

Hydrokinetic Energy: Trying to Navigate the Energy and Water Law Framework to Develop New Renewable Energy Technology

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Introduction

From waves crashing on the beach to rivers rushing through a narrow canyon, the power of moving water can serve as an abundant source of clean, renewable energy. New hydrokinetic technologies allow us to harness the energy of moving water to generate power without the negative impacts associated with traditional hydropower projects. Hydrokinetics is the process of extracting energy from currents, tides, or waves.¹ This modern source of energy creation raises many legal issues in water law concerning questions of ownership, environmental concerns, and water quality impacts. Legal issues that will arise with the development and implementation of hydrokinetic technology will involve the interests of a myriad of stakeholders consisting of

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¹ Congress defined hydrokinetic energy as “electrical energy from waves, tides, and currents in oceans, estuaries, and tidal areas; free flowing water in rivers, lakes, and streams, or man-made channels; and differentials in ocean temperature (ocean thermal energy conversion).” The Energy Independence and Security Act of 2007, 42 U.S.C. § 17211 (2006).

regulatory agencies, project developers, conservationists, and concerned citizens. With so many stakeholders having an interest in hydrokinetic energy, it may be difficult to create a comprehensive solution for most of the legal disputes that are likely to occur.

The need for reliable sources of energy production continues to increase. The 2009 energy outlook by the International Energy Agency predicted world energy consumption will grow 40% by the year 2030, with fossil fuels meeting up to 75% of this demand.² In addition, the current financial crisis has created much uncertainty as to whether all the energy investment needed to meet growing energy needs will occur. The International Energy Agency projects that \$26 trillion is required to meet projected energy demand through the year 2030.³ By adopting policies to mitigate climate change and enhance energy security countries can give hydrokinetic projects the opportunity to demonstrate the economic and environmental benefits this technology can provide.

This analysis will focus on the development of hydrokinetic energy projects and how such projects can be impacted by current water law. Part I will provide a background of hydrokinetic technology. Part II outlines the current regulatory framework for licensing hydrokinetic energy projects and highlights emerging regulatory issues that may impact hydrokinetic energy in the future. Part III analyzes how hydrokinetic energy projects could be impacted based on how the local jurisdiction defines water rights. Part IV concludes that hydrokinetic energy projects can become a significant renewable energy resource if governing bodies adopt smart, sustainable policies for implementing these new renewable energy projects.

² International Energy Agency, *World Energy Outlook Executive Summary 2009 Edition*, at 4, available at <http://iea.org/Textbase/npsum/WEO2009SUM.pdf>.

³ *Id.* at 5.

I. Background

For thousands of years water has been an important resource for energy production.⁴ The Ancient Greeks in the eighth century used water wheels that harnessed the energy in falling water to generate power to grind wheat.⁵ Today, hydrokinetic technologies present an opportunity to develop a new generation of water power.

A. Types of Hydrokinetic Energy

Unlike traditional hydropower projects, hydrokinetic energy projects do not require impoundments or diversions of water.⁶ Instead, to produce electricity these projects harness the power of moving water in waves, currents, and tidal channels.⁷ Hydrokinetic technologies can be distinguished based on these three major sources for harnessing hydrokinetic energy.

There are several wave energy devices that capture the energy contained in near and off-shore waves. The most common type of wave technology includes attenuators, point absorbers, and oscillating water columns. Attenuators are floating segmented structures that are visually similar to a snake. The motion of the waves generates energy at the segment hinges, pressurizing a hydraulic piston that drives fluids through a motor which turns a generator.⁸ In 2008, Pelamis Wave Power utilized an attenuator design when it developed the first commercial wave farm off the coast of Portugal.⁹ Point absorbers involve floating buoy structures that collect energy when

⁴ Michael B. Walsh, *A Rising Tide in Renewable Energy: The Future of Tidal In-Stream Energy Conversion (TISEC)*, 19 Vill. Envtl. L.J. 193, 196 (2008).

⁵ *Id.* Gates close and trap water in a storage pond during high tide. During low tide, the water is released through a water wheel to mill grain. *Id.*

⁶ House Subcommittee on Energy and Environment, *Marine and Hydrokinetic Energy Technology: Finding the Path to Commercialization*, Dec. 3, 2009, at 2, available at http://democrats.science.house.gov/Media/File/Commdocs/hearings/2009/Energy/3dec/Hearing_Charter.pdf.

⁷ *Id.*

⁸ Laura Koch, *The Promise of Wave Energy*, 2 Golden Gate U. Envtl. L.J. 162, 165 (2008).

⁹ Pelamis Wave Power, *Statement on Portuguese Aguçadoura Project*, http://www.pelamiswave.com/media/statement_on_aguadoura_project.pdf (last visited Mar. 15, 2010).

a pump, that rises and falls with the waves, compresses seawater which turns a turbine.¹⁰

Oscillating water columns operate by allowing waves to enter and exit a partially submerged hollow chamber.¹¹ Air inside the chamber becomes pressurized by the rise and fall of water within the structure.¹² As the air is compressed it is forced into a turbine, producing electricity.¹³

Unlike wave energy technologies that extract energy directly from surface waves, current and tidal energy technologies harness energy from currents below the water surface.¹⁴ There are several different energy technologies being used to capture the energy found in ocean, tidal, and river currents.¹⁵ The technology used to harness energy from tidal and river currents generally involve either horizontal or vertical-axis turbines.¹⁶ Both types of technology rely on underwater turbine blades being driven by moving water, causing the blades of the rotor to turn a generator.¹⁷ The process is similar to how windmill blades are moved by the wind to harness wind energy.¹⁸ However, hydrokinetic turbines can extract more energy at lower velocities than wind turbines, because water is 832 times denser than air.¹⁹ In fact, hydrokinetic turbines will produce forty times more power than a similar sized wind turbine.²⁰

Hydro Green Energy and Verdant Power are two companies that have implemented instream hydrokinetic energy projects. Hydro Green Energy established the first federally

¹⁰ Koch, *supra* note 8.

¹¹ Hon. Jon Wellinoff, James Pederson, and David Morenoff, *Facilitating Hydrokinetic Energy Development Through Regulatory Innovation*, 29 Energy L. J. 397, 399 (2008).

