Deep Decarbonization and Hydropower

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Summary

Hydropower—both conventional and pumped storage hydropower—is crucial to sustaining our transition to a decarbonized grid. Additional hydropower development that meets modern environmental requirements is essential to reduce the United States' dependence on carbon. Realizing the full potential of hydropower and maintaining the current hydropower fleet will likely depend on overcoming a number of impediments, including lengthy and complex regulatory requirements, failure of electricity markets to adequately compensate hydropower generators for the grid benefits they provide, environmental opposition to new hydropower, and interest in dam removal. This Article, excerpted from Michael B. Gerrard & John C. Dernbach, eds., *Legal Pathways to Deep Decarbonization in the United States* (forthcoming in 2018 from ELI Press), examines how these challenges can be overcome with targeted legal and policy reforms.

I. Introduction

Hydropower, which generates electricity through falling water,[1] is the nation's most established and mature renewable resource, and accounts for more than 6% of all electricity generation and about one-half of all renewable power in the United States.[2] Hydropower resources serve an essential role supporting the electric grid by providing low-cost, flexible energy services, and a multitude of secondary benefits such as flood control, irrigation, water supply, and recreational opportunities. Hydropower also is critical in maintaining grid reliability and integrating variable generation resources, such as solar and wind, that continue to come online in larger numbers. Because solar and wind are intermittent resources, the electric grid cannot rely on them in all hours; no other renewables but hydropower, and to a lesser degree geothermal and biomass, are capable of quickly responding to the variable nature of wind and solar, coming on- and off-line when needed to ensure proper grid functioning.[3]

The Deep Decarbonization Pathways Project (DDPP) report, *Pathways to Deep Decarbonization in the United States*, recognizes the crucial role of hydropower to sustain our transition to a decarbonized electric grid—particularly with regard to hydropower pumped storage[4] and its ability to balance and integrate non-dispatchable renewables and water power.[5] In fact, the DDPP report assumes that the installed capacity of pumped storage will need to more than triple by 2050 to sustain a decarbonized grid.[6]

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1. Hydropower also includes hydrokinetic technologies, which generate electricity from waves, currents, and tides within a water body.
2. *See* U.S. Energy Information Administration, *Hydropower Explained*, http://www.eia.gov/energyexplained/?page=hydropower_home (last updated June 13, 2017).
3. Combustion gas turbines also have this capability but are not renewable.
4. A pumped storage hydroelectric project can store and generate energy by pumping water between an upper and lower reservoir at different elevations. During times of low demand, water is pumped to the upper reservoir and stored, and during periods of high demand, the stored water is released through the turbines to generate electricity. Pumped storage is currently the only utility-scale energy storage technology available, although other storage technologies are emerging.
5. James H. Williams et al., Energy and Environmental Economics, Inc. et al., Pathways to Deep Decarbonization in the United States, US 2050 Report, Volume 1: Technical Report 17-20 (2015), *available at* http://usddpp.org/downloads/2014-technical-report.pdf.
6. To achieve this balancing, the authors of the DDPP report assumed the availability of 72 gigawatts (GW) of available pumped storage—50.4 GW more than the 21.6 GW installed in the United States as of 2016. E-mails From Jim Williams and Ryan Jones, Authors of the DDPP Report (Nov. 14-16, 2017) (on file with authors).

Still, the DDPP report did not fully account for the potential for environmentally responsible expansion of new conventional hydropower in the United States by 2050. Since that report was issued, the U.S. Department of Energy (DOE) released the results of a new investigation, *Hydropower Vision: A New Chapter for America's 1st Renewable Electricity Source*,[7] that sheds new light on the potential to expand both conventional and pumped storage hydropower. To chart a path for achieving the results envisioned in both the DDPP and DOE reports, this Article identifies new opportunities for sustainable growth, explains environmental risks and requirements pertaining to hydropower, and identifies legal and market reforms needed to capture a greater percentage of environmentally responsible hydropower—both conventional and pumped storage. We conclude that, based on its ability to provide electricity-generation capacity, baseload power, peaking power, energy storage, load following, and other essential generation features—together with its unique ability to integrate other renewables such as wind and solar into the grid—additional hydropower development above current levels that meets modern environmental requirements must be a component of any proposal to reduce the United States' dependence on carbon over the long term.

The DDPP report analyzes four distinct scenarios to achieve significant reductions in U.S. greenhouse gas (GHG) emissions by 2050, organized by the primary energy choices for electricity: (1) renewable energy (High Renewables Scenario); (2) nuclear (High Nuclear Scenario); (3) fossil fuels with carbon capture and storage (CCS) (High CCS Scenario); and (4) the Mixed Scenario with roughly equivalent generation from all three primary energy resources. In all but the High CCS Scenario, the percentage share of hydropower in overall electricity generation decreases from current levels. In the Mixed Scenario, which is the main case for the report, the percentage share of hydro in overall electricity generation decreases from 6.2% in 2014 to 5.6% in 2050 due to overall growth in electricity consumption but without substantial new growth in hydropower resources.[8] The report asserts that hydropower is not expected to keep pace with electricity growth because "development of new hydropower resources is . . . limited for sustainability reasons" as well as resource constraints.[9]

It is correct that hydropower is more site-limited than other resources; it requires a site where the natural flow and falling of water can be captured. However, the DDPP report does not explain its conclusion that hydropower is limited due to "sustainability." The report itself assumes that the amount of pumped storage must triple to effectively balance non-dispatchable renewables and nuclear power.[10] Moreover, the report makes no mention of development opportunities for conventional hydropower by adding hydropower infrastructure at existing dams, making capacity and efficiency upgrades at existing hydropower projects, implementing new technologies at low-head dams that were once infeasible, and deploying emerging marine and hydrokinetic (MHK) technologies to achieve emissions reduction goals—all of which, if developed in accordance with modern environmental requirements, can enhance balancing of the grid, add dispatchable resources, and meet "sustainability" considerations.

