/Ocean%20Tidal%20and%20Wave%20Energy.PDF; *Ocean Energy*, CALIFORNIA ENERGY COMMISSION, www.energy.ca.gov/oceanenergy/index.html (last visited Dec. 17, 2010).

[7] Electricity generation in the United States equaled 3,950 TWh in 2009, and average household energy consumption is about 10,000 kWh per year. *See* Energy Information Agency, Summary Statistics for the United States, November 2010, *available at* www.eia.gov/cneaf/electricity/epa/epates.html; *see also* C. MCGOWIN, *supra* note 6; MMS, *supra* note 3, at 3.

change, air pollution, fossil fuel depletion, and national security. Wave power, like its more well-known counterparts, wind and solar power, is a carbon-free energy source with a zero-cost "fuel," it emits no pollutants or greenhouse gases, and it can be developed near existing coastal population centers, thereby reducing reliance on foreign energy imports.[8] And while wind and solar power are often criticized for their unpredictable intermittency, wave energy availability is comparatively stable.[9] For instance, waves can be forecasted several days in advance and at utility-level detail ten to forty-eight hours ahead of time.[10] In addition, even during seasonal periods when the ocean appears calm, swells are moving water up and down enough to generate electricity, and waves roll in twenty-four hours a day, unlike solar radiation.[11] The constancy and predictability of waves allow for more reliable integration into the electric utility grid, particularly when multiple devices are combined into a wave farm to smooth overall output.[12]

Another benefit of wave energy is that since water is so dense (840 times more so than air), the energy it carries is much more concentrated than the energy produced from solar radiation or wind. This high energy density means a wave energy device can generate more kilowatt-hours of electricity from a given area than either a wind turbine or solar panel with an equivalent footprint.[13] Wave power also shows high economic promise—it is currently estimated to cost anywhere from ten to thirty-two cents per kilowatt-hour. This is on par with solar photovoltaic electricity, and the cost is expected to drop as the industry grows and more projects move to commercialization.[14]

Wave power generation is generally expected to have limited environmental impacts, but the full impact of these devices is not yet

---

[8] *See* WORLD ENERGY COUNCIL, *supra* note 2, at 570.

[9] *See* JAHANGIR KHAN, GOURI S. BHUYAN & ALI MOSHREF, POTENTIAL OPPORTUNITIES AND DIFFERENCES ASSOCIATED WITH INTEGRATION OF OCEAN WAVE AND MARINE CURRENT ENERGY PLANTS IN COMPARISON TO WIND ENERGY 20-21 (2009) (report prepared for the International Energy Agency), *available at* www.iea-oceans.org/_fich/6/T0311_document.pdf.

[10] *See* MCARTHUR & BREKKEN, *supra* note 7, at 2; WORLD ENERGY COUNCIL, *supra* note 2, at 563, 570.

[11] *See* MMS, *supra* note 3, at 2.

[12] *See* KHAN ET AL., *supra* note 9, at 21.

[13] *See* MCARTHUR & BREKKEN, *supra* note 7, at 2; KHAN ET AL., *supra* note 9, at 18.

[14] *See* URS, WAVE POWER FEASIBILITY STUDY REPORT FOR THE CITY & COUNTY OF SAN FRANCISCO 5 (2009), *available at* www.sfenvironment.org/downloads/library/final_wave_feasibilty_report_121409.pdf; KHAN ET AL., *supra* note 9, at 23-24; ROGER BEDARD ET AL., FINAL SUMMARY REPORT: PROJECT DEFINITION STUDY – OFFSHORE WAVE POWER FEASIBILITY DEMONSTRATION PROJECT 7, 28 (2005), *available at* http://oceanenergy.epri.com/attachments/wave/reports/009_Final_Report_RB_Rev_2_092205.pdf.

known.[15] Environmental concerns identified in a 2006 Minerals Management Service (MMS) white paper include visual appearance and noise (above and below water); reduction in wave height from wave energy converters and changes in sedimentation patterns; changes in marine habitat (including the creation of new habitat, as well as ocean floor disturbance during project installation and decommissioning); and toxic releases, particularly for those systems with working hydraulic fluids.[16] Other potential environmental impacts include disturbances to marine life, including marine mammals, seabirds, and fish stocks from mooring equipment, electrical cable placement, and habitat alteration. Social impacts, such as conflict with other sea space uses including shipping, commercial fishing, or recreation, must also be considered. All of these are very site specific hazards, addressed through detailed project environmental assessments, as required by state and federal regulations, and they will vary considerably between different ocean sites.[17]

Government leadership is urgently needed to enable the wave energy industry to succeed and eventually become commercially viable. State and local governments are currently taking a lead in this respect, but they face a complex, and often competing, federal regulatory regime with the potential to stifle the emergence of the wave energy industry altogether if procedures are not streamlined and comprehensive regulations addressing ocean power enacted. The City of San Francisco's permitting application for its proposed Oceanside Wave Energy Project highlights these hurdles and illustrates the need for comprehensive regulatory reform that addresses both short- and long-term scenarios for the development of wave energy, while at the same time ensuring proper protection of the marine environment.

This Article provides a brief history of wave energy development, examines the status of hydrokinetic projects undertaken at a state and local level, and navigates the overlapping, and often competing, jurisdictional mandates confronting U.S. project developers. It also explores lessons learned from the European Union's (EU) recent regulatory experience and provides recommendations for short- and long-term steps forward in the United States. Part II discusses early wave energy projects, research and policy developments, and highlights recent advances in technical testing and economic feasibility of wave energy

---

[15] *See* WORLD ENERGY COUNCIL, *supra* note 2, at 570.

[16] *See* MMS, *supra* note 3, at 8-9; H.T. HARVEY & ASSOCS., DEVELOPING WAVE ENERGY IN COASTAL CALIFORNIA: POTENTIAL SOCIO-ECONOMIC AND ENVIRONMENTAL EFFECTS 75-115 (2008), *available at* www.energy.ca.gov/2008publications/CEC-500-2008-083/CEC-500-2008-083.PDF.

[17] *See* MMS, *supra* note 3, at 8-9; H.T. HARVEY & ASSOCS., *supra* note 16.

projects. Part III analyzes the status of hydrokinetic energy development at the state and local level, using California and San Francisco as significant case studies. Part IV clarifies the challenges that the emerging hydrokinetic industry faces with regard to competing policy and jurisdictional considerations, particularly between the Federal Energy Regulatory Commission (FERC) and the MMS.[18] Part V examines the European wave energy regulatory regime and extracts relevant lessons learned that can be applied to federal jurisdiction over wave energy projects in the United States. Finally, Part VI suggests immediate regulatory actions to streamline procedures for the continued and future development of wave power, as well as long-term strategies to reform the federal permitting process and ensure proper consideration of the marine environment in all project operations.

II. HISTORY OF WAVE ENERGY

A. EARLY WAVE ENERGY PROJECTS, RESEARCH, AND POLICY DEVELOPMENTS

Humans have been trying to harness the power of waves for over two centuries, with Europeans initiating the majority of early inventions. The first patent for a device designed to generate power from ocean waves was issued in France in 1799, with similar patents following shortly thereafter in the United Kingdom.[19] From 1855 to 1973, wave power development greatly intensified, and 340 patents were filed in the United Kingdom alone.[20] In the United States, California was the hotbed for wave power experimentation, peaking around the turn of the twentieth century.[21] The modern-era scientific pursuit of wave energy

[18] The Minerals Management Service (MMS) changed its name to the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) in June 2010. BOEMRE is now the federal agency responsible for overseeing the "safe and environmentally responsible development of energy and mineral resources on the Outer Continental Shelf." BUREAU OF OCEAN ENERGY MGMT., REGULATION & ENFORCEMENT, www.boemre.gov/ooc/newweb/frequentlyaskedquestions/ frequentlyaskedquestions.htm (last visited May 11, 2011). For purposes of this Article, however, we refer to the agency by its prior name, given that our discussion focuses on agency decisions that were made prior to its name change.

[19] *See Wave Energy*, OCEAN ENERGY COUNCIL, www.oceanenergycouncil.com/index.php/ Wave-Energy/Wave-Energy.html (last visited Dec. 10, 2010); Ewan Callaway, *Energy: To Catch a Wave*, 450 NATURE 156, 157 (2007). The first wave power was used primarily to drive pumps, saws, mills, or other heavy machinery. *Id.*

[20] *See* Clément et al., *Wave Energy in Europe: Current Status and Perspectives*, 6 RENEWABLE AND SUSTAINABLE ENERGY REVIEWS 405, 406-407 (2002).

[21] *See* Christine Miller, *A Brief History of Wave and Tidal Energy Experiments in San*

was pioneered by Japanese naval commander Yoshio Masuda's experiments in the 1940s. Masuda tested various large-scale wave energy devices at sea, with a particular focus on devices used to power navigation lights.[22]

Wave power research and development escalated in response to the 1973 and 1979 oil crises, as part of the rush to identify alternative, or renewable, energy generation opportunities.[23] Several government-sponsored wave energy programs began, particularly in Japan, Norway, and the United Kingdom, and on the academic side, university researchers took up the charge to create viable working models.[24] These programs resulted in several prototypes but failed to produce any commercially viable WEC devices; this was largely due to the high construction costs, extensive construction times, significant technical challenges, and resultant high capital and power generation costs, all of which continue to hamper the implementation of wave energy technology today.[25]

Meanwhile, in the 1970s, the U.S. government began investing in the development of ocean thermal energy conversion (OTEC), which utilizes the difference between cooler deep and warmer shallow waters to run a steam turbine.[26] In 1980, Congress passed the Ocean Thermal Energy Conversion Act,[27] which gave the National Oceanic & Atmospheric Administration (NOAA) authority over ocean energy. Under the Act, OTEC facilities were not required to obtain leases or pay royalties to the federal government, a provision intended to encourage commercial development of the energy source. Despite the streamlined process and a handful of government-sponsored pilot projects, NOAA still had not received any license applications by 1998, and it

---

Francisco and Santa Cruz, WESTERN NEIGHBORHOODS PROJECT (Sep. 3, 2004), www.outsidelands.org/wave-tidal3.php.

[22] *See* F.J.M. Farley & R.C.T. Rainey, *Radical Design Options for Wave-Profiling Wave Energy Converters*, INTERNATIONAL WORKSHOP ON WATER WAVES AND FLOATING BODIES, LOUGHBOROUGH (2006), *available at* www.iwwwfb.org/Abstracts/iwwwfb21/iwwwfb21_15.pdf.

[23] *See* Falnes, *A Review of Wave-Energy Extraction*, 20 MARINE STRUCTURES 185 (2007); MCARTHUR & BREKKEN, *supra* note 7, at 2.

[24] The researchers most notably included Stephen Salter from the University of Edinburgh, Kjell Budal and Johannes Falnes from Norwegian Institute of Technology, and David Evans from Bristol University. *See* Falnes, *supra* note 23; MCARTHUR & BREKKEN, *supra* note 7, at 2.

[25] *See* HYDRAULICS & MAR. RESEARCH CTR., HISTORY OF WAVE ENERGY (2007), *available at* www.wave-energy.net/Schools/History.htm (last visited Dec. 11, 2010).

[26] OTEC is a form of ocean energy, but not wave energy—these early government programs, though, helped shape future regulation of ocean energy projects. OTEC devices can also be used to desalinize water, an area of growing interest in many parts of the world.