¹² *Id.*

¹³ *Id.*

¹⁴ *Id.*

¹⁵ Ocean currents, such as the Gulf Stream, are caused by winds and temperature changes from surface heating processes. Subcommittee on Energy and Environment, *supra* note 6. Tidal currents, on the other hand, are formed from the rise and fall of the tides caused by the moon's gravitational pull. *Id.*

¹⁶ *Id.*

¹⁷ *Id.*

¹⁸ *Id.*

¹⁹ Walsh, *supra* note 4, at 198. Hydrokinetic technology is effective in water that is moving as slowly as five feet per second. *Id.*

²⁰ *Id.*

licensed hydrokinetic power project in the United States on the Mississippi River in Hastings, Minnesota.²¹ The project consists of a barge-mounted horizontal-axis turbine located downstream from an existing hydropower plant at Mississippi Lock and Dam No. 2.²² The project began operations on August 20, 2009, with a second more efficient turbine to be installed in the spring of 2010.²³

Verdant Power developed the Roosevelt Island Tidal Energy Project on the East River near New York City.²⁴ The project has six full-scale turbines that distribute power to a large supermarket nearby.²⁵ Verdant Power plans to install up to thirty underwater turbines between Queens and Roosevelt Island by 2011.²⁶ The final project will provide one megawatt of electricity, which is equal to supplying 30,000 houses with power.²⁷

B. Benefits of Hydrokinetic Energy

Companies that are interested in developing hydrokinetic energy projects are attracted to the many benefits this type of technology exhibits. First, hydrokinetic projects are renewable and emission-free.²⁸ The United States could avoid emitting 250 million metric tons of carbon dioxide per year if hydrokinetic energy represented 9% of the United States' electric

²¹ *Id.*

²² U.S. Department of Energy, *Federal Regulators Approve an In-Stream Hydrokinetic Project*, Federal Energy Management Program- News and Events, Dec. 17, 2008, available at http://www1.eere.energy.gov/femp/news/m/news_detail.html?news_id=12146.

²³ Subcommittee on Energy and Environment, *supra* note 6.

²⁴ Isabel Ordóñez, *Everybody Into the Ocean*, The Wall Street Journal, Oct. 6, 2008, available at <http://online.wsj.com/article/SB122305758177602871.html>.

²⁵ *Id.*

²⁶ Leigh Remizowski, *Change is in the wind, thanks to green East River hydroelectric power project*, New York Daily News, Feb. 5, 2010, available at http://www.nydailynews.com/ny_local/bronx/2010/02/05/2010-02-05_change_is_in_the_wind_thanks_to_green_east_river_project.html.

²⁷ *Id.*

²⁸ Larry Eisenstat and Bethany Dukes, *Overcoming Boundaries (Real and Imagined) to Hydrokinetic Power Development*, Electric Light & Power (2009), available at <http://www.elp.com/index/display/article-display/0267424228/articles/electric-light-power/volume-87/issue-6/columns/overcoming-boundaries.html>.

consumption, displacing energy generated by fossil fuel power plants.²⁹ The Electric Power Research Institute estimates that hydrokinetic resources could provide about 10% of today's electric consumption in the United States.³⁰

Unlike the intermittent nature of other renewable energy sources, the sources of hydrokinetic energy are generally predictable and unaffected by weather variability.³¹ Wave patterns can be accurately forecast several days in advance,³² and tides “will always reoccur every twelve hours and twenty-five minutes,” because they are connected to the moon's gravitational pull.³³ Both wave and tidal energy can provide base load power, displacing the need for backup fossil fuel power plants.³⁴ River currents, on the other hand, are known to fluctuate seasonally and are susceptible to wet and dry years, making it difficult to predict instream flow from year to year.³⁵

Hydrokinetic energy is also an attractive energy source because of how hydrokinetic projects have little to no effect on the local aesthetics.³⁶ Generally, most of the mechanical components of the various hydrokinetic devices are located underwater. Also, offshore wave energy projects would have “device markings that would only be seen from shore on exceptionally clear days,” because the Coast Guard only requires the projects to display markings visible for one nautical mile.³⁷

²⁹ PEW Center on Global Climate Change, *Hydrokinetic Electric Power Generation*, Dec. 2009, at 4, available at <http://www.pewclimate.org/docUploads/Hydrokinetic%2009%2012%2004.pdf>.

³⁰ Subcommittee on Energy and Environment, *supra* note 6.

³¹ PEW Center on Global Climate Change, *supra* note 29, at 1.

³² *Id.*

³³ Walsh, *supra* note 4, at 198.

³⁴ Mark Sherman, *Wave New World: Promoting Ocean Wave Energy Development through Federal-State Coordination and Streamlined Licensing*, 39 *Env'tl. L.* 1161, 1170 (2009).

³⁵ PEW Center on Global Climate Change, *supra* note 29.

³⁶ Walsh, *supra* note 4, at 220; Sherman, *supra* note 34.

³⁷ Minerals Mgmt. Serv., U.S. Dep't of the Interior, *Technology White Paper on Wave Energy Potential on the U.S. Outer Continental Shelf*, 2 (2006), available at http://ocsenergy.anl.gov/documents/docs/OCS_EIS_WhitePaper_Wave.pdf.

A renewable energy project's aesthetic impact on the surrounding environment can present a major obstacle to its development by subjecting the project to lengthy and costly legal disputes.³⁸ For example, area residents and environmental groups challenged Cape Wind Associates' plans to build the first offshore wind farm in the United States off the coast of Massachusetts in Nantucket Sound.³⁹ Aesthetic concerns over the more than 400 feet high turbines have contributed to the delayed development of the Cape Wind project.⁴⁰ Fortunately, hydrokinetic energy thus far appears more successful than wind energy at gaining community support and reducing the "not in my back yard" phenomenon.⁴¹ For instance, the Roosevelt Island community near Manhattan in New York has shown support for Verdant Power's RITE project.⁴² In fact, in response to delayed approval of necessary permits by New York state officials, "the president of the Roosevelt Island Residents Association told Verdant: 'You just give us the word and we're going to Albany on buses to get that permit for you. We want this power project in our backyard.'"⁴³ This type of public support is essential to ensuring that the development of hydrokinetic projects is not delayed based on aesthetic reasons.