In its *Hydropower Vision* report, which was released after the DDPP report, DOE estimates that hydropower in the United States could feasibly grow from 101 gigawatts (GW) of emissions-free[11] generating and storage capacity to nearly 150 GW by 2050, avoiding 5.6 billion metric tons of carbon dioxide (CO_2) emissions, saving $209 billion in avoided global damages from CO_2 emissions, and creating more than 195,000 new jobs.[12] While much of this potential—consistent with the assumptions in the DDPP report—comes from a significant increase in pumped storage,[13] the DOE report finds opportunity for 13 GW of new conventional hydropower generation capacity at new and existing facilities.[14] The *Hydropower Vision* report did not include MHK technologies, which represent potential additional sources of hydropower development in future years.

Beyond the modeled increases of hydropower in the DDPP report, the DOE report demonstrates the considerable role that hydropower—both conventional and pumped storage—could play in nationwide decarbonization, and indicates that there are more available opportunities and pathways for the expansion of hydropower than the DDPP report assumes to meet the nation's climate goals. The legal pathways described in this Article for hydropower provide additional approaches to achieving the 80% reduction in GHG emissions by 2050 envisioned in the DDPP report, provide additional options to public and private decisionmakers (including options that are less expensive or have greater economic, social, and environmental benefits), and increase the likelihood that the required reduction can be achieved.

Realizing this full potential and even maintaining the current hydropower fleet will likely depend on overcoming a number of impediments to hydropower in the United States. Because expanding hydropower at federally constructed and operated dams is generally constrained by

7. DOE, Hydropower Vision: A New Chapter for America's 1st Renewable Electricity Source (2016) (DOE/GO-102016-4689) [hereinafter Hydropower Vision], *available at* http://energy.gov/sites/prod/files/2016/10/f33/Hydropower-Vision-10262016_0.pdf.
8. Williams et al., *supra* note 5, tbl. 7.
9. *Id.* at 12.
10. *See supra* note 6.
11. While some research asserts that reservoirs created by dams are important sources of GHG emissions, DOE's *Hydropower Vision* report notes that "[g]iven the state of scientific understanding and discourse, including persistent uncertainties, the [report] does not attempt to address hydropower-related biogenic GHG emissions." Hydropower Vision, *supra* note 7, at 43. Moreover, the research analyzed reservoirs impounded by both hydroelectric and non-hydroelectric dams, and only 3% of U.S. dams currently have a hydroelectric component. Thus, adding hydropower at these existing dams would not result in an increase in GHG emissions.
12. *Id.* at 3, 23.
13. *See supra* note 6.
14. Hydropower Vision, *supra* note 7, at xvii, 1, 7, 31.

competing agency priorities and depends on congressional authorization and funding,[15] for purposes of this Article, we focus on the impediments to nonfederal hydropower development. Such impediments include lengthy and complex regulatory requirements, failure of the organized electricity markets to adequately compensate hydropower generators for the grid benefits they provide, environmental opposition to new hydropower, and interest in dam removal. These challenges can be overcome with targeted legal and policy reforms that would not roll back environmental standards.

For the past 30 years, conventional wisdom in the United States has generally maintained that environmental impacts of new hydropower outweigh the benefits.[16] However, the expansions of hydropower under consideration today in the United States for the most part do not include new large dam construction or greenfield development. Also, new technologies have allowed hydropower owners and developers to effectively mitigate environmental effects of existing projects, increase generation at existing projects, and pursue hydropower at low-impact sites such as existing, non-powered dams. While all energy projects, including hydropower, come with environmental effects, the impacts of most new hydropower development today are significantly less than those of the large, new dam projects built in the previous century,[17] and the large dam projects in the United States are improving environmental performance more than ever before.[18]

The Article provides an overview of the potential to expand hydropower in the United States and the regulatory and market impediments that challenge this expansion. Part II begins with a brief discussion of the regulatory framework associated with nonfederal hydropower projects in the United States and environmental requirements that are specific to, or of particular significance in, the licensing of hydropower projects. Next, Part III identifies the regulatory impediments to the expansion of nonfederal hydropower and discusses solutions to overcome these impediments. Finally, Part IV discusses the market impediments to the expansion of hydropower and makes recommendations to incentivize the expansion of hydropower resources in the United States, and Part V concludes.