[27] *See* Ocean Thermal Energy Conversion Act of 1980, Pub. L. No. 96-320, 94 Stat. 974 (1980).

subsequently dismantled the OTEC licensing program and rescinded the OTEC licensing regulations.[28]

As oil prices decreased in the 1980s, wave energy funding was drastically reduced,[29] although a few first-generation prototypes continued to be tested as growing awareness and concern over climate change reignited interest in wave power and other forms of renewable energy.[30] In the mid-1980s, the EU organized a series of international conferences to encourage coordination among universities, industry, and government agencies, and it enacted the Joule Program in 1992 to finance non-nuclear energy research and development, including wave power.[31]

Moving into the new millennium, Europe has continued its leadership role in the development of ocean power, initiating the European Thematic Network on Wave Energy under the auspices of the European Commission's (EC) Energy, Environment and Sustainable Development Programme.[32] In the United States, the California Energy Commission (CEC) and EPRI carried out wave energy resource studies and environmental analyses from 2004 to 2008, but there are currently few platforms for research and development and little government support for such projects. Although land-based alternative energy programs have received generous support from the U.S. government in recent years, including tax breaks, production credits, grants, and loans to support project development, only a small percentage of the support is available for ocean energy programs and technologies.[33]

B. RECENT PROJECTS: TESTING THE TECHNICAL AND ECONOMIC FEASIBILITY OF WAVE ENERGY

While private financing was pouring into wave power technologies

---

[28] *See* NOAA, OCEAN THERMAL ENERGY CONVERSION (OTEC) REGULATORY REGIME, coastalmanagement.noaa.gov/otec/docs/regulatoryfactsheet.pdf (last visited June 16, 2011).

[29] *See* WORLD ENERGY COUNCIL, *supra* note 2, at 562.

[30] *See* Falnes, *supra* note 23, at 186.

[31] *See* Clément et al., *supra* note 20, at 407.

[32] *See* EUROPEAN WAVE ENERGY NETWORK, www.wave-energy.net/index3.htm (last visited June 16, 2011).

[33] For example, in its 2010 budget proposal (approved by President Obama in October 2009) the U.S. DOE's Energy Efficiency & Renewable Energy division sought $320 million for solar (an increase of $145 million from 2009), $75 million for wind (an increase of $20 million), and only $30 million for water power, which includes marine and hydrokinetic resources—a $10 million reduction from 2009 levels. *See* Holly V. Campbell, *A Rising Tide: Wave Energy in the United States and Scotland*, 2 SEA GRANT L. & POL'Y J. 29, 32-33 (2009), *available at* nsglc.olemiss.edu/SGLPJ/Vol2No2/Campbell.pdf.

(and alternative energy generally) on a global scale in the middle part of the last decade, the wave power industry came to a crashing halt as a result of the 2008 financial crisis. Demonstration projects for promising new technologies were largely put on hold, and many existing projects lost financing and were unable to move forward. For example, the Aguçadoura Wave Farm, located five kilometers offshore near Póvoa de Varzim in Portugal, was the world's first commercial wave farm, though it is now defunct. The farm consisted of three Pelamis wave attenuators, totaling 2.25 megawatts (MW) in installed capacity, and first generated electricity in July of 2008.[34] The wave farm was shut down only four months later, however, in November 2008, as a result of the financial collapse of its project financier due to the global economic crisis. The machines were off-site at the time due to technical problems and currently remain off-site due to the inability to find new financial backing. A second phase of the project, intended to increase the installed capacity to 21 MW using an additional twenty-five machines, remains in doubt.[35]

The industry is now revving up again, as financing loosens up and governments step up to the plate; most development, though, is progressing in university labs and a handful of small engineering companies.[36] As of December 2010, no commercial wave energy farms existed anywhere in the world, though pilot installations and testing of full-scale devices are now underway in Scotland,[37] Australia,[38] and,

---

[34] *See First Electricity Generation in Portugal*, PELAMIS WAVE POWER, www.pelamiswave.com/news?archive=1&mm=7&yy=2008 (last visited Dec. 17, 2010).

[35] *See Pelamis Sinks Portugal Wave Power*, CLEANTECH.COM (Mar. 17, 2009); Kate Galbraith, *Wave Power Development Hits Some Rocks*, N.Y. TIMES, May 20, 2009, *available at* green.blogs.nytimes.com/2009/05/20/wave-power-development-hits-some-rocks.

[36] *See* Artur Palha et al., *The Impact of Wave Energy Farms in the Shoreline Wave Climate: Portuguese Pilot Zone Case Study using Pelamis Energy Wave Devices*, 35 RENEWABLE ENERGY 62 (2010).

[37] In November 2009, the first full-scale demonstration wave project, a device from Aquamarine Power and Queen's University in Belfast, began producing power when it was launched at the European Marine Energy Centre (EMEC) in Orkney, Scotland. *See* Heather Clancy, *Wave Energy's New Pearl: University Begins Testing Oyster Tech off Scottish Coast*, ZDNET (Dec. 30, 2009), www.zdnet.com/blog/green/wave-energys-new-pearl-university-begins-testing-oyster-tech-off-scottish-coast/9576. The device is currently the world's largest working wave energy device, and Aquamarine is planning to test another array of three second-generation devices in 2011-2012. *See* EMEC, *Site Activity*, www.emec.org.uk/site_activity.asp (last visited Dec. 13, 2010). A Pelamis Wave Power machine was also installed at EMEC in May 2010. *Id.* Several years of testing will precede commercial use in the United Kingdom. *Id.* Ultimately, Eon, the power developer, hopes to install sixty-six wave power machines in the Pentland Firth (the strait between Orkney and mainland Scotland), after winning the rights to a site in a leasing round by the United Kingdom's Crown Estate. *See* CROWN ESTATE, *Wave and Tidal: Pentland Firth and Orkney Waters*, www.thecrownestate.co.uk/our_portfolio/marine/wave-tidal/pentland-firth-orkney-waters.htm (last

soon, England[39] and Oregon.[40] Moreover, from a U.S. perspective, at the end of 2010, sixteen wave energy projects, totaling 3.5 GW of maximum capacity, had already received FERC preliminary permits to commence device testing within the state waters off the Pacific Coast and Hawaii.[41]

---

visited Dec. 10, 2010).

[38] In early 2010, Australian firm Oceanlinx installed its third and final demonstration-scale, grid-connected oscillating water column unit off Port Kembla, near Sydney, Australia. The 2.5 MW system, which was successfully feeding electricity back to the grid, snapped off its pylons during a storm in early May 2010. *See Oceanlinx Told to Clean-Up Sunken Energy Generator*, ABC NEWS, May 25, 2010, www.abc.net.au/news/stories/2010/05/25/2908749.htm. It is now unclear if the sunken machine may be reusable. The company's much smaller first-generation prototype unit, in operation from 2006, was disassembled in 2009. *See id.* In addition to Oceanlinx, Carnegie Wave Energy Limited, an Australian clean-tech developer, installed its CETO II submerged buoy-type wave device off the coast of Western Australia in 2008. *Preliminary In-Sea Trial Results, October 2007*, CETO WAVE POWER, www.carnegiecorp.com.au/index.php?url=/ceto/milestones/ preliminary_trial_results (last visited Dec. 23, 2010). The technology has been operating in order to prove commercial viability and, after preliminary environmental approval, is now poised for further development. The company is planning to use data from the pilot project to inform the development of a new 5 MW farm near Perth, which is expected to begin construction in 2011. *See* Announcement, Carnegie Wave Energy Ltd., Launch of Perth Wave Energy Project (2010), *available at* www.carnegiecorp.com.au/files/projects/garden-island/ 100118_Formal%20Launch%20of%20Perth%20Wave%20Energy%20Project_ASX.pdf; Keith Orchison, *Wave of the Future Needs Investment*, THE AUSTRALIAN, Oct. 7, 2010, www.theaustralian.com.au/special-reports/climate-change/climate-change/story-fn5oikwf-1225935586957 (last visited Dec. 17, 2010).

[39] A new wave power demonstration and testing facility, similar to the EMEC in Scotland, is now operating off the north coast of Cornwall, England. The so-called "Wave Hub" provides offshore transmission access, allowing up to 20 MW of wave energy devices to connect to the electricity grid. The £42 million Wave Hub project was developed by the South West Regional Development Agency, with funding from the European Regional Development Fund Convergence Programme and the U.K. government, as a key part of its strategy to develop a world-class marine energy industry in the United Kingdom. *See* Press Release, Wave Hub, Wave Hub "Plugged In" and Open for Business (Nov. 3, 2010), *available at* www.wavehub.co.uk/news/press_releases/ wave_hub_plugged_in_and_open.aspx.

[40] In February 2010, construction began off Oregon's coast on the first commercial U.S. wave energy farm, which will supply power to approximately 400 homes. *See Ocean Power Technologies Begins Wave Power Farm Development Off Oregon Coast*, RENEWABLE ENERGY WORLD, Feb. 22, 2010, www.renewableenergyworld.com/rea/news/article/2010/02/ocean-power-technologies-begins-wave-power-farm-development-off-oregon-coast. The Pacific Northwest Generating Cooperative is funding the commercial wave-power park at Reedsport, Oregon, using Ocean Power Technologies' PowerBuoy device. *See id.* The Reedsport project will likely receive the first license ever issued by the FERC for a commercial-scale wave power project in the United States. *See* News Release, Ocean Power Techs., Ocean Power Technologies Signs Historic Stakeholder Agreement for Oregon Wave Energy Project (Aug. 4, 2010), *available at* phx.corporate-ir.net/phoenix.zhtml?c=155437&p=irol-newsArticle&ID=1456110&highlight=. In addition to the pending Reedsport license, one other wave energy project, Washington's Finavera Makah Bay Offshore Wave Pilot Project, was issued a FERC license in 2007, but it surrendered the license in 2009 due to the economic downturn. FERC, Project No. 12751-006, Order Accepting Surrender of Lease, 127 FERC ¶ 62,054.

[41] Data obtained from FERC's table of preliminary permits issued (updated Oct. 18, 2010), *available at* www.ferc.gov/industries/hydropower/gen-info/licensing/issued-pre-permits.xls *and*

This growing number of new wave energy projects suggests real promise for the development of an operational commercial wave energy project in the near future. However, stepping back and anticipating the existing and potential challenges to future wave energy projects is critical to ensuring that the regulatory frameworks are in place to truly achieve this goal. As evidenced by state and local hydrokinetic project development activities in California and San Francisco, discussed below, a wealth of hydrokinetic opportunities may also bring an abundance of regulatory and jurisdictional obstacles to overcome.

III. THE NEW "CALIFORNIA GOLD RUSH": STATE AND LOCAL APPROACHES TO HYDROKINETIC ENERGY DEVELOPMENT

A. STATEWIDE MEASURES

The 2004 U.S. Ocean Action Plan estimated that seventy-five percent of the nation's population will be living on or near its coasts by the year 2025.[42] In California, however, this projection was exceeded a decade ago, with seventy-seven percent of the state's then thirty-four million residents already living in coastal counties along California's 1,200-kilometer coastline.[43] Surges in coastal populations place excessive demand on energy resources and infrastructure, especially for those states with substantial coastlines. California, whose population continues to grow, has recently taken proactive measures to reduce the health and environmental impacts of anticipated energy use intensification. The Governor's 2009 Executive Order S-29-09 mandates an increase in California's Renewable Portfolio Standard to thirty-three percent by 2020,[44] and the state legislature's passage of the 2006 California Global Warming Solutions Act (AB 32) requires the California Air Resources Board to adopt regulations reducing greenhouse gas emissions to 1990 levels by 2020.[45] As a result of California's increased focus on identifying alternative energy sources, attention has

---

www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/licences.asp.