The greatest benefit of hydrokinetic energy may be how it is capable of being installed wherever energy is needed.⁴⁴ Many high-demand urban centers are located near moving water. This allows for the easy integration of hydrokinetic power into the existing grid without having

³⁸ Walsh, *supra* note 4, at 220-221.

³⁹ The project involves the placement of 130 wind turbines over twenty-four square miles in Nantucket Sound. Avi Brisman, *The Aesthetics of Wind Energy Systems*, 13 N.Y.U. Envtl. L.J. 1, 47-48 (2005). Each turbine would stand over 400 feet high. *Id.* at 67.

⁴⁰ Beth Daley, *Chasing the Wind*, The Boston Globe, July 20, 2009, available at http://www.boston.com/business/articles/2009/07/20/new_technology_emerges_for_deep_water_wind_farms/.

⁴¹ Walsh, *supra* note 4, at 220.

⁴² *Id.* at 220-221.

⁴³ *Id.* (citing Peggy Shaw, *Lunar Power in the Big Apple*, *Multihousing Professional*, Jan. 2007, at 66.).

⁴⁴ See Paul Davidson, *Catch a Wave, Throw a Switch*, USA Today, Apr. 19, 2007, *Academic Search Premier*, EBSCOhost (accessed March 20, 2010).

to distribute the energy through miles of transmission lines that lose a portion of the energy along the way.⁴⁵ Rural areas, in particular, can gain from the development of hydrokinetic energy despite the traditional difficulty in supplying those areas with power.⁴⁶ Some studies report that “one-third of the world's population does not have access to electricity, but does have access to moving water.”⁴⁷ Several renewable energy developers are attempting to bring tidal instream energy conversion devices (TISEC) to rural areas. For example, Verdant Power is in the process of implementing TISEC systems in rural villages in the Amazon basin.⁴⁸ In rural Alaskan villages, developers are trying to replace the high costs of using diesel engines to produce energy with lower-cost TISEC devices.⁴⁹ Such a change would drastically reduce the cost of energy.⁵⁰

C. Advantages over Conventional Hydropower

In the area of using water to harness energy, hydrokinetic energy has distinct advantages over hydropower. First, hydrokinetic energy projects do not require impoundments or diversions of water.⁵¹ Hydropower projects, however, rely on dams and reservoirs that drastically alter the surrounding land.⁵² A hydropower dam causes an increased likelihood of flooding upstream of the dam.⁵³ Because a hydropower dam obstructs the course of a river, the river's reduced flow increases sedimentation in the reservoir.⁵⁴ The riverbed upstream rises and becomes more susceptible to flooding as a result of the increase in sedimentation.⁵⁵ Simultaneously, there is

⁴⁵ *Id.*

⁴⁶ Walsh, *supra* note 4, at 199.

⁴⁷ *Id.*

⁴⁸ *Id.*

⁴⁹ *Id.* Energy production using diesel engines costs up to eighty cents per kilowatt hour. *Id.*

⁵⁰ *Id.*

⁵¹ Subcommittee on Energy and Environment, *supra* note 6.

⁵² Walsh, *supra* note 4, at 203.

⁵³ *Id.*

⁵⁴ *Id.*

⁵⁵ *Id.*

accelerated erosion of the riverbed caused by sediment-free water released downstream at a high velocity.⁵⁶

Second, unlike hydropower, large numbers of people would not need to be displaced to make way for a hydrokinetic energy project. Hydrokinetic projects can be placed in existing water sites without having to create a large reservoir on land already occupied by people. Large hydropower dams have displaced an estimated twenty-three million people in China,⁵⁷ and forty to eighty million persons worldwide.⁵⁸ In addition, there is a continued threat of dam failure for populations who have avoided being displaced but live downstream of a hydropower dam.⁵⁹ Of particular concern is the impact an earthquake could have on an aging or inadequately maintained dam.⁶⁰

Lastly, hydrokinetic energy may be able to avoid impacts on wildlife that are associated with conventional hydropower projects. Areas with hydropower present difficult environmental challenges to wildlife by altering the river systems and surrounding habitat.⁶¹ The operations of hydropower dams create fluctuations in water levels, reducing the flow of water downstream.⁶² Reduced water levels downstream can create inhospitable conditions for fish as a result of higher water temperatures and lower oxygen levels.⁶³ This impact is not likely to occur from most

⁵⁶ *Id.*

⁵⁷ John A. Sautter, *The Clean Development Mechanism in China: Assessing the Tension Between Development and Curbing Anthropogenic Climate Change*, 27 Va. Env'tl. L.J. 91, 107 (2009). The Three Gorges Dam on the Yangtze River in China displaced 1.1 million people and estimates indicate 4 million people will be displaced by 2020 because of rising water, erosion, landslides, and pollution caused by the dam's construction. *Id.*

⁵⁸ Walsh, *supra* note 4, at 204.

⁵⁹ *Id.*

⁶⁰ Kyna Powers, *Aging Infrastructure: Dam Safety*, CRS Report for Congress, Sept. 29, 2005, at 2, available at <http://www.ewrinstitute.org/files/pdf/aidamsafetyreport.pdf>.

⁶¹ Avinash Kar, *Ensuring Durable Environmental Benefits Through a Collaborative Approach to Hydropower Re-licensing: Case Studies*, 11 Hastings W.-N.W. J. Env. L. & Pol'y 27, 28 (2004).

⁶² *Id.*

⁶³ *Id.*

hydrokinetic projects because these projects generally do not appear to significantly reduce the flow of water.

Hydrokinetic dams have also been seen to block the migratory routes of threatened and endangered species such as salmon and sturgeon.⁶⁴ For example, threatened and endangered salmon once were found along approximately 13,000 miles of Columbia Basin rivers and streams in the Northwestern United States.⁶⁵ The construction of several dams blocked salmon from reaching upstream habitat, denying them access to more than half of their traditional habitat in the Columbia Basin.⁶⁶

Hydrokinetic energy developers are seeking to avoid impacting fish migration by operating turbines at speeds to allow fish to safely travel around and even through the turbines.⁶⁷ A recently conducted fish survival study at the Hastings Project on the Mississippi River found that the hydrokinetic horizontal-axis turbine currently in operation “has little if any considerable impact on the fish populations in the vicinity of the project.”⁶⁸ The study concluded that the

⁶⁴ Kurt Stephenson, *Taking Nature into Account: Observations about the Changing Role of Analysis and Negotiation in Hydropower Re-licensing*, 25 Wm. & Mary Env'tl. L. & Pol'y Rev. 473, 474-475 (2000).