II. Overview of Hydropower Regulation and Hydropower Development Potential

As of the end of 2015, there were 2,198 active conventional hydropower plants in the United States owned and operated by federal and nonfederal entities, with a cumulative capacity of 79.6 GW, together with 42 pumped storage plants with a cumulative capacity of 21.6 GW, resulting in a total of 101 GW of installed hydropower capacity.[19] These plants (excluding pumped storage), over the 10-year period from 2006-2015, produced an average of 270,000 GW hours of electricity each year,[20] which powers 85 million homes and avoids nearly 190 million metric tons of CO_2 emissions annually.[21] Hydropower in the United States consists of conventional hydropower plants, including traditional large dams and small hydropower plants (including conduit and low-head projects),[22] open- and

15. Hydropower generation at large federal dams has been curtailed in recent years by environmental requirements. For example, the federal agencies operating dams on the Columbia River must comply with a biological opinion (BiOp) under the Endangered Species Act (ESA) issued in 2008 and updated in 2014 for 13 species of Columbia River Basin salmon and steelhead. The BiOp requires a series of mitigation measures, including spilling water over the dams in the spring and summer to help juvenile salmon and steelhead migrate safely to the ocean. *See* National Oceanic and Atmospheric Administration Fisheries, *Federal Columbia River Power System Biological Opinion*, http://www.westcoast.fisheries.noaa.gov/fish_passage/fcrps_opinion/federal_columbia_river_power_system.html (last visited Dec. 11, 2017). In addition, under the Glen Canyon Dam Long-Term Experimental and Management Plan Environmental Impact Statement, issued in October 2016, the Bureau of Reclamation and the National Park Service, which operate the Glen Canyon Dam, would be obligated to provide flow and non-flow measures for the benefit of fishery resources. U.S. Department of the Interior (DOI) et al., Glen Canyon Dam Long-Term Experimental and Management Plan Final Environmental Impact Statement 2-41 to 2-72 (2016), http://ltempeis.anl.gov/documents/final-eis/. These environmental restrictions have resulted in substantial losses in electrical generation. *Id.* at 4-335, tbl. 4.13-1 (Alternative D (the preferred alternative) results in a 1.1% decrease in average daily generation and a 6.7% decrease in firm capacity).

16. *See*, *e.g.*, Dan Tarlock, *Hydro Law and the Future of Hydroelectric Power Generation in the United States*, 65 Vand. L. Rev. 1723 (2012); Dan Tarlock, *The Legal-Political Barriers to Ramping Up Hydro*, 86 Chi.-Kent L. Rev. 259 (2011). *But see* Lea Kosnik, *The Potential of Water Power in the Fight Against Global Warming in the US*, 36 Energy Pol'y 3252 (2008); Lea Kosnik, *The Potential for Small Scale Hydropower Development in the US*, 38 Energy Pol'y 5512, 5518 (2010).

17. For example, with the installation of hydropower capability at existing non-powered dams, "many of the costs and environmental impacts of dam construction have already been incurred . . . and may not be significantly increased by the incorporation of new energy production facilities." Office of Energy Efficiency and Renewable Energy, DOE, An Assessment of Energy Potential at Non-Powered Dams in the United States 5 (2012) (GPO DOE/EE-0711) [hereinafter Assessment of Energy Potential at Non-Powered Dams], *available at* http://www1.eere.energy.gov/water/pdfs/npd_report.pdf.

18. The emergence of modern environmental requirements over the past 50 years, as discussed in Part III.B. below, including enactment of the Electric Consumers Protection Act of 1986 and the Energy Policy Act of 2005 (EPAct 2005), has improved the environmental performance of new and existing Federal Energy Regulatory Commission (FERC)-licensed hydropower facilities.

19. Hydropower Vision, *supra* note 7, at 2; *see also* Office of Energy Efficiency and Renewable Energy, DOE, 2014 Hydropower Market Report 5, 47 (2015) (DOE/EE-1195) [hereinafter 2014 Hydropower Market Report], *available at* https://energy.gov/sites/prod/files/2015/05/f22/2014%20Hydropower%20Market%20Report_20150512_rev6.pdf.

20. U.S. Energy Information Administration, Electricity Data Browser Report No. 1.1, Net Generation by Energy Source: Total—All Sectors.

21. *See* 2014 Hydropower Market Report, *supra* note 19, at 36 (reporting that the capacity factor for the U.S. hydropower fleet was 39% in 2013); U.S. Energy Information Administration, *Frequently Asked Questions* (noting average annual electricity consumption for a U.S. residential utility customer is 10,766 kilowatt hours), https://www.eia.gov/tools/faqs/faq.php?id=97&t=3 (last updated Nov. 7, 2017); U.S. Environmental Protection Agency (EPA), *Greenhouse Gas Equivalencies Calculator*, https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator (last updated Sept. 2017).

22. Conventional hydropower plants can be operated for water storage (or impoundment) or as run-of-river or diversion (without the need for a reservoir). Kelsi Bracmort et al., Congressional Research Service, Hydropower: Federal and Nonfederal Investment 2 (2015), *available at* https://fas.org/sgp/crs/misc/R42579.pdf.

closed-circuit pumped storage, and MHK and new technology projects.

Of the existing hydropower fleet, federal agencies, including the U.S. Army Corps of Engineers (the Corps), the Bureau of Reclamation, and the Tennessee Valley Authority, own approximately 49% of installed capacity. Public entities, including public utility districts, irrigation districts, states, and rural cooperatives, own 24% of installed capacity, and private entities, including investor-owned utilities, independent power producers, and industrial companies, own the remaining 27% of installed capacity.[23] This Article focuses entirely on nonfederal hydropower, which has the highest growth potential, and is highly regulated and must be reauthorized every 30 to 50 years.