[42] U.S. OCEAN ACTION PLAN: THE BUSH ADMINISTRATION'S RESPONSE TO THE U.S. COMMISSION ON OCEAN POLICY 3 (2004), *available at* groups.ucanr.org/HumboldtBayEBM/files/38672.pdf.

[43] *See* Brian E. Baird & Amber J. Mace, *Regional Ocean Governance: A Look at California*, 16 DUKE ENVTL. L. & POL'Y F. 217, 219 (2006).

[44] Exec. Order No. S-14-09**,** *available at* gov.ca.gov/news.php?id=12868.

[45] CAL. HEALTH & SAFETY CODE § 38550 (Westlaw 2011); *Assembly Bill 32: Global Warming Solutions Act*, CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY, AIR RESOURCES BOARD (May 1, 2011, 7:18 PM), www.arb.ca.gov/cc/ab32/ab32.htm.

turned toward developing a diverse renewable energy portfolio, including harnessing California's immense wave power potential.[46]

The western U.S. coastline currently holds the nation's greatest promise of hydrokinetic power.[47] Oregon and California have shown the highest level of interest in hydrokinetic energy thus far.[48] Oregon has assumed a clear leadership role in making hydrokinetic projects a reality, going so far as to create the Oregon Wave Energy Trust private-public partnership, which supports the development of wave energy throughout the state.[49] California, although initially slow to get out of the gate, is gradually starting to make strides in the development of wave power.[50] Between 2005 and 2007, the CEC researched the state's wave energy potential, as well as applicable technological, environmental, and permitting issues.[51] By 2007, wave energy project developers began applying for hydrokinetic study permits from MMS and FERC to conduct feasibility assessments in California waters.[52]

Today, there are seven active California hydrokinetic pilot projects in the initial phases of planning and development.[53] These include (1)

---

[46] Deborah A. Sivas & Margaret R. Caldwell, *A New Vision for California Ocean Governance: Comprehensive Ecosystem-Based Marine Zoning*, 27 STAN. ENVTL. L.J. 209, 224 (2008).

[47] The West Coast—California, Oregon, and Washington—has both a high wave energy potential and the population to take advantage of it. With an estimated incident wave energy flux of 440 TWh/yr (assuming fifteen percent is extractable at usual efficiencies of eighty percent), 64 TWh could be generated annually, compared to West Coast electricity demand of 376 TWh per year. *See* MCGOWIN, *supra* note 6.

[48] *See* Laura Koch, *The Promise of Wave Energy*, 2 GOLDEN GATE U. ENVTL. L.J. 162, 190 (2008).

[49] *Id.* at 192; *see also* OREGON WAVE ENERGY TRUST (OWET), www.oregonwave.org ("OWET emphasizes an inclusive, collaborative model to ensure that Oregon maintains its competitive advantage and maximizes the economic development potential of this emerging industry. Our work includes stakeholder outreach and education, policy development, environmental assessment, applied research and market development.").

[50] The average deep water wave power in California is 37,000 megawatts, of which twenty percent can reasonably be converted into electricity. This is enough to provide approximately twenty-three percent of the state's current annual electricity consumption. CALIFORNIA ENERGY COMMISSION, *supra* note 6.

[51] *See* Koch, *supra* note 48, at 192-93.

[52] Memorandum from Laura Engeman, Project Manager, to Cal. Ocean Prot. Council (Mar. 3, 2010), *available at* www.opc.ca.gov/webmaster/ftp/project_pages/energy/ 1003_COPC_09_Marinerenew.pdf. After the MOU was signed by FERC and MMS, some project applicants revised their applications to site their projects in state, rather than federal, waters. *See id.*

[53] *See Database of Active Projects*, PACIFIC FISHERY MANAGEMENT COUNCIL, www.pcouncil.org/habitat-and-communities/wave-tidal-and-offshore-wind-energy/ (providing details regarding current wave energy projects in California). It is worth noting that twelve projects have failed in planning stages due to jurisdictional conflicts, insufficient power potential, or operational uncertainties. *Id.*

Pacific Gas & Electric's WaveConnect Project,[54] which includes a site in Humboldt Bay[55] and a second site southwest of Vandenberg Air Force Base in Santa Barbara County; (2) the Sonoma County Water Resources Agency's Sonoma Coast Hydrokinetic Project,[56] which includes three sites located offshore in Sonoma County; (3) the Golden Gate Energy Company's San Francisco Bay Tidal Energy Project;[57] and (4) the most current project to have been permitted as of October 2010, the San Onofre OWEC Energy Farm pilot project in San Diego County.[58] However, as described in Part II, there are still no actual operational hydrokinetic projects in place anywhere along the West Coast.[59]

Although wave energy development has been termed the "new California gold rush," the emerging hydrokinetic industry faces competing policy and jurisdictional considerations, as well as growing apprehension from the fishing sector and environmental groups.[60] In California alone, six different state agencies play a role in supervising

---

[54] *WaveConnect*, PAC. GAS & ELEC., www.pge.com/myhome/environment/pge/cleanenergy/waveconnect (last visited June 16, 2011).

[55] On October 28, 2010, Pacific Gas & Electric (PG&E) announced that it was suspending development of its Humboldt WaveConnect Pilot Project (FERC Docket No. P-12779) off the Northern California coast. Chad Marriot, *PG&E Suspends WaveConnect Project*, RENEWABLE + LAW (Nov. 4, 2010), www.lawofrenewableenergy.com/2010/11/articles/oceanwave-energy/pge-suspends-waveconnect-project. The company stated that "several major challenges made the project unviable at its current location and configuration." *Id.* However, "PG&E remains committed to [wave energy] technology." *Id.* The company held on to its Humboldt permit, which expired at the end of February 2011, while it looked for partnership interest in creating a demonstration facility within the larger Humboldt site. *Id.* In addition, PG&E will continue its work to determine the feasibility of its proposed Central Coast project (FERC Docket No. P-13641). *Id.* The Central Coast project is proposed in forty-five square miles of coastal waters off the coast of Santa Barbara County, California. *Id.* PG&E submitted its preliminary permit application in December 2009 and was awarded its preliminary permit on May 14, 2010. *Id.*

[56] *See Sonoma Coast Hydrokinetic Energy Project*, SONOMA COUNTY WATER AGENCY, www.scwa.ca.gov/schep (last visited May 1, 2011).

[57] This project is in danger of having its permit revoked due to inactivity; Golden Gate Energy Company made a filing after receiving notice and it is currently unclear if it was able to retain the permit. *See* File List, FERC ONLINE, elibrary.ferc.gov/idmws/file_list.asp?accession_num=20100322-5105 (last visited May 1, 2011).

[58] *FERC Issues Notice Regarding Preliminary Permit Application Accepted for Filing, Soliciting Comments*, U.S. FED. NEWS SERV., June 19, 2010, www.highbeam.com/doc/1P3-2061376991.html.

[59] *Habitat and Communities: Wave, Tidal, and Offshore Wind Energy*, PACIFIC FISHERY MANAGEMENT COUNCIL, www.pcouncil.org/habitat-and-communities/wave-tidal-and-offshore-wind-energy/ (last visited May 1, 2011). Including California, a total of twenty-two wave energy projects are in consideration along the nation's west coast. *Id.*

[60] *See* Sivas & Caldwell, *supra* note 46, at 224; Charles Burress, *Prospectors Claim Stretches of Ocean, Hoping to Harness Wave Energy*, S.F. CHRON., Nov. 12, 2007, *available at* articles.sfgate.com/2007-11-12/news/17268300_1_wave-energy-energy-resources-chevron-california-renewable-energy.

marine renewable energy development.[61] Further, although states have jurisdiction over submerged lands from the shoreline outward to three nautical miles, they must coordinate with numerous federal government agencies in planning and siting decisions, even for projects located wholly within state waters.[62] Additional regional cooperation and collaboration is also necessary if wave energy projects cross state borders.[63] Thus, there is an urgent need for integrated coastal management, regulatory regimes that provide guidance on jurisdictional issues, and public outreach and education efforts.[64]

B. LOCAL GOVERNMENTS TAKING THE LEAD ON WAVE ENERGY DEVELOPMENT – SAN FRANCISCO'S OCEANSIDE WAVE ENERGY PROJECT

Increasingly, local governments across the country are also assuming an active role in energy planning and development, from promoting energy efficiency and conservation through building codes and community outreach to providing electricity through community choice aggregation programs.[65] The City and County of San Francisco (the City) has long been at the forefront of this alternative energy

---

[61] *See* Memorandum from Laura Engeman, *supra* note 52. These agencies include the California Coastal Commission, the California State Lands Commission, the California Department of Fish and Game, the California Public Utilities Commission, the California Energy Commission, and the State Water Resources Control Board. *Id.*

[62] Rachael E. Salcido, *Rough Seas Ahead: Confronting Challenges to Jump-Start Wave Energy*, 39 ENVTL. L. 1073, 1082 n.53 (2009).

[63] *See id.*, at 1082 n.55; WEST COAST GOVERNORS' AGREEMENT ON OCEAN HEALTH (2006) (WCGA), *available at* westcoastoceans.gov. Launched in September 2006, the WCGA is a regional collaboration between California, Oregon, Washington, and relevant federal agencies to "address regulatory and information needs for the development of offshore wave, wind, and tidal energy along the West Coast." *Wave Energy Development*, STATE OF CALIFORNIA OCEAN PROTECTION COUNCIL (OPC), www.opc.ca.gov/2010/05/offshore-wave-energy-development/ (last visited May 1, 2011).

[64] Sivas & Caldwell, *supra* note 46, at 226. Work is slowly beginning on this front; OPC and the California Energy Commission (CEC) co-funded a report in 2008 assessing potential environmental and socio-economic effects of wave energy development. H.T. HARVEY & ASSOCS., *supra* note 16. Although the ultimate degree of impacts will depend on the scale and location of each project, the study concluded that there are "no clear conclusions of dramatic ecological, social, or economic impacts—positive or negative," though the report urged that caution should still be taken with future hydrokinetic development until more data becomes available. *Id.* In addition to the joint report with CEC, OPC is currently developing a West Coast Guidebook for Renewable Energy that will serve as a reference guide for wave power planning and siting decisions. *See* Memorandum from Laura Engeman, *supra* note 52.