⁶⁵ Rollie Wilson, *Removing Dam Development to Recover Columbia Basin Treaty Protected Salmon Economies*, 24 Am. Indian L. Rev. 357, 392 (1999).

⁶⁶ *Id.*

⁶⁷ Angela Neville, *Hydrokinetic Plant Piggybacks on Existing Hydro Plant*, Power, Apr. 1, 2009, available at http://www.powermag.com/o_and_m/Hydrokinetic-Plant-Piggybacks-on-Existing-Hydro-Plant_1794_p4.html.

⁶⁸ Normandeau Associates, Inc., *An Estimation of Survival and Injury of Fish Passed Through the Hydro Green Energy Hydrokinetic System, and a Characterization of Fish Entrainment Potential at the Mississippi Lock and Dam No. 2 Hydroelectric Project*, Dec. 2009, at 8, available at <http://www.hgenenergy.com/Hastings%20Agencies%20Review%20Draft%2012-21-09.pdf>. The study involved 502 balloon and radio tagged fish of a variety of species and sizes: 402 fish swam through the turbine and 100 were allowed to swim freely in the river near the turbine, which rotates at 21 revolutions a minute. Hydro Green Energy, *Fish Survival Study on Hydrokinetic Power Turbine Shows Device is Ultra Fish Friendly*, Jan. 6, 2010, at 1, available at <http://www.hgenenergy.com/Final%20Fish%20Study%20Release.pdf>. “Only one fish out of the 402 that were introduced into the hydrokinetic unit showed evidence of direct physical harm.” *Id.* at 2. Hydro Green Energy contends, “this was almost certainly due to the fact that the fish was outfitted with a balloon tag, causing it rise to the surface to interact with the hydrokinetic device in a manner that otherwise would never occur.” *Id.*

hydrokinetic turbine cannot inflict any pressure related injuries on fish.⁶⁹ Additionally, no signs of increased predation were observed directly or indirectly downstream from the hydrokinetic project, which can be an issue with conventional hydropower facilities.⁷⁰

Although studies are beginning to confirm that hydrokinetic energy is a more environmentally friendly technology than hydropower, a recent study by the U.S. Department of Energy found that marine and hydrokinetic technologies could disrupt marine resources.⁷¹ The report suggests that underwater noise generated during installation and operation of energy conversion devices could interfere with sounds animals make to communicate, or cause animals to avoid areas with the highest noise levels.⁷² Also, the report indicated there could be toxic effects on aquatic organisms caused by the accidental leakage of hydraulic fluids and lubricating oils coming from the hydrokinetic device or service vessels used to install and maintain the device.⁷³

However, the report did emphasize that the possible environmental impacts are speculative based on the limited amount of environmental studies of hydrokinetic technology and the small number of hydrokinetic devices that have been deployed and tested in rivers and

⁶⁹ *Id.* at 13-14.

⁷⁰ *Id.* at 8.

⁷¹ See U.S. Department of Energy- Office of Energy Efficiency and Renewable Energy, *Report to Congress on the Potential Environmental Effects of Marine and Hydrokinetic Energy Technologies*, Dec. 2009, available at http://www1.eere.energy.gov/windandhydro/pdfs/doe_eisa_633b.pdf. See also Katie Howell, *Wave Technologies Could Harm Marine Resources--DOE Study*, The New York Times, Feb. 24, 2010, available at <http://www.nytimes.com/gwire/2010/02/24/24greenwire-wave-technologies-could-harm-marine-resources-95837.html>. The Office of Energy Efficiency and Renewable Energy report indicated “potential impacts include the alteration of currents and waves; alteration of substrates and sediment transport and deposition; alteration of habitats for benthic organisms; noise during construction and operation; emission of electromagnetic fields; toxicity of paints, lubricants, and antifouling coatings; interference with animal movements and migrations; and strike by rotor blades or other moving parts.” DOE Report to Congress, *supra* note 71.

⁷² *Id.* at 24

⁷³ *Id.* at 31, 32.

oceans.⁷⁴ Furthermore, the report proposed mitigation practices that could be implemented to reduce negative impacts, such as limiting the number of devices and siting projects away from environmentally sensitive areas.⁷⁵ The report also suggested hydrokinetic energy projects could benefit marine habitats and populations by limiting fishing activities near a project.⁷⁶

II. The Regulatory Process

While traditional hydropower is a well-established industry with a firm regulatory framework, hydrokinetic energy is a promising new technology that has yet to be proven commercially viable.⁷⁷ A clear and reasonable regulatory process for hydrokinetic projects is crucial for hydrokinetic energy to be successful in reaching its full potential. In the past few years, the federal government has implemented several regulatory changes to facilitate hydrokinetic energy development. Before addressing these changes, it is necessary to identify the key agencies in the regulatory process and describe the principle federal statutes involved in siting hydrokinetic projects.

A. Legal Authority over Hydrokinetic Projects

Various government agencies are involved in the regulatory processes used in siting and operating hydrokinetic projects. The Federal Power Act designated the Federal Energy Regulatory Commission (FERC) as the primary administrative authority responsible for overseeing hydropower projects.⁷⁸ The Energy Policy Act of 2005 expanded FERC's oversight

⁷⁴ *Id.* at 1.

⁷⁵ *Id.* at 25.

⁷⁶ *Id.* at 22.

⁷⁷ Wellinghoff, *supra* note 11, at 398.