Nonfederal hydropower projects are licensed pursuant to the Federal Power Act (FPA),[24] which involves a lengthy process that can result in significant new environmental obligations and operational restraints. These projects also are subject to the substantive and procedural requirements of a number of federal environmental statutes that complicate and extend the licensing process. While there is ample opportunity to expand hydropower development in the United States, such expansion will depend on regulatory reform and emerging new hydropower technologies (such as low-head conventional and MHK technologies) to develop projects at lower costs and with improved environmental performance. In addition to expanding hydropower, reforms must be undertaken to preserve the existing fleet to continue hydropower's contributions to U.S. renewable generation.

A. *Regulation Over Nonfederal Hydropower Under the FPA*

Nonfederal hydropower projects are one of the most heavily regulated energy resources in the nation. The current regulatory system, which is expensive, time-consuming, overlapping with other federal requirements, and often results in the loss of operational flexibility and reduction in capacity factor,[25] makes it difficult for hydropower to fairly compete with emitting resources (primarily natural gas).[26] Modernization and reform of the legislative and administrative policies currently governing the licensing and administration of hydropower, without compromising environmental standards, will be necessary for hydropower to effectively participate in the decarbonization of the U.S. electric grid.

The vast majority of hydropower dams owned and operated by nonfederal entities in the United States are regulated by the Federal Energy Regulatory Commission (FERC).[27] FERC holds exclusive authority under the FPA to issue licenses authorizing the construction, operation, and maintenance of new and existing hydropower projects.[28] In carrying out its statutory responsibilities, FERC is required to consider all the factors affecting the public interest in the comprehensive development of a waterway, including power development, navigation, water supply, recreation, and appropriate conditions to protect the environment.[29] FERC is obligated under the FPA to include conditions in an operating license to: (1) ensure a comprehensive development of the waterway that balances various uses such as hydropower power development, public recreation, and environmental protection[30]; (2) protect fish and wildlife resources as recommended by certain resource agencies[31]; (3) adequately protect and utilize federal reservations occupied by the project, as directed by the federal agency that manages the reservation[32]; and (4) establish annual charges to be paid by the licensee.[33] All FERC hydropower licenses also include standard conditions related to land management and ownership requirements, dam safety, and authorization for FERC to reopen the license and reestablish a licensee's obligations under certain circumstances.[34]

The FPA also provides mandatory conditioning authority for federal agencies at certain projects. For projects located on federal reservations, the FPA requires that any license issued by FERC must incorporate any conditions

23. Hydropower Vision, *supra* note 7, at 11, 78.
24. 41 Stat. 1063, as amended, 16 U.S.C. §§791a et seq.
25. Capacity factor of a power plant is the measure of its actual output compared to its potential maximum output.
26. *See* Hydropower Vision, *supra* note 7, at 143 (explaining that the lengthy time line to license and permit new hydropower development "can lead developers and utilities to favor other generation technologies with shorter times to achieve commercial operation, such as natural gas turbines"). *See also Hearing on Discussion Drafts Addressing Hydropower Regulatory Modernization and FERC Process Coordination Under the Natural Gas Act Before the House Comm. on Energy and Commerce, Subcomm. on Power and Energy*, 114th Cong. 9 (2017) (testimony of John Suloway, National Hydropower Association) (explaining that "the regulatory approval processes for simple cycle turbine or combined cycle plants are generally 1-2 years—even in urban areas like New York City"), http://docs.house.gov/meetings/IF/IF03/20150513/103443/HHRG-114-IF03-Wstate-SulowayJ-20150513.pdf.
27. Projects under FERC's jurisdiction include those that: (1) are located "across, along, or in any of the navigable waters of the United States"; (2) occupy "any part of the public lands or reservations of the United States"; (3) "utilize the surplus water or water power from any Government dam"; (4) are located on non-navigable waterways that are subject to Congress's Commerce Clause jurisdiction; (5) affect interstate or foreign commerce; and (6) have undergone construction or major modification after August 26, 1935. 16 U.S.C. §817(1). The Hydropower Regulatory Efficiency Act (HREA) of 2013, Pub. L. No. 113-23, 127 Stat. 493, excluded from FERC's mandatory licensing jurisdiction qualifying conduit hydropower facilities less than 5 MW that use only the hydroelectric potential of a nonfederally owned conduit. The Bureau of Reclamation Small Conduit Hydropower Development and Rural Jobs Act, Pub. L. No. 113-24, 127 Stat. 498 (2013), shifted jurisdiction over conduit projects less than 5 MW at Bureau of Reclamation facilities from FERC to the Bureau of Reclamation.
28. 16 U.S.C. §797(e).
29. *Id.* §§797(e), 803(a)(1).
30. *Id.* §803(a)(1).
31. *Id.* §803(j).
32. *Id.* §797(e). "Reservations" are defined under the FPA as
> national forests, tribal lands embraced within Indian reservations, military reservations, and other lands and interests in lands owned by the United States, and withdrawn, reserved, or withheld from private appropriation and disposal under the public land laws; also lands and interests in lands acquired and held for any public purposes; but shall not include national monuments or national parks.