[65] Community Choice Aggregation allows cities and counties to purchase or generate electricity for their residents and businesses within a defined jurisdiction in order to secure alternative energy supply contracts.

movement. For instance, the City has been exploring and promoting renewable energy generation opportunities—such as solar photovoltaics, urban wind, and ocean energy—for over a decade.[66]

The City's initial foray into ocean energy came about as the result of exploring the potential for tidal power opportunities under the Golden Gate Bridge. Although initially the project appeared promising, studies showed only modest generation potential when compared to the steep costs and economic unknowns of such an undertaking.[67] The City then moved its attention to offshore wave energy along the City's Pacific coast. In 2004, EPRI completed a pre-feasibility study to determine wave energy capacity off the coast of San Francisco, and it began modeling specific projects in 2006.[68]

In 2008, drawing on EPRI's work, the City (with the help of local engineering firm URS) commenced a wave power feasibility study of the vicinity around San Francisco's Southwest Ocean Outfall Buffer Zone, an area seven kilometers off the coast where the City's treated wastewater is released.[69] The Outfall Buffer Zone presents an ideal location from both a geographic and economic standpoint. Geographically, San Francisco is bordered by both the Farallones Islands and Monterey Bay National Marine Sanctuaries. Industrial activities are not permitted within marine sanctuaries, and in 2009 the Gulf of the Farallones and Monterey Bay National Marine Sanctuary Advisory Councils passed a joint resolution specifically stating the sanctuaries were not appropriate locations for wave energy devices and development.[70] The Outfall Buffer Zone, though, was excluded from the surrounding National Marine Sanctuaries in 1993 due to the combination of vessel traffic inside the area, dredge operations from the Golden Gate channel, and outfall from the wastewater treatment plant.[71] Thus, the

---

[66] *See Energy*, SAN FRANCISCO DEPARTMENT OF ENVIRONMENT, www.sfenvironment.org/energy (last visited May 1, 2011).

[67] *See* URS, TIDAL POWER INITIATIVE FEASIBILITY STUDY REPORT SAN FRANCISCO PUBLIC UTILITIES COMMISSION at ES-3 (2008).

[68] *See* EPRI, SYSTEM LEVEL DESIGN, PERFORMANCE, COST, AND ECONOMIC ASSESSMENT - SAN FRANCISCO ENERGETECH OFFSHORE WAVE POWER PLANT (2004).

[69] *See* URS, *supra* note 14, at 1.

[70] *See* Memorandum from Maria Brown, Superintendent, Gulf of the Farallones Nat'l Marine Sanctuary, & Paul Michel, Superintendent, Monterey Bay Nat'l Marine Sanctuary, to Daniel J. Basta, Director, Office of Nat'l Marine Sanctuaries, Regarding Monterey Bay and Gulf of the Farallones National Marine Sanctuary Advisory Councils' Joint Resolution on Wave Energy Projects Within National Marine Sanctuaries (Feb. 18, 2009), *available at* montereybay.noaa.gov/sac/2009/021209/021209wave_energy.pdf.

[71] *See* Nat'l Oceanic & Atmospheric Admin., Proposed Notice of Designation and Final Rule Making, Section I: Background Part III: Alternatives, Including the Preferred Alternative, in Monterey Bay National Marine Sanctuary Final Environmental Impact Statement/Management Plan,

Outfall Buffer Zone provides a logical location for a wave power facility, and the existing outfall pipe right-of-way provides an existing route for a transmission cable.

Even though the project study area fell within the Outfall Buffer Zone, the City nonetheless carried out its feasibility study with consideration for marine sanctuary goals of resource protection, research, education, and public use.[72] Bearing in mind that species in the adjacent protected habitat do not recognize administrative boundaries, the City has committed itself to designing wave projects to protect marine species, especially those listed as endangered or recovering species under the Endangered Species Act.[73] In addition to the protection of species, early stakeholder outreach meetings identified other social and environmental considerations, such as commercial fishing activities in the site area, recreational activities, and aesthetic impacts. All of these are key concerns, given the importance of tourism to San Francisco and the fact that many residential and recreational beach areas face the ocean. Beach dredging operations and high commercial sea vessel traffic entering and exiting San Francisco Bay were also recognized as significant factors for consideration.[74]

From an economic standpoint, the City's feasibility study estimated that power production from a 30 MW wave farm in the study area would generate between 100 and 150 gigawatt-hours of electricity per year—enough to power ten percent of San Francisco households. Mid-range cost estimates of seventeen to twenty-two cents per kilowatt-hour—comparable to solar photovoltaic power costs—are encouraging, particularly for an emerging technology that is likely to see price reductions as the industry matures.[75]

The City submitted a preliminary permit application to FERC in February 2009 to develop a 30 MW underwater wave electricity generation farm, roughly four to eight miles southwest of San Francisco's Ocean Beach.[76] However, two months later, a Memorandum of Understanding (MOU) between FERC and the Department of the Interior's (DOI) MMS declared that wave power projects in federal Outer Continental Shelf (OCS) waters beyond the state three-mile limit

---

Volume II: Appendices (1992), 15 C.F.R. Chapter IX, Subchapters A and B and Part 944, *available at* montereybay.noaa.gov/intro/mp/archive/original_eis/appendixB_sI.html. The Monterey Sanctuary is designated under the Oceans Act of 1992, Pub. L. No. 102-587, 106 Stat. 5039.

[72] *See* URS, *supra* note 14, at 17.

[73] *See id.*

[74] *See id.* at ES-3.

[75] *See id.*; KHAN ET AL., *supra* note 9, at 24.

[76] *See* URS, *supra* note 14, at 2.

require an MMS lease before a FERC permit application can be considered complete.[77] Accordingly, given that the San Francisco wave power project was in OCS waters and did not have a MMS lease, FERC dismissed the City's application outright.[78]

As it turns out, San Francisco found itself stuck in the middle of an eight-year battle between FERC and MMS. The dismissal of the City's wave power application is just one symptom of a much larger problem spurred by the historical jurisdictional conflict between FERC and MMS, however, and this conflict has far-reaching and immediate effects on the future of U.S. wave energy development. To appreciate the totality of the situation, one must first understand the background behind the jurisdictional conflict and how such dual regulation operates to inhibit efforts to develop offshore renewable energy projects.

IV. TURF WARS: DUAL REGULATION AND JURISDICTIONAL CONFLICT BETWEEN FERC AND MMS

The jurisdictional disagreement between FERC and MMS began in 2002 over the controversial Cape Wind project in Massachusetts.[79] The Cape Wind company proposed and eventually received an MMS lease for an offshore wind farm on the OCS off of Nantucket.[80] Project opponents argued that the lease, and thus the project, was unlawful because MMS was empowered to issue leases only for oil and gas, and not wind, under the Outer Continental Shelf Lands Act.[81]

---

[77] *See id.*; MEMORANDUM OF UNDERSTANDING BETWEEN THE U.S. DEPARTMENT OF THE INTERIOR AND FEDERAL ENERGY REGULATORY COMMISSION (Apr. 9, 2009), *available at* www.ferc.gov/legal/maj-ord-reg/mou/mou-doi.pdf.

[78] An environmental study and permitting process was launched in 2010 in preparation for a second permit attempt, to address potential impacts from wave projects such as electromagnetic fields surrounding power generation and submarine cables and underwater noise from device motion. *See* John Upton, *Ocean Beach May Be Center of Harnessing Wave Power*, SF EXAMINER, Aug. 21, 2010, *available at* www.sfexaminer.com/local/ocean-beach-may-be-center-harnessing-wave-power. Thus far, the City has commenced a gray whale migration study and coastal sediment transport study. *Id.* Given the current lack of wave power pilots in the United States, these studies will no doubt provide crucial examples, lessons learned, and scientific data for future efforts statewide and nationally. *Id.*

[79] *See* MMS, *Protest of the United States Minerals Management Service*, FERC Docket P-12752-000 (Jan. 30, 2007); *FAQ Re: MMS-FERC Jurisdictional Dispute over Authorization of Wave, Tidal and Current Projects on the Outer Continental Shelf*, OCEAN RENEWABLE ENERGY COALITION (2009) www.oceanrenewable.com/wp-content/uploads/2009/03/fercmmsfaqnew_2009.doc.

[80] *See Record of Decision: Cape Wind Energy Project, Horseshoe Shoal, Nantucket Sound*, U.S. DEPARTMENT OF THE INTERIOR, MINERALS MANAGEMENT SERVICE (Apr. 28, 2010), *available at* www.doi.gov/news/doinews/upload/Cape-Wind-ROD.pdf.

[81] *See id.*

In order to address this regulatory gap, Congress authorized the OCS Alternative Energy and Alternate Use (AEAU) Program under the Energy Policy Act of 2005 (EPAct 2005), which gave DOI new authority to grant leases and easements for the development of offshore energy projects, including renewable energy projects.[82] The EPAct 2005 contained a savings clause, providing that nothing in the new law diminished another agency's existing authority under other laws or statutes.[83]

Rather than settling the issue, however, the savings clause opened up further disagreement from FERC. Under the Federal Power Act, FERC has authority to license projects located on navigable waters that use water to generate electricity.[84] In the 2003 *AquaEnergy* decision,[85] FERC determined that a wave energy converting buoy was a hydropower "project" within the meaning of the Federal Power Act. As such, the buoy was subject to FERC jurisdiction because of its location in navigable waters, which FERC defined as extending twelve miles out or to the limits of the territorial seas under the authority of Presidential Proclamation No. 5928.[86] Because the *AquaEnergy* decision was in place when EPAct 2005 was passed, FERC argued that EPAct's savings clause preserved the agency's jurisdiction. DOI countered that FERC has jurisdiction to issue licenses and preliminary permits for projects only within state waters, i.e., up to three miles from shore.[87] Projects beyond

---

[82] Energy Policy Act of 2005, Pub. L. No. 109-58, § 388(a), 119 Stat. 594, 744 (amending section 8(p) of Outer Continental Shelf Lands Act, 43 U.S.C.A. § 1337(p)(1)(C) (Westlaw 2011)).

[83] *See* 43 U.S.C.A. § 1337(p)(9) (Westlaw 2011).

[84] *See* Federal Power Act, 16 U.S.C.A. § 797(e) (Westlaw 2011).

[85] The AquaEnergy Makah Bay project comprised four buoy-type point absorber WECs. *See* Federal Power Act, 16 U.S.C.A. § 796(11) (Westlaw 2011). AquaEnergy contended that FERC jurisdiction did not apply because the Makah Bay Project was not a conventional hydropower "project" within the strict definition laid out in the Federal Power Act: "a power house, all water conduits, all dams and appurtenant works and structures (including navigation structures) which are a part of said unit and all storage, diverting, or forebay reservoirs directly connected therewith, the primary line or lines transmitting power therefrom to the point of junction with the distribution system or with the interconnected primary transmission system, all miscellaneous structures used . . . ." *Id.* The floating buoy system had no powerhouse, reservoir or conduits. *Id.* Moreover, the system did not use traditional hydro technology (namely, dams). *Id.* FERC held that the floating buoys that contained generators were powerhouses under the statutory definition, and that the Makah project was subject to jurisdiction because of its location on navigable waters, which FERC defined as extending up to twelve miles out from shore per an Executive Order that declared U.S. jurisdiction to that limit. *See Aqua Energy Group*, DI02-3-01, 102 FERC ¶ 61,242 (Feb. 28, 2003), *available at* www.oceanrenewable.com/wp-content/uploads/2007/03/mmsfercprotest.pdf.

[86] *See* Presidential Proclamation No. 5928, 54 Fed. Reg. 777 (Dec. 27, 1988); *see also* Federal Outer Continental Shelf Lands Act, 43 U.S.C.A. § 1331 et seq. (Westlaw 2011).

[87] The exceptions to this are Florida and Texas, whose state waters extend nine miles offshore.

state waters are considered to be located on the OCS and are thus within DOI's purview under the AEAU Program.