⁷⁸ The Federal Power Act authorizes the Federal Energy Regulatory Commission to “[i]ssue licenses... for the purpose of constructing, operating, and maintaining dams, water conduits, reservoirs, power houses, transmission lines, or other project works necessary or convenient for the development and improvement of navigation and for the development, transmission, and utilization of power across, along,

to include hydrokinetic projects by making “FERC responsible for licensing, inspecting and overseeing environmental matters relating to hydrokinetic technologies.”⁷⁹ Although FERC is the leading role in this area, a developer may be required to obtain authorizations from other agencies, such as the Minerals Management Service (MMS), the United States Army Corps of Engineers, the United States Fish and Wildlife Service, or the National Marine Fisheries Service. Furthermore, a developer may need to obtain authorizations from various state agencies under applicable federal laws, such as the Clean Water Act⁸⁰ and the Coastal Zone Management Act.⁸¹

Conflicts can arise as to the appropriate role of an agency in the regulatory process because of the involvement of such a large number of government agencies. An example of such a conflict occurred between FERC and MMS over federal jurisdiction on the Outer Continental Shelf (OCS).⁸² Although the Energy Policy Act of 2005 generally made FERC responsible for hydrokinetic technologies,⁸³ the Act also amended the Outer Continental Shelf Lands Act to allow the Secretary of the Interior to grant leases, easements, and rights-of-way for the production, transportation, or transmission of renewable energy on the OCS.⁸⁴ The Secretary subsequently delegated this authority to the MMS, and the MMS created rules to govern the siting of renewable energy projects that occur on the OCS leases, easements, or rights-of-way.⁸⁵

from, or in any of the streams or other bodies of water over which Congress has jurisdiction...” 16 U.S.C. § 797(e) (2006).

⁷⁹ DOE Report to Congress, *supra* note 71, at 10.

⁸⁰ 33 U.S.C. § 1341(e)(1) (2006).

⁸¹ 16 U.S.C. § 1456(3)(A) (2006).

⁸² The Outer Continental Shelf generally includes the seabed, submerged lands, and waters extending seaward of state coastal waters up to 200 miles from shore. Wellinghoff, *supra* note 11, at 414.

⁸³ U.S. DOE Report to Congress, *supra* note 71.

⁸⁴ Wellinghoff, *supra* note 11, at 415.

⁸⁵ *Id.*

In response to the confusion over the scope of each agency's jurisdiction of hydrokinetic projects on the OCS, both FERC and MMS jointly created a Memorandum of Understanding.⁸⁶ In April 2009, the Memorandum of Understanding was signed by the Secretary of the Interior and the Chairman of FERC.⁸⁷ The document clarified each agency's authority in regulating renewable energy projects on the OCS by making FERC responsible for issuing licenses for all hydrokinetic projects and by delegating authority to MMS to "issue leases and easements for hydrokinetic projects located partially or wholly on the OCS."⁸⁸

Although FERC is clearly now the lead agency in the permitting and licensing of hydrokinetic projects, developers will need to comply with several environmental statutes before FERC may issue a permit or license. First, the National Environmental Policy Act requires an assessment of the environmental impacts of a proposed action through the completion of an Environmental Assessment or an Environmental Impact Statement.⁸⁹ Both documents provide a record to guide federal action agencies in their decision-making when reviewing license and permit applications.⁹⁰ Second, § 7 of the Endangered Species Act mandates that federal agencies consult with the National Marine Fisheries Service or the U.S. Fish and Wildlife Service to insure that the agency's act in authorizing an action, such as development of a renewable energy project, will not jeopardize endangered species or adversely impact critical habitats.⁹¹ Third,

⁸⁶ Memorandum of Understanding Between the U.S. Department of the Interior and Federal Energy Regulatory Commission, *available at* http://www.mms.gov/offshore/RenewableEnergy/PDFs/DOI_FERC_MOU.pdf.

⁸⁷ DOE Report to Congress, *supra* note 71, at 10.

⁸⁸ *Id.*

⁸⁹ 42 U.S.C. §§ 4321-4370 (2006).

⁹⁰ *Id.*

⁹¹ Endangered Species Act of 1973, 16 U.S.C. § 1536(a)(2). The ESA defines "critical habitat" to mean "the specific areas within the geographical area occupied by the species" that is "essential to the conservation of the species" and "may require special management considerations or protection" and "areas outside the geographical area ... essential for the conservation of the species." 16 U.S.C. § 1532(5)(A) (2006).

hydrokinetic projects must comply with § 401 and § 404 of the Clean Water Act.⁹² Under § 401, developers must obtain a water quality certification from the appropriate state to ensure they will not violate state water quality standards.⁹³ Pursuant to § 404, developers must obtain a permit from the U.S. Army Corps of Engineers before discharging dredged material into navigable waters.⁹⁴ In addition to the federal statutes outlined above, developers are required to comply with the Rivers and Harbors Act, the Magnuson-Stevens Fishery and Conservation Act, the Fish and Wildlife Coordination Act, the Marine Mammal Protection Act, the Migratory Bird Treaty Act, the National Historic Preservation Act, and the Coastal Zone Management Act.⁹⁵

Traditionally, a hydrokinetic energy developer could seek three types of issuances from FERC once the developer has obtained the necessary authorizations under the other federal statutes listed above. These issuances include a preliminary permit, a project license, or an exemption from licensing.⁹⁶

A preliminary permit, issued for up to three years, gives the permit holder priority to apply for a license on a site while the permit holder determines the project's feasibility, performs baseline studies, and prepares to apply for a license.⁹⁷ Importantly, a preliminary permit does not authorize construction or operation of a hydrokinetic project on the permit site.⁹⁸ However, the

⁹² 33 U.S.C. §§ 1251-1387 (2006).

⁹³ Wellinghoff, *supra* note 11, at 406.

⁹⁴ 33 U.S.C. § 1311 (2006). Hydrokinetic projects may require dredging during the installation of underwater transmission cables and anchors.

⁹⁵ DOE Report to Congress, *supra* note 71, at 73.

⁹⁶ Wellinghoff, *supra* note 11, at 398.

⁹⁷ *Id.* at 404; see Federal Energy Regulatory Commission, *Preliminary Permits*, available at <http://www.ferc.gov/industries/hydropower/gen-info/licensing/pre-permits.asp>. A developer is not required to obtain a preliminary permit in order to apply for a license. Wellinghoff, *supra* note 11, at 404-405.