Id. §796(2). *See also* Federal Power Comm'n v. Tuscarora Indian Nation, 362 U.S. 99, 111 (1960).
33. 16 U.S.C. §803(e), (f).
34. 18 C.F.R. §2.9 (2017) (identifying FERC's standard-form license conditions).

imposed by the secretary of the department that supervises the reservation.[35] The FPA also directs FERC to require the licensee to construct any fishways for the safe and timely upstream and downstream passage of fish that may be prescribed by the federal fishery agencies.[36] FERC is not authorized to modify and is required to include the agencies' conditions and prescriptions in a license.[37] Licensees and other parties to a licensing have a limited ability to challenge disputed issues of material fact with respect to mandatory conditions and prescriptions through a trial-type hearing before an administrative law judge, or to propose alternative conditions and prescriptions to the federal agency during the licensing.[38]

B. Environmental Regulation Over Nonfederal Hydropower Under Federal Environmental Statutes

In addition to the requirements of the FPA, modern environmental statutes, including the National Environmental Policy Act (NEPA), Clean Water Act (CWA), Endangered Species Act (ESA), National Historic Preservation Act (NHPA), and Coastal Zone Management Act (CZMA), each require additional substantive and procedural requirements that complicate and extend the licensing process.[39]

NEPA requires all agencies to prepare an environmental impact statement (EIS) for federal actions significantly affecting the quality of the human environment.[40] FERC's regulations require it to prepare an EIS for an original license to construct a new hydroelectric facility, but allow the agency—if it determines that the facility will not significantly affect the quality of the human environment—to instead prepare an environmental assessment (which is less detailed).[41] The environmental document prepared under NEPA must examine a project's effects on the environment and alternatives to the project.[42] NEPA also applies to other agency decisions in hydropower development, including Corps permits under the CWA and federal land management agency permits under the Federal Land Policy and Management Act (FLPMA).[43]

The CWA reserves significant authority to the states to participate in the licensing process and condition FERC-issued licenses.[44] Under this statute, "[a]ny applicant for a Federal license or permit to conduct any activity . . . which may result in any discharge into the navigable waters" is required to "provide the licensing or permitting agency a certification from the State in which the discharge originates . . . that any such discharge will comply" with state water quality standards.[45] As discharges from a dam, such as flows over the project's spillway and through the powerhouse, trigger certification under the CWA,[46] the state may impose conditions to its water quality certification that it deems necessary to ensure compliance with state water quality standards, which become conditions of the license that FERC may not reject.[47] The U.S. Supreme Court has endorsed a broad interpretation of state conditioning authority under §401, holding that a state may impose instream flow requirements and conditions to protect recreational and aesthetic values, as part of its water quality certification.[48]

The ESA requires FERC, in consultation with the federal fish and wildlife agencies, to ensure that the projects it authorizes do not jeopardize endangered or threatened species or their critical habitat.[49] If FERC determines that an endangered or threatened species is likely to be affected by a project, it must enter into formal consultation with the federal agencies, and the agency must prepare a biological opinion (BiOp). If the agency determines that the project may jeopardize the species or adversely affect its critical habitat, the BiOp can include "reasonable and prudent alternatives" to the project, which FERC typically adopts as part of its license. BiOps are a frequent source of delay in the FERC relicensing process, sometimes delaying license issuance by several years or more.[50]

The CZMA and NHPA impose additional requirements on FERC before it may issue a license for a hydropower project. The CZMA requires hydroelectric facilities within a state's coastal zone to conform to the state's coastal zone management plan.[51] FERC may issue a license only if the state agency concurs that the project is consistent with the state's coastal zone management plan. The NHPA requires

35. 16 U.S.C. §797(e).
36. *Id.* §811. The U.S. Fish and Wildlife Service (FWS) is responsible for freshwater and terrestrial species, while the National Marine Fisheries Service (NMFS) is responsible for marine and anadromous species.
37. *See* American Rivers v. Federal Energy Regulatory Comm'n, 187 F.3d 1007, 1030 (9th Cir. 1999) (holding that FERC "may not modify, reject, or reclassify any prescriptions submitted by the Secretaries under color of section 18").
38. EPAct 2005, Pub. L. No. 109-58, 119 Stat. 594. For a more in-depth discussion of FERC's jurisdiction over nonfederal hydropower projects, see Michael A. Swiger et al., *Hydroelectric Regulation Under the Federal Power Act*, *in* Waters and Water Rights (Amy Kelley ed., Matthew Bender 2009), and Michael A. Swiger et al., *Hydroelectric Power*, *in* Energy Law and Transactions (William A. Mogel & David J. Muchow eds., Matthew Bender 2009).
39. NEPA, 42 U.S.C. §§4321-4370h; CWA, 33 U.S.C. §§1251-1387; ESA, 16 U.S.C. §§1531-1544; NHPA, 16 U.S.C. §§470-470x; CZMA, 16 U.S.C. §§1451-1466. *See*, *e.g.*, Charles R. Sensiba & Sharon L. White, *Hydropower Licensing Under the Federal Power Act: A Century of Resource Conflict Resolution in the Public Interest*, 31 Nat. Resources & Env't 27 (2016).
40. 42 U.S.C. §4332(2)(C).
41. 18 C.F.R. §380.6 (2017).
42. *See* Scenic Hudson Pres. Conference v. Federal Power Comm'n, 354 F.2d 608 (2d Cir. 1965).
43. 43 U.S.C. §§1701-1785, ELR Stat. FLPMA §§102-603.
44. 33 U.S.C. §1341.
45. *Id.* §1341(a)(1).
46. S.D. Warren Co. v. Maine Bd. of Envtl. Prot., 547 U.S. 370, 374, 36 ELR 20089 (2006).
47. 33 U.S.C. §1341(d); American Rivers v. Federal Energy Regulatory Comm'n, 129 F.3d 99, 28 ELR 20258 (2d Cir. 1997).
48. Public Util. Dist. No. 1 of Jefferson Cty. v. Washington Dep't of Ecology, 511 U.S. 700, 24 ELR 20945 (1994).
49. 16 U.S.C. §1536(a)(2).
50. *See*, *e.g.*, FERC, Report on the Pilot Two-Year Hydroelectric Licensing Process for Non-Powered Dams and Closed-Loop Pumped Storage Projects and Recommendations Pursuant to Section 6 of the Hydropower Regulatory Efficiency Act of 2013, at 43 (2017) ("The formal [ESA] consultation process can be lengthy and can hinder [FERC]'s ability to issue a license in a timely manner."), *available at* https://www.ferc.gov/legal/staff-reports/2017/final-2-year-process.pdf.
51. 16 U.S.C. §1456(c)(3)(A).