The April 2009 MOU finally delineated the role of each agency in offshore renewable energy projects. According to the MOU's terms, MMS holds the exclusive permitting authority to issue leases, easements, and rights-of-way for renewable energy projects on the OCS.[88] FERC maintains exclusive jurisdiction to issue licenses for hydrokinetic projects under Part II of the Federal Power Act, and to issue exemptions from licensing under sections 405 and 408 of the Public Utility Regulatory Policies Act of 1978 for the construction and operation of hydrokinetic projects on the OCS.[89] No FERC license or exemption for a hydrokinetic project on the OCS may be issued, however, before MMS issues a lease, easement, or right-of-way.[90]

Although the MOU clarified the roles and responsibilities of the two agencies, the resultant dual lease and license system requires project developers to go through two burdensome and somewhat redundant application processes for projects on the OCS. In addition, the process fails to adequately recognize the added public value that local government-led projects provide.

MMS ocean energy lease procedures are particularly lengthy, expensive, and cumbersome—so much so that San Francisco is considering avoiding the process by restricting its project study area to a less favorable area within state waters. And it is not alone in doing so—Sonoma County, for example, is taking the same approach,[91] limiting all three of its hydrokinetic power study areas to within 0.5 to 3 miles offshore.[92] Based on information contained in MMS's 2009 renewable energy framework guidebook,[93] siting projects on the OCS should take one to two years for non-competitive leases, and two to five years for competitive leases.[94] Only after a project has an MMS lease can the developer apply for a FERC license, which will take another one to two

---

[88] *See* MEMORANDUM OF UNDERSTANDING BETWEEN THE U.S. DEPARTMENT OF THE INTERIOR AND FEDERAL ENERGY REGULATORY COMMISSION, *supra* note 77.

[89] *See id.*

[90] *See id.*

[91] *See* E-mail from Amy Bolten, Public Information Officer, Sonoma Cnty. Water Agency, to author Danielle Murray (Apr. 23, 2010) (on file with authors).

[92] *See* Press Release, Sonoma Cnty. Water Agency, Preliminary Permits Approved for Feasibility Study of Sonoma Coast Hydrokinetic Energy Project (July 16, 2009), *available at* drivecms.com/uploads/scwa.ca.gov/7-16-09-Prelim-Wave-Permits.pdf.

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

[94] *Id.* at 38.

years to process.[95]

To expedite and simplify the process, FERC has developed a "preliminary permit," which takes only six months to a year to complete, and which gives a developer the ability to study a project at the specified site for up to three years.[96] The preliminary permit does not authorize construction (only a license authorizes construction and operation), but it provides "guaranteed first-to-file status" if a license is pursued.[97] FERC has also developed a "hydrokinetic pilot project licensing" program, which would allow short-term pilot projects to be constructed, operated, and connected to the grid.[98] Unfortunately, these preliminary permits and pilot project licenses have limited value for projects beyond state waters, given that MMS may lease a potential project site to a different party during the preliminary permit period.

Applicants deciding to forge ahead with MMS leases must provide high levels of financial assurance (options include an initial $100,000 lease-specific bond or cash, with further assurance required after the approval of the site assessment plan and construction and operations plan),[99] which frequently represents a considerable burden for many public agencies and small research entities. An MMS lease also comes with a minimum rent of $3 per acre per year, plus operating fees.[100] While MMS has the authority to reduce or waive such rental or operating fees,[101] it remains to be seen if or how MMS will exercise this discretion.

In addition to the high transaction costs of the new regulatory system, MMS's "competitive leases" place public agencies, often pursuing wave power for the public good, against the private sector, including traditional oil and gas companies that, generally speaking, are better able to afford rental fees and seek financial assurances. Government-led projects represent an opportunity to test and demonstrate early-stage technologies, engage a wide range of stakeholders, and make critical research and data publicly available—all of which are generally absent from most private sector endeavors. Further, renewable energy development is given no preference over

---

[95] *Id.*

[96] *See Preliminary Permits*, FERC, www.ferc.gov/industries/hydropower/gen-info/licensing/pre-permits.asp (last visited Mar. 7, 2011).

[97] *Hydrokinetic Projects*, FERC, www.ferc.gov/industries/hydropower/indus-act/hydrokinetics.asp (last visited Jan. 11, 2011).

[98] *Licensing Hydrokinetic Pilot Projects*, FERC 4 (Apr. 4, 2010), www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/pdf/white_paper.pdf.

[99] *See* MINERALS MGMT. SERV., *supra* note 93, at 40.

[100] 43 C.F.R. § 3504.25 (Westlaw 2011).

[101] *See* MINERALS MGMT. SERV., *supra* note 93, at 41.

fossil fuel exploration, despite the social and environmental benefits associated with the former.

Once a lease is requested, MMS issues a public notice, and the highest qualified bidder wins the lease. FERC, on the other hand, which issues preliminary permits free of cost, is required under the Federal Power Act to favor permit and license proposals submitted by local governments over proposals of equal merit from other entities.[102] This public agency benefit is lost, however, when those same proposals must first pass through MMS's competitive lease process.

Given the added time, cost, and uncertainties for projects straddling the three-mile boundary, the current lease-permit scheme may have the effect of keeping wave energy developers inside state waters, while oil and gas companies continue to capture offshore leases beyond state waters. This will in turn skew research, development, and ultimately the commercialization of wave energy technologies toward devices that are more suitable for shallower waters rather than technologies that require greater depths and that could potentially generate greater amounts of power.

Although the MOU between FERC and MMS is an initial step in the right direction, the agreement fails to clarify federal jurisdiction over wave energy projects. Thus, the current cumbersome dual procedure between the agencies will continue to present obstacles for development of hydrokinetic projects in the United States. Such regulatory burdens are not limited to projects initiated by private developers and public agencies within the three-nautical-mile limit of state waters or to the oil industry's energy needs on the OCS. FERC's and MMS's competing jurisdictional claims may also redirect developers' efforts internationally to regions that prioritize the development of domestic wave energy industries and that consider effective regulation as a necessary component to achieve that goal. One example of this is the EU, where member states have already enacted, or are currently in the process of enacting, legislation to develop ocean energy projects as part of their binding commitments under various EU renewable energy directives. In particular, Portugal and the United Kingdom have already passed statutes to jumpstart the wave energy industry in distinct and innovative ways—leading to the realization that one single agency with authority over wave energy is better than two.

---

[102] FERC, *supra* note 97.

V. LESSONS FROM ABROAD: EUROPEAN REGULATION OF WAVE ENERGY

Several European countries are aggressively pursuing wave energy exploitation, and, as discussed in Part II, many European projects are near or in commercial operation. In addition to the impetus for wave energy after the oil crises in the 1970s, the rapid increase in wave power technologies can also be attributed to the launch of the European Commission's (EC) Fourth Framework Programme in 1994, an umbrella for funding wave energy research, among other initiatives.[103] The EC also financed projects in Portugal and Scotland to demonstrate the technical feasibility of wave energy extraction.[104] Throughout the last decade, research has evolved and a number of additional projects have been deployed throughout Europe—particularly in Portugal, the United Kingdom, Sweden and Norway.

Although research has been ongoing for more than two decades, wave energy legislation in Portugal and the United Kingdom was only recently enacted under the framework of EU electricity and renewable energy directives.[105] Pursuant to these directives, Portugal and the United Kingdom have adopted regulatory structures to jumpstart the industry. Notably, licensing authority is lodged in a single entity in each country, but the scope of authority differs. For instance, Portugal's licensing agency claims expertise in, and authority over, the energy industry, while the United Kingdom's licensing agency's expertise and authority focus on the marine environment.

Although it is too soon to determine the effectiveness or shortcomings of these regulatory frameworks, Portugal and the United Kingdom are experimenting in innovative ways to attract private initiatives for the development of wave energy industries off their respective coasts. To be sure, binding renewable energy targets are one step in that direction. However, examining the major features of the U.K.

---

[103] *See The Fourth Framework Programme (1994-1998)*, EUROPEAN COMMISSION, ec.europa.eu/research/specpr.html (last visited Dec. 21, 2010). Two studies published under the Programme in 1996, the "Atlas of Wave Energy Resource in Europe" and the "Exploitation of Tidal and Marine Currents," set the basis for the development of tidal and wave energy. *Id.* The EC "promote[s] the general interest of the European Union . . . by participating in the decision-making process, in particular by presenting proposals for European law, by overseeing the correct implementation of the Treaties and European law, and by carrying out common policies and managing funds." *Id.*

[104] *See* EUROPEAN THEMATIC NETWORK ON WAVE ENERGY, CURRENT STATUS AND PERSPECTIVES, CENTRE FOR RENEWABLE ENERGY SOURCES 5-6 (2002).

[105] Portugal's regulatory measures have been in place for two years, and the United Kingdom's go into effect this year.

and Portugal frameworks indicates that wave energy is still very much in a research and development phase. Accordingly, each country's framework sets forth rules to address the development of the industry in the short term, as well as the hydrokinetic industry's proper regulation with consideration of the marine environment into the future.

Portugal and the United Kingdom's distinct initiatives, situated within the broader EU framework of renewable energy directives, may provide a number of useful lessons for the United States. These include recognizing that successful wave energy regulation entails a coordinated effort that starts at the regional level (or, in the case of the United States, the federal level, along with coastal sub-regions), while properly accounting for state and local authority where relevant; understanding that comprehensive ocean energy legislation is needed; recognizing that one-stop procedures are more conducive to advancing the industry than separate multi-agency approval processes; and understanding that regulatory frameworks are indeed able to address short-term (i.e., testing the technical and economic feasibility of the industry) and long-term goals (i.e., appropriately addressing environmental impacts in the marine environment).

A. EU ELECTRICITY AND RENEWABLE ENERGY DIRECTIVES

Electricity production from renewable energy sources has been a priority in Europe for more than a decade. In 1997, the EC proposed to set a target of twelve percent gross national energy consumption from community renewable energy sources by 2010, which the EC and Parliament both endorsed the following year.[106] In 2001, the EU adopted Directive 2003/30/EC ("Electricity Directive") to promote electricity from renewable energy sources.[107] As written, the Electricity Directive required member states to set national indicative targets for renewable electricity consumption, to evaluate existing legislative and regulatory frameworks to reduce regulatory barriers to renewable energy production, and to streamline administrative procedures.[108]

---

[106] *See* EUROPEAN COMMISSION ENERGY FOR THE FUTURE: RENEWABLE SOURCES OF ENERGY (1997), *available at* europa.eu/documents/comm/white_papers/pdf/com97_599_en.pdf; *see also Renewable Energy Targets*, EUROPEAN COMMISSION, ec.europa.eu/energy/renewables/ targets_en.htm (last visited Nov. 14, 2010).

[107] *See* Directive 2003/30/EC of the European Parliament and of the Council of May 8, 2003, 2003 O.J. (L 123) 42, *available at* eur-lex.europa.eu/LexUriServ/ LexUriServ.do?uri=OJ:L:2003:123:0042:0046:EN:PDF.

[108] *See* Directive 2001/77/EC of the European Parliament and the Council of September 27, 2001, 2001 O.J. (L 283) 33, 35, *available at* eur-lex.europa.eu/LexUriServ/ LexUriServ.do?uri=OJ:L:2001:283:0033:0033:EN:PDF. Pursuant to this policy, the EU also issued

By 2006, the EU had achieved nine percent of its consumption from renewable energy sources, but regular assessments made it clear that the EU as a whole would fail to meet the specified 2010 targets. As a result, the EC proposed a more comprehensive framework covering all renewable energy.[109] The resulting legislation, Directive 2009/28/EC ("Renewable Energy Directive"), repealed the Electricity Directive and required member states to adopt mandatory national targets consistent with a community-wide goal of twenty percent electricity consumption from renewable energy sources by 2020.[110] The Renewable Energy Directive also required member states to submit national renewable-energy action plans by June 2010, including detailed road maps on those targets and measures needed to overcome obstacles to the development of renewable energy.[111] In addition, the Renewable Energy Directive calls for member states to take steps to ensure coordination among local, national, and regional administrative bodies with permitting authority for renewable energy projects and to ensure that their planning and building applications meet strict deadlines. A number of countries, such as Ireland, are in the process of revising their legal frameworks to that end. Others, such as Portugal and the United Kingdom, have already passed relevant legislation under the umbrella of the repealed Electricity Directive.