⁹⁸ Wellinghoff, *supra* note 11, at 404.

failure to obtain a preliminary permit could result in loss of a site to another developer that does obtain a permit.⁹⁹

A license, in contrast, authorizes the construction and operation of a facility on the project site for up to 50 years.¹⁰⁰ A license is required for all hydrokinetic energy projects that transmit power to the electric grid.¹⁰¹ In order to obtain a license, project developers must “acquire and retain all interests in non-federal lands and other property necessary to carry out project purposes.”¹⁰² These property interests can be obtained by contract or federal eminent domain.¹⁰³ In exercising the right to eminent domain, a licensee can acquire land covering both the project site and the transmission line from the project site to interconnect with the electric grid.¹⁰⁴

An exemption from licensing can be given to two types of projects. First, an exemption can be given to a small hydropower project five megawatts or less to be built at an existing dam or use a natural water feature for head.¹⁰⁵ Second, an exemption can be given to projects located on non-federal lands that utilize a conduit “constructed primarily for purposes other than power production.”¹⁰⁶

B. Changes to the Regulatory Process

Several problems with the traditional regulatory process have recently prompted FERC to adopt innovative regulatory approaches for hydrokinetic projects. Under the traditional

⁹⁹ *Id.* at 405-405.

¹⁰⁰ 16 U.S.C. § 803(i) (2006) (Section 6 of the Federal Power Act provides that a license cannot exceed fifty years.).

¹⁰¹ *Id.*

¹⁰² Wellinghoff, *supra* note 11, at 405. “Standard Article 5 appears in what are called “L-Forms,” which are published at 54 F.P.C. 1792-1928 (1975) and are incorporated into project licenses by an ordering paragraph.” 18 C.F.R. § 2.9 (2005).

¹⁰³ *Id.*

¹⁰⁴ 16 U.S.C. § 814 (2006).

¹⁰⁵ Wellinghoff, *supra* note 11, at 405.

¹⁰⁶ *Id.*

preliminary permit process, developers found that not being able to operate a facility made it difficult to determine if the project would be commercially feasible or impact the surrounding environment.¹⁰⁷ Additionally, it is not easy for a developer to obtain the information necessary to apply for a license without operating a facility for which a license is required.¹⁰⁸ These problems are enlarged by the difficulty developers can have in raising the capital necessary to complete the licensing process, because the commercial feasibility of hydrokinetic technology has not yet been proven.¹⁰⁹

In response to such problems, FERC made several changes to the traditional regulatory framework for hydrokinetic projects. First, FERC attempted to implement a procedure where a developer's project could qualify as a "test project," allowing the project to operate for testing purposes without the need to obtain a license issued by FERC.¹¹⁰ In order to be a test project, three conditions must be met: the project has to utilize experimental technology, the project's facilities can only be used "for a short period for the purpose of conducting studies necessary to prepare a license application," and any power generated from the test project cannot be transmitted into the national energy grid or displace power from the grid.¹¹¹ Although the test project approach allows developers to begin hydrokinetic operations without having to obtain a permit, it does not provide an economic return to the developers.¹¹²

¹⁰⁷ *Id.*

¹⁰⁸ *Id.*

¹⁰⁹ *Id.*

¹¹⁰ *Id.*

¹¹¹ 111 F.E.R.C. P61, 24, 61 (F.E.R.C. 2005). Verdant Power became the first hydrokinetic energy developer to develop a project under the regulatory process for test projects when Verdant Power began operating a hydrokinetic project on the East River in Queens County, New York. Wellinghoff, *supra* note 11, at 407.

¹¹² *Id.* at 409.

To address this issue, FERC revised the process for obtaining a license for hydrokinetic development by establishing an expedited pilot project licensing process. The new process allows for a license to be granted in only six months.¹¹³

A pilot project must meet the following criteria: “small,¹¹⁴ short term,¹¹⁵ not located in sensitive areas based on [FERC’s] review of the record; removable and able to be shut down on short notice; removed, with the site restored, before the end of the license term (unless a new license is granted); and initiated by a draft application in a form sufficient to support environmental analysis.”¹¹⁶

The pilot project licensing process appears to solve the financial problem associated with the test project approach, because a pilot project license allows a developer to offset the cost of the project with revenue obtained from the sale of electricity generated by the pilot project transmitting power into the national energy grid.¹¹⁷

The federal government’s attempt to facilitate hydrokinetic energy development through adopting changes to the traditional regulatory scheme demonstrates the importance the federal government places on hydrokinetic technology. FERC and other regulatory agencies will need to continue to take an active role in making a regulatory framework that facilitates hydrokinetic energy development in order for hydrokinetic energy to reach its full potential.

¹¹³ Licensing Hydrokinetic Pilot Projects, F.E.R.C., Staff White Paper, at 4, *available at* http://www.ferc.gov/industries/hydropower/indus-act/hydrokinetics/pdf/white_paper.pdf. The traditional permitting process for hydroelectric projects can take up to seven years to obtain a license. PEW Center on Global Climate Change, *supra* note 29, at 6.

¹¹⁴ In order to qualify as “small,” FERC expects the pilot project to have a generating capacity of 5 MW or less while also considering the number of generating units and the project footprint. FERC White Paper, *supra* note 113, at 13.

¹¹⁵ FERC “expects pilot projects will have terms of five years.” *Id.*

¹¹⁶ *Id.* at 4.

¹¹⁷ *Id.*

III. The Relationship between Hydrokinetic Energy and Water Policy

Energy and water resources share a complex relationship that is becoming increasingly interdependent as impacts from climate change put pressure on water supplies and energy infrastructure. Both energy and water needs are linked by the fact that large amounts of energy are required to treat and distribute water while large volumes of water are often used in the production of energy.¹¹⁸ Regions of the United States, particularly the arid western states, are finding it difficult to maintain a sustainable supply of both energy and water as a result of exponential population growth and development.¹¹⁹ Renewable energy technology, such as hydrokinetics, could help address the problems associated with water-intensive energy projects that are located in areas with diminishing water resources. However, the successful creation and deployment of a hydrokinetic energy project could be impacted based on how the local jurisdiction defines water rights.