FERC to consult with federal and state agencies and Indian tribes and take into account any effect of a relicensing on properties that are listed in, or eligible for listing in, the National Register of Historic Places.[52]

C. Potential for Expansion of Nonfederal Hydropower in the United States

Hydropower is a critical energy resource, and there is significant potential to expand hydropower development in the United States to meet future demand and reduce dependency on fossil fuels. Successful expansion of hydropower will depend on regulatory reform and new hydropower technologies to develop projects at lower costs and with improved environmental performance. In the near term, the hydropower industry is focused on efficiency upgrades and modernization at existing hydropower projects and new project development at existing non-powered dams. DOE estimates that by 2030, up to 9.4 GW of new conventional hydropower generation in the United States can be installed through project upgrades and powering non-powered dams.[53] Through 2050, moreover, DOE estimates that another 3.4 GW of new conventional generation can be added through project upgrades and powering non-powered dams.[54] In the longer term, there is vast potential to develop hydropower technology at low-head water conveyance systems such as irrigation canals and conduits, expand pumped storage for both generation and storage benefits, and develop MHK into a commercially feasible source of hydropower generation.

1. Upgrades and Optimization of Existing Conventional Projects

Upgrades to the existing fleet of hydropower assets are the low-hanging fruit of potential hydropower growth opportunities. Existing hydropower projects require maintenance to avoid potential degradation of capacity or generation, and provide opportunities for increased production and environmental performance through upgrades and operational adjustments. Federal and nonfederal operators may choose to refurbish or replace turbines and generators, upgrade their water conveyance systems to increase generation efficiency, or modify impoundment structures to increase hydraulic head.[55] Operators may also modify the dispatch of units at a plant and coordinate the operation of plants within a river basin to increase generation without any physical modifications at all.[56] DOE modeled 1,799 hydropower plants in the United States and found 6,856 megawatts (MW) of potential expansion opportunity, or a growth potential of about 9%.[57] DOE also found that upgrades at existing facilities were the lowest-cost option for hydropower expansion.[58]

2. New Hydropower Development at Existing Non-Powered Dams

Installation of hydropower facilities at existing non-powered dams is another expansion opportunity with vast potential. Of the 87,000 existing dams in the United States, only 3% have hydropower generating capability.[59] These dams serve a number of purposes, including water supply, irrigation, and flood control. Hydropower development at existing non-powered dams is an attractive option because most infrastructure needed is already in place, and the costs and environmental impacts of dam construction have already been incurred. Thus, installation of generating equipment can be achieved with fewer costs and environmental impacts, and in a shorter time frame than new dam construction.[60]

Certainly, not all existing dams are candidates for hydropower development. Environmental considerations, economic and technical feasibility, site and transmission access, and the age and condition of existing infrastructure are among the many factors that gauge whether an existing dam is a strong candidate for hydropower development. Despite these considerations, a DOE investigation conducted in 2012 found potential to add up to 12 GW of new generating capacity at existing non-powered dams. A majority of this potential is at Corps dams, many of which are at navigation locks on the Ohio, Mississippi, Alabama, and Arkansas Rivers and their tributaries, and at Bureau of Reclamation dams.[61]

The Corps and the Bureau of Reclamation operate hundreds of non-powered dams and other water infrastructure facilities across the United States. Both of these agencies may authorize nonfederal development at their facilities. In certain instances, the U.S. Congress authorizes construction of a federal dam and reserves exclusive authority to the federal government to develop the hydropower resources at the dam; in other instances, Congress does not include such a reservation.[62] Where Congress does not reserve federal authority to develop hydropower resources at a federal dam, the site may be open to development by nonfederal entities, subject to FERC's jurisdiction under the FPA.[63] FERC and the Bureau of Reclamation have entered into a memorandum of understanding (MOU) that establishes criteria and guidelines for determining whether a proposed