Portugal and the United Kingdom are approaching the development of wave energy technologies in distinct and novel ways that, as mentioned, are designed to address short-term needs (such as testing and generating information regarding the technical feasibility and economic and environmental impacts of wave energy technologies) and also long-term considerations (including the goal of protecting the marine environment). Both countries' wave energy strategies converge on one critical point: licensing and permitting procedures for the development of hydrokinetic projects are carried out by a single entity. Despite this key

---

Directive 2003/30/EC on the promotion of the use of biofuels and other renewable fuels for transport. *See* Directive 2003/30/EC, *supra* note 107.

[109] *See* THE RENEWABLE ENERGY PROGRESS REPORT: COMMISSION REPORT in accordance with Article 3 of Directive 2001/77/EC, Article 4(2) of Directive 2003/30/EC and on the implementation of the EU Biomass Action Plan, COM(2005)628 (Brussels, Apr. 24, 2009).

[110] *See* Directive 2009/28/EC of April 23, 2009, 2009 O.J. (L 140) 16, 17, *available at* eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:en:PDF. The European Wind Energy Association recently published an analysis of the EU's twenty-seven National Renewable-Energy Action Plans. *See Europe and Renewable Energy*, ENVTL. NEWS NETWORK (Jan. 6, 2011), www.enn.com/pollution/article/42200 (last visited Jan. 9, 2011). Based on the report, the EU is on track not only to meet, but to exceed, its target of obtaining twenty percent of its gross energy consumption from renewable sources by the year 2020. *See id.*

[111] *See* Directive 2009/28/EC, *supra* note 110, at 28, 33.

similarity, however, their legislative frameworks are very different. Portugal has, to date, focused on regulating ocean energy as a sub-sector of the electricity industry, giving licensing authority and discretion to the electric company that operates the grid to effectively control the development of the industry. In contrast, the United Kingdom has removed wave energy project approvals from the authority of general statutes regulating electricity and instead has granted permitting authority to a specialized body in charge of regulating the marine environment.

B. PORTUGAL

As part of the Renewable Energy Directive framework, Portugal set an ambitious goal of achieving a thirty-one percent share of energy consumption from renewable energy sources by 2020. By 2005, Portugal had already achieved the EU's 2020 target, with 20.5% of its energy consumption originating from renewable sources, fifth in the EU behind only Sweden (39.8%), Latvia (32.6%), Finland (28.5%), and Austria (23.3%).[112]

Even before the passage of the Renewable Energy Directive, Portugal had taken steps to promote the development of ocean energy through legislation and administrative regulations specific to the wave energy industry. In Portugal, as in other countries of civil law tradition, public property (including ocean waters and its resources under the country's sovereign jurisdiction) is subject to the regime of administrative concessions.[113] These concessions are granted by the Portuguese government to an entity in charge of managing these resources. Electricity distribution is one resource subject to this regime.

Several years ago, Portugal enacted legislation to place ocean energy generation on the same footing as general electricity distribution. The legislation established a concession regime for ocean waters, with a special emphasis on creating additional sources of clean energy,[114] and created an "industrial cluster" for the development of a new domestic

---

[112] *See Renewable Energy Targets*, *supra* note 106.

[113] *See, e.g.,* Presidência do Conselho de Ministros no. 49/2010, Resolução do Conselho de Ministros, Diário da República, 1a série, no. 126, 1 de julho de 2010, *available at* www.energiasrenovaveis.com/images/upload/RCM492010-Energiaondas.pdf.

[114] *See* Ministerios da Defesa Nacional, do Ambiente, do Ordenamiento do Território e do Desenvolvimento Regional, da Economia e da Inovaçao, da Agricultura, do Desenvolvimento Rural e das Pescas e das Obras Públicas, Transportes e Comunicaçoes, Despacho conjunto no. 324/2006, Diário da República, 1a. serie, No. 71, 10 de Abril de 2006; Lei no. 57/2007 de 31 de agosto, Autoriza o Governo a aprovar o regime jurídico de acesso e exercício das actividades de produção de energia eléctrica a partir da energia das ondas, Diário da República, 1a. serie, no. 168, 31 de agosto de 2007, *available at* www.dre.pt/pdf1sdip/2007/08/16800/0607706077.PDF.

industry.[115] Most noteworthy is the creation of a pilot zone for the development of ocean projects and a flexible licensing procedure under the authority of a single entity with expertise in electricity production and transmission.[116] The legislation also provides for different licenses depending on the purpose and the phase of proposed projects. Presumably, this split was made to allow fast-track permitting for the purpose of testing the financial viability of WEC technologies, and to provide a different, competitive regime for the licensing of longer-term projects in the future when they are ready for commercial operation.

In 2008, pursuant to the now repealed Electricity Directive, the Portuguese National Defense Ministry issued a legislative decree creating a "pilot zone" for the construction and operation of ocean projects.[117] The zone, which comprises Portuguese ocean waters deeper than thirty meters, is located north of São Pedro de Muel, in Marinha Grande, Portugal.[118] The pilot zone is defined in a map annexed to the decree,[119] and its boundaries are subject to revision and, if needed, amendment every ten years.[120]

Wave energy development in Portugal revolves around a one-stop permitting process. A single entity in charge of "managing" the pilot zone (*entidade gestora da zona piloto*) is authorized to issue licenses for the construction and operation of wave projects under the terms of a forty-five-year exclusive concession granted by the ministries of Finance, National Defense, Environment and Energy to Redes

[115] *See* Ministerio da Defesa Nacional, Decreto-Lei no. 5/2008 de 8 de Janeiro, Diário da República, 1a. série, No. 5, 8 de Janeiro de 2008, at 169, *available at* www.dre.pt/pdf1sdip/2008/01/00500/0016800179.PDF.

[116] *See id.*

[117] *See id.*

[118] *See id.* at 178, annex 1.

[119] The pilot zone is precisely defined in terms of parallels and meridians, in the following manner, with A to D representing the four edges of the zone:

Vortex	Longitude West	Latitude North
A	-9º 0' 5.42"	39º 57' 30"
B	-9º 12'	39º 57' 30"
C	-9º 12'	39º 47' 30"
D	-9º 3' 53.20"	39º 47' 30"

"Anexo 1, Zona Piloto," *id.*

[120] *See id.* at 169. Under the concession, Redes Energéticas Nacionais (REN) was required to produce an actual map that characterizes the geophysical and environmental situation in the pilot zone, with the cooperation of relevant cabinet ministries, for submission to the Portuguese government. This is the official map of the pilot zone. *See* Ministerio da Economia e da Inovaçao, Decreto-Lei no. 238/2008 de 15 de Dezembro, Diário da República, 1a. série, No. 241, 15 de Dezembro de 2008, Section XI, at 8775, *available at* www.dre.pt/pdf1sdip/2008/12/24100/0877308780.PDF.

Energéticas Nacionais (REN), the company that operates the transmission grid in Portugal.[121] The concession authorizes REN to "explore" the pilot zone and to install the necessary infrastructure to connect wave energy projects to the grid.[122]

REN grants two types of licenses for a wave energy project: (1) a construction license (*licença de estabelecimento*), which entitles the developer to build and operate the project; and (2) a production license (*licença de exploração*), which authorizes the developer to sell the power produced to the grid.[123] REN grants construction and production licenses in three different stages of a project: "testing," "pre-commercial," and "commercial." A license in the testing phase is provided if the purpose of the project is to demonstrate that a certain concept or technology is technically and economically viable; a license in the pre-commercial phase involves technologies whose technical and economic viability have been established but that need further refinement until the proposed project is financially self-sustainable; finally, a license in the commercial phase is available for a project that is ready for commercial operation.[124] Construction licenses have a maximum term of five years in the testing phase, and twenty-five years in pre-commercial or commercial phases, subject to renewal for two additional periods of five years each.[125]

REN grants licenses for a wave project in the testing and commercial phases if the application fulfills certain requirements aimed at proving the viability of the project. These requirements include the submission of a specific road map for the construction of works, including costs and financing mechanisms; evidence that shows the developer's technical, economic and financial capability; a demonstration of how the project will contribute to create a domestic industry; and an environmental impact statement. REN is required to provide this information to all relevant agencies, which then must issue opinions on the proposed project within twenty days of each submission.[126]

Licenses for commercial operation, however, are subject to competitive bidding procedures, and it is usually private developers, not REN, that propose the projects and their specifications. These sections of

---

[121] *See* Ministerio da Economia e da Inovaçao, Decreto-Lei no. 238/2008, *supra* note 120, at 8773; *see also* www.ren.pt/vEN/Pages/home02.aspx (last visited Jan. 9, 2011).

[122] *See* Ministerio da Defesa Nacional, Decreto-Lei no. 5/2008, *supra* note 115, at 170; Ministerio da Economia e da Inovaçao, Decreto-Lei no. 238/2008, *supra* note 120, at 8773-74.

[123] *See* Ministerio da Defesa Nacional, Decreto-Lei no. 5/2008, *supra* note 115, 169.

[124] *See id.* at 172.

[125] *See id*. at 173-74.

[126] *See id*.

the regulations, intended to address long-term operations, are clearly not as well-developed. Guidelines for commercial operation are not as comprehensive as those for testing and pre-commercial fast-track licenses. Rather, an applicant submits a proposal and, if REN determines that the proposed project is viable, the proposal details are published in a newspaper to allow other interested parties the opportunity to apply for a license for that same project under competitive procurement procedures.[127] The initial applicant, however, has priority for consideration of its bid.[128]

C. UNITED KINGDOM

The development of ocean energy is a priority in the United Kingdom. In its renewable-energy action plan, the United Kingdom set a target of fifteen percent energy consumption from renewable energy by 2020, with an emphasis on electricity generation. This goal sets the bar high for the United Kingdom, since its energy consumption originating from renewable energy sources in 2005 was only one and one-third percent.[129] The United Kingdom is currently considering the development of a network of marine energy parks to help meet its target, and each park will have unique characteristics depending on the region where it will be located.[130]

The United Kingdom has placed great emphasis on enacting policies and financial measures to promote the research, development and use of renewable energy.[131] One relevant example of these programs for the United Kingdom (excluding Scotland) is the 2002 "Renewables Obligation" policy measure on large infrastructure projects for renewable electricity generation, which provides some financial assistance to energy corporations. A more recent measure includes the enactment of "Feed-in-Tariffs," initiated in April 2010, which is aimed at promoting smaller-scale (i.e., less than 5 MW) renewable energy generation projects by small businesses and communities.[132] In addition, the 2010 £22 million Marine Renewables Proving Fund, created by the Carbon Trust