The Federal Power Act requires hydrokinetic developers who wish to obtain a license from FERC to supply the agency with “satisfactory evidence” of compliance with state laws regarding “appropriation, diversion, and use of water for power purposes.”¹²⁰ State water rights generally can be divided into the doctrines of riparianism or prior appropriation. Riparianism refers to a bundle of rights that a landowner possesses based on his or her land abutting a body of

¹¹⁸ Adell Amos, *Freshwater Conservation in the Context of Energy and Climate Policy: Assessing Progress and Identifying Challenges in Oregon and the Western United States*, 12 U. Denv. Water L. Rev. 1, 5 (2008); Ronald C. Surdam, *New data could help manage CBM activity*, 1 Benchmark: The Newsletter of the Wyoming State Geological Survey 2 (2007) (Methane moratorium would save 130 billion gallons of water).

¹¹⁹ Dr. Cat Shrier, *Integrated Water-Energy Planning*, 66 The Water Report 1 (2009).

¹²⁰ 16 U.S.C. § 802(a) (2006). However, the Federal Power Act does not require the license applicant to actually acquire a state water permit as a prerequisite to obtaining a federal license. *First Iowa Hydro-Electric Cooperative v Federal Power Com.*, 328 U.S. 152 (1946).

water.¹²¹ Included in these rights is the right to use the water without transforming it.¹²² A riparian landowner would most likely refer to this right to use water if he or she wanted to install a hydrokinetic project in an adjoining watercourse.

Traditionally, uses of water have been considered as either “consumptive” or “non-consumptive.”¹²³ A consumptive use, unlike a non-consumptive use, significantly alters the quantity or quality of the water being used.¹²⁴ It is likely that hydrokinetic energy generation will be considered a non-consumptive use, because the law of riparian rights has viewed hydropower production as a non-consumptive use.¹²⁵ Under the doctrine of riparianism, the distinction between types of use is important when resolving conflicts among users. Courts may apply different criteria to the two categories of use in order to determine whether the contested use is reasonable.¹²⁶

Conflicts between similar non-consumptive uses over securing water to generate energy helped to shape the beginning case law on riparian rights.¹²⁷ These early disputes occurred between competing mills on opposite sides of a stream both wanting to use water in the process of powering their mill.¹²⁸ Courts required the mill owners to share the power in proportion based on their respective ownership interests of the riverbed.¹²⁹ Over time, conflicts extended to

¹²¹ 1-6 Waters and Water Rights § 6.01 (Robert E. Beck and Amy L. Kelley, eds., 3rd ed. LexisNexis/Matthew Bender 2009).

¹²² *Id.*

¹²³ *Id.*

¹²⁴ *Id.*

¹²⁵ *Id.*

¹²⁶ 1-7 Waters and Water Rights § 7.03 (Robert E. Beck and Amy L. Kelley, eds., 3rd ed. LexisNexis/Matthew Bender 2009). This is true despite the fact that the reasonable use theory does not make a distinction between consumptive and non-consumptive uses. *Id.*

¹²⁷ *Id.*

¹²⁸ *Id.*

¹²⁹ *Id.*

disputes caused by a mill interrupting or altering the instream flow to other mills downstream.¹³⁰ In solving these disputes, courts have traditionally looked to customary usage or the natural capacity of the stream to determine whether a mill owner's use was reasonable.¹³¹ This approach is problematic for riparian users who install a hydrokinetic device, which is a radically different technology than has been customarily operated within rivers and streams.¹³² However, courts have proven that they are willing to ignore arguments concerning customary usage or the natural instream capacity "when adoption of a socially desirable new technology actually necessitates displacing outmoded technologies."¹³³ Courts may look to how best they can harmonize the competing uses, or if necessary, determine which use is most beneficial and productive for society.¹³⁴

Individuals who want to develop hydrokinetic technology in states following the doctrine of prior appropriation will have to become familiar with an entirely different system for apportioning water rights. Unlike the eastern states, where riparian rights historically developed around the use of water for instream power,¹³⁵ the western states organized their water law around off-stream consumptive uses such as irrigation and farming.¹³⁶

Prior appropriation seeks to maximize the use of water while ensuring individual users receive their appropriative right to the water.¹³⁷ Under this doctrine, an individual obtains a

¹³⁰ See *Holyoke Water Power Co. v. Whiting & Co.*, 276 Mass. 528 (1931); see also *Essex Co. v. City of Lawrence*, 214 Mass. 79 (1913).

¹³¹ 1-7 Waters and Water Rights § 7.03, *supra* note 126.

¹³² *Id.*

¹³³ *Id.* See also *Thunder Bay River Booming Co. v. Speechly*, 31 Mich. 336 (1875).

¹³⁴ 1-7 Waters and Water Rights § 7.03, *supra* note 126.

¹³⁵ Carol M. Rose, *Energy and Efficiency in the Realignment of Common Law Water Rights*, 19 J. Legal Stud. 261, 293 (1990).

¹³⁶ Olivia S. Choe, *Appurtenancy Reconceptualized: Managing Water in an Era of Scarcity*, 113 Yale L.J. 1909, 1936 (2004).

¹³⁷ Wendy M. Fisher, *Small Hydroelectric Projects and State Water Rights*, 18 Pac. L.J. 1225, 1239 (1987).

property right in the use of water by diverting the water from a watercourse and putting the water to a beneficial use.¹³⁸ Water rights are not limited to withdrawals by riparian landowners, but can extend to nonriparian landowners who wish to use water on nonriparian land.¹³⁹ During water shortages, senior appropriators who are first in time to appropriate water are the first in right to use their limit of the water resource.¹⁴⁰

Today, all states following prior appropriation, except Colorado, have permit systems to administer appropriative water rights.¹⁴¹ Hydrokinetic energy developers will need to apply for a water right permit from the applicable state agency that has been delegated administrative authority to manage water resources for the state.¹⁴² The state agency will determine if unappropriated water is available and whether the permit applicant has met the factors of prior appropriation adopted by state statute regarding diversion, beneficial use, and the public interest.¹⁴³

Hydrokinetic energy developers may have difficulty meeting the criteria for obtaining an appropriative permit. Many jurisdictions require that water “must” be diverted before being put to beneficial use.¹⁴⁴ However, hydrokinetic devices that harness energy from rivers and streams operate almost exclusively instream and do not require the diversion of water.¹⁴⁵ In order for hydrokinetic projects to be protected from claimed prior appropriation rights, project developers

¹³⁸ 2-12 Waters and Water Rights § 12.01 (Robert E. Beck and Amy L. Kelley, eds., 3rd ed. LexisNexis/Matthew Bender 2009).