52. 54 U.S.C. §306108.
53. Hydropower Vision, *supra* note 7, at 4. This includes upgrades to federal hydropower projects as well as upgrades to nonfederal hydropower subject to FERC jurisdiction or Bureau of Reclamation lease of power privilege (LOPP) authority.
54. *Id.*
55. *Id.* at 247-48.
56. *Id.* at 248.
57. *Id.* at 251.
58. *Id.* at 251, 255.
59. *Id.* at 11.
60. Assessment of Energy Potential at Non-Powered Dams, *supra* note 17, at vii.
61. *Id.* at vii-viii.
62. *See, e.g.*, Uncompahgre Valley Water Users Ass'n v. Federal Energy Regulatory Comm'n, 785 F.2d 269 (10th Cir. 1986).
63. *See* 16 U.S.C. §§797(e), 817(1).

nonfederal project at a Bureau of Reclamation facility is subject to FERC's jurisdiction.[64]

Hydropower development at Corps dams requires a FERC license, a Corps dredge and fill permit under §404 of the CWA,[65] and permission to modify the dam under the Rivers and Harbors Act of 1899.[66] The Corps and FERC have entered into several agreements intended to coordinate and expedite these regulatory approvals.[67] Hydropower development at Bureau of Reclamation facilities requires either a lease of power privilege (LOPP) or a FERC license.[68] Pursuant to a 1992 MOU between the Bureau of Reclamation and FERC,[69] if the authorizing statute reserves hydropower development exclusively to the United States or withdraws FERC's jurisdiction, the Bureau of Reclamation has jurisdiction over the development through an LOPP. Bureau of Reclamation dams not authorized for federal hydropower development must be authorized by a FERC license. All development of nonfederal hydropower on Bureau of Reclamation conduits are exempt from FERC jurisdiction and require an LOPP.[70]

The Hydropower Regulatory Efficiency Act of 2013 (HREA) included provisions to encourage the addition of hydropower facilities at existing dams. Congress directed FERC to investigate the feasibility of issuing a license for hydropower development at non-powered dams in a two-year period, including FERC's prefiling consultation requirements. After gathering public comments and recommendations, FERC issued a notice soliciting projects to participate in a two-year licensing process.

To qualify, the project must be located at a non-powered dam (or closed-loop pumped storage project), have a well-developed project proposal, cause little to no change to environmental resources, and be located in an area where there is substantial existing information on environmental resources and effects. Only one project was found to meet these criteria, and FERC issued a license within two years.[71] In its report to Congress in May 2017, FERC concluded that a more abbreviated licensing process would be challenging for most projects unless they are located at an ideal site, have a well-defined project proposal, are based on a thorough prefiling consultation, and involve the submission of a complete application.[72]

3. Low-Head Conduit Projects

Low-head conduit hydropower projects are constructed on existing water conveyance structures, such as irrigation canals or pressurized pipelines that deliver water to municipalities, industry, or agricultural water users, without the need to construct new dams or diversions.[73] Water is typically conveyed through open canals and ditches through the force of gravity. To reduce damage from erosion or to reduce pressure in pipelines, devices such as pressure-reducing valves and canal drops[74] are often installed to dissipate excess energy in the structure. Small hydropower turbines can, in some instances, be installed near these devices to harvest electric energy from the conduit. There are many thousands of miles of previously constructed conduits in the United States, and hydropower development in these structures is an untapped source of new renewable energy for the nation.

Congress has enacted provisions to promote hydropower development in nonfederal conduits and to streamline the regulatory process to authorize it. As part of the HREA, certain qualifying conduit hydropower facilities under 5 MW are not subject to FERC jurisdiction and require no FERC license or exemption.[75] Enactment of the HREA was the first instance in which Congress relaxed regulatory requirements to promote hydropower development. To qualify, the facility must use "only the hydroelectric potential of a non-federally owned conduit" that is "operated for the distribution of water for agricultural, municipal, or industrial consumption and not primarily for the generation of electricity."[76] A qualifying facility need only notify FERC of its intent to construct such a facility; if FERC concurs that it qualifies, it will issue a determination within 60 days.[77] While the CWA and other permits are still required, there are no process costs or delays in the federal licensing and permitting of these facilities. In just the first three years since HREA's passage in 2013, FERC