---

[127] *See id.*
[128] *See id.*
[129] *See* Directive 2009/28/EC, *supra* note 110, at 11.
[130] *See id.* at 7.
[131] The United Kingdom has a number of financing programs that includes not only electricity, but also renewable fuel, biomass processing, woodlands management, renewable heat, sustainable agriculture, and multilateral financing mechanisms such as the European Investment Bank. *See id.* at 15.
[132] *See id.* at 15, 108, 115.

with funds from the British Department of Energy and Climate Change, funds the development of marine technologies until they advance and qualify for the existing Marine Renewables Deployment Fund, a £50 million fund that will support marine technologies in commercial phase.[133]

Generally speaking, the United Kingdom's Secretary of State for Energy and Climate Change is authorized to issue electricity "consents" under the Electricity Act of 1989 for onshore projects over 50 MW and offshore projects over 100 MW, unless those projects constitute "nationally significant infrastructure projects," which are then regulated under the Planning Act. The Planning Act of 2008 authorizes the Secretary to issue consents for large generating stations greater than 100 MW capacity in English and Welsh territorial waters and in the "renewable energy zones," which are areas of the English and Welsh exclusive economic zone that the United Kingdom has designated for renewable energy production.[134] The Planning Act consents also include infrastructure developments associated with the construction of generating stations, such as grid construction.[135] Finally, the Food and Environment Protection Act of 1985 and the Coastal Protection Act provide for licenses for certain marine energy projects if such projects will deposit substances and articles in the sea, or if they could be detrimental to navigation, respectively.[136]

Finally, similar to permitting requirements in the United States, development activities in the United Kingdom affecting the marine environment require a lease or license from the Crown Estate,[137] which owns the United Kingdom's entire seabed from the mean low water line up to twelve nautical miles.[138] Although the statute requires the Crown Estate Commissioners to enhance the financial return from the estate, profit maximization is not the primary intent. Rather, the Crown Estate was formed as a public body with statutory duties to manage the Crown Estate, while at the same time fulfilling regional environmental objectives, such as the protection of biodiversity.[139]

---

[133] *See* Campbell, *supra* note 33, at 40.

[134] *See* Directive 2009/28/EC, *supra* note 110, at 27.

[135] *See id.* at 28-29.

[136] *See id.* at 33.

[137] *See id.* at 42.

[138] *See* SCHEDULE OF THE CROWN ESTATE'S PROPERTIES RIGHTS AND INTERESTS 11 (2010), *available at* www.thecrownestate.co.uk/schedule_of_properties_rights_and_interests.pdf. The Crown Estate Act of 1961 specifies the Crown Estate's property rights. *Id.*

[139] *See* HOUSE OF COMMONS TREASURY COMMITTEE, THE MANAGEMENT OF THE CROWN ESTATE, at Ev 70 (2010), *available at*

In 2009, the United Kingdom passed the Marine and Coastal Access Act (MCAA), which regulates licensing of marine activities (such as fishing, oil and gas exploitation, ocean dredging, and renewable energy development), fisheries conservation, coastal access, and marine spatial planning (MSP)[140] in English and Welsh waters. Most notably, the MCAA created a Marine Management Organisation (MMO). The MMO is empowered to regulate ocean resources under its jurisdiction in a sustainable manner that takes into account scientific evidence and information on social, economic and environmental impacts.[141] The MMO, which is also required to produce research and make it available to the public, serves as the United Kingdom's center of expertise in the marine environment.[142]

The MCAA provides rules for the development of smaller-scale marine energy projects in the coastal zone and larger-scale projects in renewable energy zones, with a strong emphasis on developing information that contributes to the advancement of science and allows an assessment of environmental impacts on the marine environment. The MCAA transfers the Secretary of State's consent authority under the Electricity Act to the MMO, which is entitled to issue marine licenses for generating stations of a capacity between 1 MW and 100 MW, as well as generating stations in the renewable energy zone of a capacity between 50 MW and 100 MW.[143] To streamline procedures, these licenses replace the Coast Protection Act and Food and Environment Protection Act

books.google.com/books?id=HLnbNhT8nBwC&pg=PA69&lpg=PA69&dq=marine+management+organisations+crown+estate+lease&source=bl&ots=G8Xj45euZz&sig=I1tDbyHIAJvRNo95cvfEAzrMCa0&hl=en&ei=GHsuTfL2LoGqsAOmg_jGBQ&sa=X&oi=book_result&ct=result&resnum=6&ved=0CDcQ6AEwBQ#v=onepage&q&f=false.

[140] Marine spatial planning (MSP) has a variety of definitions, but it is generally considered to be "a comprehensive, ecosystem-based process through which compatible human uses are objectively and transparently allocated, both spatially and temporally, to appropriate ocean areas to sustain critical ecological, economic, and cultural services for future generations. An adaptive process, MSP requires the participation and input of stakeholders throughout a plan's development, implementation, monitoring, and evaluation." EASTERN RESEARCH GROUP, INC., MARINE SPATIAL PLANNING STAKEHOLDER ANALYSIS (2010), *available at* www.csc.noaa.gov/publications/MSP_Stakeholder_Analysis.pdf; *see generally* Sivas & Caldwell, *supra* note 46.

[141] *See* MARINE AND COASTAL ACCESS ACT 2009, THE STATIONARY OFFICE LIMITED 1-2 (2009), *available at* shareweb.kent.gov.uk/Documents/environment-and-planning/environment-and-climate-change/marine-and-coastal-act.pdf. In Wales, the Welsh Assembly Government will regulate its respective marine environment. *See Marine and Coastal Access Act*, ENVIRONMENT AGENCY, www.environment-agency.gov.uk/research/planning/40191.aspx (last visited June 3, 2011).

[142] Marine and Coastal Access Act 2009, *supra* note 141, at 17; Directive 2009/28/EC, *supra* note 110, at 47.

[143] *See* Marine and Coastal Access Act 2009, *supra* note 141, at 7.

consents for projects falling under the MCAA.[144] The exact application procedure for marine licenses has undergone consultation procedures but has not yet been determined.[145] The Secretary of State will retain consent authority over oil and gas projects, which are regulated under the Petroleum Act of 1998.[146] Authority over small projects, however, has been granted to the MMO, signaling that ocean energy projects are generally distinct from offshore oil and gas developments.

Finally, the MCAA introduces MSP. The statute requires the preparation of a "Marine Policy Statement" to set forth policies for sustainable development of the U.K. marine area.[147] It also creates specific marine regions comprising the English inshore and offshore regions, the Scottish inshore and offshore regions, the Welsh inshore and offshore regions, and the Northern Ireland inshore and offshore regions.[148] As envisioned, there will be one marine authority for each planning region, which will be required to prepare marine plans for areas comprising the whole or part of its region. Under the MCAA, the MMO is required to exercise its powers, including its marine licensing authority, in accordance with the Marine Policy Statement and the Marine Plans. The latter must conform to relevant provisions of the Crown Estate Act of 1961.[149] According to practitioners, it is anticipated that the marine planning system will come into force in April 2011.[150] At that point, the MMO's marine licensing powers should also be more clearly defined through relevant legislation and regulations.[151]

D. WHAT THE UNITED STATES CAN LEARN

Portugal and the United Kingdom have enacted ocean energy legislation and regulations to jumpstart the industry, test the technical and economic feasibility of wave energy technologies, and document impacts on the marine environment to ensure proper regulation over time. Between the two countries, Portugal has the more aggressive framework, placing a priority on the generation of electricity and its

---

[144] *See* Directive 2009/28/EC, *supra* note 110, at 40.

[145] *See* The Marine and Coastal Access Act—Opportunities and Challenges for the Energy Industry, Norton Rose Group (2010), www.nortonrose.com/knowledge/publications/32382/the-marine-and-coastal-access-act-opportunities-and-challenges-for-the-energy-industry.

[146] *See id.*

[147] *See* Marine and Coastal Access Act 2009, *supra* note 141, at 26-27.

[148] *See id.* at 29.

[149] *See id.*

[150] *See* Norton Rose Group, *supra* note 145.

[151] *See id.*

transmission and sale to the national grid through fast-track permitting procedures, while simultaneously limiting the scope of environmental impacts to a legislatively created pilot zone. The United Kingdom, on the other hand, prioritizes protection of the marine environment by granting consent authority to the legislatively created MMO, which, when approving wave energy projects, is bound by regional marine plans. While neither system provides a definitive answer to the question of how the United States can resolve its current jurisdictional and policy disputes for the development of wave energy, these examples provide lessons as to the importance of a one-stop permitting process, supportive regulations to stimulate industry development in the short term, coordination among federal, state and local agencies with authority over the project permitting process, and documentation of impacts on the marine environment for proper long-term regulation.

VI. LOOKING INTO THE FUTURE

The development of viable wave power opportunities presents a substantial new challenge to state and federal agencies. This is particularly true since ocean energy combines elements of many sectors—such as traditional onshore and offshore energy development, environmental regulation, natural resource management, electricity provision and reliability, climate change mitigation, and technology research and development support—that usually fall under the regulatory authority of numerous agencies. As such, ocean energy does not fit squarely within any one agency's purview and requires considerable coordination among diverse stakeholders. The United States' immediate regulatory focus should be to streamline procedures for the development of wave power. Drawing from lessons learned internationally, this Article recommends Congress's implementation of reforms that address a short-term scenario, as outlined below. Ideally, information collected from pilot project research and preliminary testing will provide a sound framework for long-term regulatory reform specific to the wave energy industry, and that research and testing will also serve to inform comprehensive MSP efforts just getting underway in the United States.

A. SHORT-TERM NEEDS

As noted in Parts II and III, the nation's western coastal states are taking an active lead in exploring and supporting wave power opportunities. Collaborative efforts between federal, state, and local governments, as already witnessed by the development of the West Coast

Wave Energy Framework,[152] should continue to be cultivated in order to support appropriate MSP strategies, streamline permitting, and encourage a local-scale and local-led wave energy industry.

Activity is already taking place at the state level to develop pilot project facilities, including the Northwest National Marine Renewable Energy Center at Oregon State University,[153] and the proposed National Renewable Energy Information Zone[154] in Massachusetts, which recently received $1.5 million in federal grants for beta testing projects. Maine also passed legislation in 2009 that mandated the creation of several ocean energy test sites in state waters.[155] Although New England aspires to lead the ocean energy industry, as discussed previously, the preeminent wave energy resources are on the Pacific coast; therefore, with the proper financial and regulatory incentives, the United States could launch a truly world-class industry. To that end, effective regulation is required.

Pilot projects supported by local governments can help move the industry forward by supplying publicly available data to inform future MSP and energy development efforts. However, local governments require support from state and federal agencies to ensure that pilot projects make it off the drawing board and are implemented. Pilot site identification could utilize existing research already available from sites such as San Francisco's Southwest Ocean Outfall Buffer Zone. San Francisco has already completed research on the wave resource, competing uses, and environmental impacts, and compiled data relating to the existing wastewater outfall right-of-way, transmission access, and exclusion from marine sanctuaries.[156] The breadth and type of existing data available for this site makes it a prime location for early testing.

---

[152] The West Coast Wave Energy Planning & Assessment Framework is a joint project of the U.S. Department of Energy and the Oregon Wave Energy Trust, and Pacific Energy Ventures. "The WCWE Framework is designed to support decision-making in the siting and permitting of wave energy projects off the West Coast of U.S. by: (1) identifying the relevant environmental information requirements; (2) synthesizing existing environmental information and making it readily accessible; (3) identifying key data gaps; and (4) proposing options to address the data gaps." *See* West Coast Wave Energy Planning & Assessment Framework, www.advancedh2opower.com/framework/Site%20Pages/West%20Coast%20Wave%20Energy%20Framework.aspx.