¹³⁹ Choe, *supra* note 136.

¹⁴⁰ 2-12 Waters and Water Rights § 12.01, *supra* note 138.

¹⁴¹ 2-15 Waters and Water Rights § 15.01 (Robert E. Beck and Amy L. Kelley, eds., 3rd ed. LexisNexis/Matthew Bender 2009).

¹⁴² Amos, *supra* note 118, at 9-10.

¹⁴³ Fisher, *supra* note 137 (“Before an appropriation is granted, the state must determine...that the grant of an appropriative permit is in the public interest.”).

¹⁴⁴ 2-12 Waters and Water Rights § 12.02 (Robert E. Beck and Amy L. Kelley, eds., 3rd ed. LexisNexis/Matthew Bender 2009). In the beginning, the prior appropriation system was based on whether water “could” be diverted and consumed. *Id.*

¹⁴⁵ Subcommittee on Energy and Environment, *supra* note 6.

may need to analogize hydrokinetic energy projects with early instream uses of water in the West that did not necessarily meet the diversion requirement. These uses included navigation, cattle watering, and instream reservoirs.¹⁴⁶

In discussing the rationale behind the diversion requirement, courts often cite to the importance of “establishing the equity of the claimant” and of providing notice to others of the claimant’s intent to appropriate water and the amount to be appropriated.¹⁴⁷ Early instream uses of water in prior appropriation jurisdictions had the ability to establish equity based on reliance and to provide notice to subsequent appropriators.¹⁴⁸ It was common in the 1800s for boats to navigate along the Missouri River and westward into bays and other rivers.¹⁴⁹ This traditional use of the watercourse established equitable reliance, and visible boat traffic provided notice of intent to use the water for navigation. Likewise, a large cattle herd may provide requisite notice and represent a substantial investment on the part of the owner giving rise to an equitable claim to water cattle without diversion of the water.¹⁵⁰ Some states also recognize a right of instream reservoirs to capture floodwaters and seasonal waters resulting from snow melt without having to divert the water from a stream into the reservoir.¹⁵¹ Construction of the reservoirs provided notice, while the expenditure of funds produced equity.¹⁵²

Although hydrokinetic developers likely will need to establish the principles of equity and notice in order to obtain a right to use water, state courts may overlook whether there is a

¹⁴⁶ 2-12 Waters and Water Rights § 12.02, *supra* note 144. Motive power and waste assimilation were additional early instream uses of water that generally did not require diversion of a water resource. *Id.*

¹⁴⁷ *Id.*

¹⁴⁸ *See id.*

¹⁴⁹ *Id.*

¹⁵⁰ *Id.*

¹⁵¹ *Id.* *See* Rocky Barker, *Idaho reservoirs have lots of water now, but will it last?*, Idaho Statesman (Nov. 5, 2009), available at <http://www.idahostatesman.com/2009/11/05/961748/idaho-reservoirs-have-lots-of.html>.

¹⁵² 2-12 Waters and Water Rights § 12.02, *supra* note 144.

diversion of water if the state's code does not specifically require diversion. For example, the Nebraska Supreme Court's 1990 analysis of the diversion requirement rejected the notion of having to divert water to obtain a water right: "Since the permit system provides a surer method of providing lasting notice of the existence and quantity of valid appropriative rights, requiring a diversion as a prerequisite serves no useful purpose."¹⁵³ Other courts in South Dakota¹⁵⁴ and Arizona¹⁵⁵ have followed suit in holding that diversion is not required in every circumstance of an appropriated water right. Hydrokinetic developers should have less difficulty meeting the criteria for obtaining a water permit as prior appropriation states abandon the diversion requirement.¹⁵⁶

IV. Conclusion

The growing significance of climate change in a time of increasing energy demand and consumption has caused governmental entities to adopt new policies regarding renewable energy development. These new policies, often in the form of renewable portfolio standards, encourage investment in emerging renewable energy technologies. Hydrokinetic energy is one such promising new technology that is easy to install and appears to have little impact on the environment.¹⁵⁷

Hydrokinetic energy could serve a vital role in lessening the burden on communities facing energy and water shortages. The ability of hydrokinetic energy to be installed in rivers and

¹⁵³ *In re Application A-16642*, 463 N.W.2d 591, 601 (1990).

¹⁵⁴ *DeKay v. United States Fish & Wildlife Serv.*, 524 N.W.2d 855, 857 (S.D. 1994)(diversion not required to use water from springs).

¹⁵⁵ *Phelps Dodge Corp. v. Ariz. Dep't of Water Res.*, 211 Ariz. 146 (Ariz. Ct. App. 2005)(The Court found no express diversion requirement in the Arizona Code and declined to imply one.).

¹⁵⁶ In addition, FERC permits for hydrokinetic development may preempt a state's prior appropriation system under certain circumstances. 2-11 Waters and Water Rights § 11.08 (Robert E. Beck and Amy L. Kelley, eds., 3rd ed. LexisNexis/Matthew Bender 2009). However, federally licensed projects must still apply for a state water right. Amos, *supra* note 118, at 128.

¹⁵⁷ Walsh, *supra* note 4, at 194, 225.

along coasts of major population centers allows for hydrokinetic energy devices to be easily connected to the existing power infrastructure without having to send the energy across vast miles of transmission lines.¹⁵⁸ A readily available hydrokinetic energy project could ensure that communities would receive uninterrupted access to clean, renewable energy. In addition, the process of extracting energy from waves, currents, and tides is not as water intensive compared to many other types of energy production that continue to drain already scarce water resources.¹⁵⁹

Ultimately, a solution to energy and water challenges will require policymakers to consider the link between energy and water policy. Policymakers will find that hydrokinetic energy could serve as an effective means of lessening the problems associated with energy and water shortages. However, governing bodies will need to adopt smart, sustainable policies for implementing hydrokinetic energy projects in order for this new technology to become a significant renewable energy resource.

¹⁵⁸ *Id.*

¹⁵⁹ “[E]lectricity production requires about 136 billion gallons of freshwater per day, accounting for over 40 percent of all daily freshwater withdrawals in the nation.” Amos, *supra* note 118.