[153] Overview, Northwest National Marine Renewable Energy Center, depts.washington.edu/nnmrec/ (last visited June 3, 2011).

[154] National Ocean Renewable Energy Innovation Zone Created, Ocean Power Magazine.net (Oct. 28, 2010), www.oceanpowermagazine.net/2010/10/28/national-ocean-renewable-energy-innovation-zone-created/.

[155] An Act to Facilitate Testing and Demonstration of Renewable Ocean Energy Technology, 2010 Me. Legis. Serv. Ch. 615 (West), *available at* www.maine.gov/doc/initiatives/oceanenergy/pdf/PUBLIC270.pdf.

[156] *See* URS, *supra* note 14.

Although local projects are critical to the future of wave energy success, pilot zones should not be restricted solely to state waters, as there may be larger energy potential beyond the three-mile limit that would provide greater power generation and a more rigorous environment for testing wave energy devices. Of course, federal cooperation is essential to any such development in the OCS.

Following in Scotland and Portugal's footsteps, MMS should support the creation or approval of pilot zones for small, short-term projects in order to foster the growth of the nascent ocean energy industry. The implementation of such a program may be best left primarily to FERC, which may draw on its broad expertise in hydroelectric generation and transmission, just as REN does in Portugal. This effort will remove some of the often insurmountable regulatory and financial barriers that ocean energy technology companies face when attempting to advance from early research stages to actual testing and full-scale commercialization phases. In addition, no MMS lease should be required at the pilot project stage, particularly as a condition precedent to the approval of a FERC license application. The MMS model is based on collecting royalties on minerals extracted; however, in the wave energy context, it is not yet certain that power will be produced, nor is it determined at what prices it will be sold to the grid. Thus, it is inappropriate to apply the same model to wave power without necessary adjustments.

Regardless of whether the projects are nearshore or offshore, permitting restrictions must be revised to facilitate pilot testing and staged ocean power development. FERC's pilot program is a good step forward in this respect. For individual pilot projects, permitting changes should include longer test periods, as well as assurances that land used for as pilot project will not be leased to other entities before the pilot is complete (at least for a project on the OCS). Federal license fees for ocean energy projects should be limited in the near term, in recognition of the emerging status of the industry. In addition, decisions on individual applications should give preference to projects that advance the public interest by increasing renewable generation capacity, effectively protecting the affected ocean resources, and making study data publicly accessible.

Providing a dedicated test facility with blanket land leases, environmental assessments, and electricity generation or grid interconnection agreements would save developers significant time and money on a per-project basis, enabling more projects to complete rigorous in-water testing and eventually reach commercial scale deployment. Federal leadership, to simplify and reduce costs of the permitting process, would send a strong message to ocean energy companies that the federal government supports the development of this emerging clean energy technology, just as the EU does in support of its member states.

Streamlined permitting and test facility development should of course be done with commensurate respect for social, environmental, and economic considerations. The public must be involved from the beginning, and comment periods should be reasonable and proportional to the scale and level of risk involved. If sited in state waters, fast-track procedures must also ensure consistency with a state's Coastal Zone Management Plan (an issue that has not been addressed by FERC's pilot permitting process, and that may lead to longer licensing timelines than pledged). Thus, MOUs between FERC and relevant states should explicitly address this issue. In addition to supporting early stage development of an American wave energy industry, the federal and state governments' main goal at this stage should be to document WEC technical performance, financial viability and environmental impacts to inform long-term policymaking.

B. LONG-TERM GOALS

In addition to the short-term needs discussed above, longer-term goals should not be overlooked. One primary long-term goal for ocean power regulation should be to remove redundancy at the federal, and even state, level. This includes streamlining the federal permitting process into a one-stop application process whereby one agency assumes responsibility for coordinating all permitting and license application review and communication needs with the project developer. Part and parcel of this is ensuring proper consideration of the marine environment by drawing on the information generated by pilot projects. Eliminating redundancy also involves coordination among all federal and state agencies involved in the environmental permitting and compliance process, including the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, NOAA, the U.S. Coast Guard, the California State Lands Commission, and California Coastal Commission, as applicable.

In this respect, it would be desirable that Congress pass comprehensive ocean or wave energy legislation or regulations addressing the relationship between FERC's authority over the energy permitting process and NOAA's authority over the marine environment. Once again, permitting procedures should not be duplicated, but true coordination must be ensured so that NOAA plays an important and active role in the development of the wave energy industry within a single-stop long-term licensing procedure. Like the MMO in the United Kingdom, NOAA should be responsible for managing the information on environmental impacts generated by such projects and making the data publicly available.

If the federal permitting process is not improved, projects may be forced closer to shore, limiting the potential for the nascent ocean energy industry both in terms of technologies pursued and size of the energy resource captured. Effective wave energy regulations on federal and state levels should ensure parallel, not consecutive, procedures, and energy policy needs to be integrated with natural resources policy—federal agencies and the states should have clearly defined authorities in relation to renewable energy. Meaningful stakeholder engagement should also be facilitated and simplified to reduce the burden on all relevant parties. Such streamlining of the federal and state permitting processes would significantly reduce transaction costs and permitting timelines. In addition, it would reduce complications regarding energy projects that straddle the three-mile jurisdictional boundary between state and OCS lands.

One version of this approach could be modeled after MMS's newly instituted "Smart from the Start" program, which was created to assist in the siting, leasing, and construction of new wind energy projects on the OCS.[157] The program allows MMS to identify priority areas most suitable for potential wind energy development. Data will be collected from these areas in order to "inform government and industry assessments and planning, and . . . promote greater efficiency in the siting and permitting process for offshore wind projects."[158] Such an accelerated and focused approach will encourage investment and ensure that projects meet high standards. MMS expects that the "Smart from the Start" program will eliminate six to twelve months in the leasing process alone.[159]

Lastly, if the development of ocean energy is to progress and

---

[157] *See* BOEMRE Initiates Leasing Process for Commercial Wind Development Offshore Massachusetts, Ocean News & Tech., www.ocean-news.com/newsletter/595-boemre-initiates-leasing-process-for-commercial-wind-development-offshore-massachusetts (last visited Jan. 10, 2011); *see also* Press Release, U.S. Dep't of the Interior, Salazar Launches "Smart from the Start" Initiative to Speed Offshore Wind Energy Development off the Atlantic Coast (Nov. 23, 2010), *available at* www.doi.gov/news/pressreleases/Salazar-Launches-Smart-from-the-Start-Initiative-to-Speed-Offshore-Wind-Energy-Development-off-the-Atlantic-Coast.cfm. Interestingly, the program was modeled on solar project efforts. *Id.*

[158] *See* U.S. Dep't of the Interior, *supra* note 157.

[159] *See id.*

become a viable source of renewable energy, key federal agencies must work to institute an ocean planning process that considers the full suite of scientific, environmental and social factors. Other marine resources must also be accounted for, including broader marine ecosystems and fisheries. One way to accomplish this integration is to implement aspects of MSP with comprehensive ocean energy regulation, as the United Kingdom is doing by tying the consent process for wave energy projects to the provisions of regional marine plans.[160] "Zoning" ocean renewable energy projects, and other competing uses, will reduce the risks associated with managing marine ecosystems and introducing new and largely unproven technologies. Comprehensive MSP efforts will also provide greater certainty for developers and likely lead to more efficient project implementation processes and lower transaction costs involved with the licensing and permitting process. Lessons from pilot projects will provide important information for the MSP process and future planning efforts.

VII. CONCLUSION

Without a doubt, the development of ocean-based hydrokinetic power has tremendous potential on a global scale. Promising wave energy projects are on the rise, largely due to concerns about climate change, air pollution, fossil fuel depletion and national security. Given that the vast majority of wave power technologies are still in their infancy, implementing these emerging technologies will require a flexible management framework to take into account potential environmental and social impacts—the extent of which can, and should, be obtained from pilot project data collection and analysis.

---

[160] In California at least, the California Marine Life Protection Act (MLPA) may provide a useful vehicle for marine spatial planning (MSP) and ecosystem-based management. *See* Marine Life Protection Act, Cal. Fish & Game Code §§ 2850-2863 (Westlaw 2011). The California State Legislature adopted the MLPA in 1999, requiring the state to utilize science-based regional approaches to redesign California's system of marine protected areas (MPA) to function, where possible, as a network. *See* Why the California Marine Life Protection Act Initiative?, Cal. Dep't of Fish & Game, www.dfg.ca.gov/mlpa/highlights.asp (last visited Dec. 22, 2010). Although there are many definitions of an MPA, one of the most coherent is stated in Executive Order 13,158, which defines an MPA as "any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural or cultural resources therein." Salcido, *supra* note 62, at 1106 (citing Exec. Order No. 13,158, 65 Fed. Reg. 34,909 (May 26, 2000), reprinted at 16 U.S.C.A. § 1431 (Westlaw 2011)). The MLPA's goal is to increase consistency and effectiveness in protecting the state's marine environment, as well as to "improve recreational, educational, and study opportunities" afforded by pristine marine ecosystems. MLPA Summary, California Department of Fish & Game, www.dfg.ca.gov/mlpa/background.asp (last visited June 3, 2011).

As discussed above, particularly from examples within California and the City of San Francisco, state and local governments are beginning to play a key role in supporting research and development, assisting local industry growth, and ensuring that wave power is ultimately included in electricity planning. However, these entities often encounter a complicated and overlapping federal regulatory regime that, combined with high upfront costs, essentially stifles development of the industry. Federal leadership in the wave energy sector is crucial due to its extensive, and often exclusive, jurisdiction over wave resources. Unlike conventional wind and solar power, ocean energy devices cannot be tested or deployed on private land; as a result, the industry will emerge and succeed only if the federal government provides ocean energy technologies the opportunities to advance.

There is a need for comprehensive regulatory reform addressing immediate and longer-term scenarios for wave energy development, while ensuring proper protection of the marine environment. While positive changes are taking place at the federal level, as evidenced by the 2009 MOU between FERC and MMS, and the new National Policy for the Stewardship of the Ocean, Our Coasts, and the Great Lakes and associated Framework for Effective Coastal and Marine Spatial Planning,[161] much more remains to be done. The United States should draw upon best practices implemented in the EU to streamline permitting procedures and encourage pilot project operations, integrate aspects of MSP to account for effects on the marine environment, and adapt renewable energy regulatory models and financial incentives to include the wave energy sector. In doing so, the federal government, and the United States in general, has the opportunity to play a leading role in supporting ocean energy and ensuring a robust local green economy, a diverse, carbon-free energy supply, and improved energy security.

---

[161] *See Coastal and Marine Spatial Planning*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., cmsp.noaa.gov/noaa-role (last visited Jan. 12, 2011); Exec. Order No. 13,547, 75 Fed. Reg. 43,023 (2010), reprinted at 33 U.S.C.A. § 857-19 (Westlaw 2011), *available at* www.whitehouse.gov/the-press-office/executive-order-stewardship-ocean-our-coasts-and-great-lakes; FINAL RECOMMENDATIONS OF THE INTERAGENCY OCEAN POLICY TASK FORCE, WHITE HOUSE COUNCIL ON ENVIRONMENTAL QUALITY (2010), www.whitehouse.gov/files/documents/ OPTF_FinalRecs.pdf.