64. *See* Memorandum of Understanding Between the Federal Energy Regulatory Commission and the Bureau of Reclamation Department of the Interior for Establishment of Processes for the Early Resolution of Issues Related to the Timely Development of Non-Federal Hydroelectric Power at Bureau of Reclamation Facilities (1992), https://www.ferc.gov/legal/mou/mou-6.pdf.
65. 33 U.S.C. §1344.
66. *Id*. §408.
67. In 2010, DOE, DOI, and the Corps entered into an MOU intended to increase hydropower project development at federal facilities and on federal lands. *See* Memorandum of Understanding for Hydropower Among the Department of Energy, the Department of the Interior, and the Department of the Army (2010) [hereinafter Energy, Interior & Army MOU], https://energy.gov/sites/prod/files/2015/02/f19/Memorandum%20of%20Understanding%20for%20Hydropower%20March%202010.pdf. In 2011, FERC and the Corps entered into an MOU to facilitate the development of hydropower at Corps facilities by coordinating the agencies' permitting processes. *See* Memorandum of Understanding Between United States Army Corps of Engineers and the Federal Energy Regulatory Commission on Non-Federal Hydropower Projects (2011), https://www.ferc.gov/legal/mou/mou-usace.pdf. This MOU was updated in 2016. *See* News Release, FERC & Office of the Assistant Secretary of the Army, FERC, U.S. Army Corps of Engineers Sign MOU on Hydropower Development (July 21, 2016), https://www.ferc.gov/media/news-releases/2016/2016-3/07-21-16-A-3.pdf.
68. An LOPP is a contractual right given to a nonfederal entity to use a Bureau of Reclamation dam or conduit for electric power generation purposes.
69. *See supra* note 64.
70. *See* Pub. L. No. 113-24, §2, 127 Stat. 498 (2013).
71. FFP Project 92, LLC, 155 FERC ¶ 62089 (2016).
72. FERC, *supra* note 50, at iii.
73. DOE, Pumped Storage and Potential Hydropower From Conduits, Report to Congress iii (2015), *available at* http://energy.gov/sites/prod/files/2015/06/f22/pumped-storage-potential-hydropower-from-conduits-final.pdf.
74. A canal drop structure reduces the bottom slope of an irrigation canal lying on steeply sloping land to avoid high velocity of the flow and risk of erosion.
75. In the 115th Congress, the full U.S. House of Representatives passed a bill that would remove the 5-MW cap for these facilities, which, if enacted, would remove most conduit facilities from FERC's jurisdiction under the FPA. *See* H.R. 2786, 115th Cong. (introduced June 6, 2017).
76. HREA §4(a)(1), 127 Stat. at 494.
77. *See* 18 C.F.R. §§4.400 et seq. (2017).

has found that 83 proposed conduit hydropower facilities have qualified for this program.[78]

If a conduit hydropower facility does not meet the criteria for a qualifying conduit hydropower facility, FERC can issue a conduit "exemption" (a FERC authorization that is similar to a license or permit) for facilities under 40 MW. To qualify, the project must use only the hydroelectric potential of a conduit that is "operated for the distribution of water for agricultural, municipal, or industrial consumption and not primarily for the generation of electricity."[79] The process of obtaining an exemption is less time-consuming and expensive than the FERC licensing process. These exemptions are issued in perpetuity and do not require reauthorization. Any conduit hydropower facilities that do not meet the criteria as a qualifying conduit hydropower facility or otherwise qualify for a conduit exemption require a FERC license to operate.[80]

Congress has also passed legislation to promote hydropower development at federal conduit facilities. In August 2013, it passed the Bureau of Reclamation Small Conduit Hydropower Development and Rural Jobs Act,[81] which authorizes all small (5 MW and under) Bureau of Reclamation conduit facilities for hydropower development. This legislation shifted jurisdiction for the approval of such facilities from FERC to the Bureau of Reclamation. An LOPP is required to authorize hydropower in a Bureau of Reclamation conduit, but the regulatory process is streamlined under the legislation because such projects are categorically exempted from NEPA review. The Bureau of Reclamation found in a March 2012 report that more than 373 of its existing canals and conduits have the potential for hydropower generation of more than 365,000 MW hours annually.[82]

4. Pumped Storage Projects

Pumped storage hydropower has a long history of providing cost-effective and operationally flexible generation to the grid. Currently, it is the only commercially proven technology available for grid-scale energy storage (though other options are emerging).[83] These projects offer black start capability, in the event of a widespread blackout, and can come online very quickly without an external power source. Pumped storage projects also provide essential ancillary services to the grid, including network frequency control and reserve generation, to support the integration of variable renewable resources, such as wind and solar.

There are two varieties of pumped storage hydroelectric projects. Pumped storage plants that are continuously connected to a naturally flowing water feature are referred to as "open-loop" projects. Plants that are not continuously connected hydraulically to a naturally flowing water feature are called "closed-loop" projects.[84] While pumped storage plants generally consume more energy than they produce, they provide important benefits that no other energy resource can offer.

There are currently 40 pumped storage plants in operation in the United States with a combined capacity of 21.6 GW, accounting for 95% of all energy storage capacity in the power grid.[85] On a global scale, there are approximately 270 pumped storage projects operating and under construction, with a combined generating capacity of more than 127 GW.[86] Much of the recent focus in pumped storage development is on closed-loop systems, which generally have fewer environmental effects than open-loop systems.

5. MHK Projects

Hydrokinetic technologies have tremendous potential to add to hydropower's contribution to overall decarbonization. DOE estimates that electrical generation from MHK projects in U.S. waters[87] has the potential to generate 1,700 terawatt hours[88] per year if fully developed, which would power 15.7 million homes and avoid nearly 1.2 billion metric tons of CO_2 emissions annually.[89] River hydrokinetic power, which can be captured through in-water devices that capture the natural flows of rivers and streams, does not require impoundment, and has the potential to replace diesel generation in isolated communities, such as those in rural Alaska.[90]

At this time, however, MHK is still considered an emerging industry, with efforts focused on research and development toward making it technologically and economically viable.[91] Hydrokinetic projects face unique and significant challenges in siting, costs, and technology to withstand the harsh conditions in oceans and rivers, as well as in obtain-

78. FERC, *supra* note 50, at ii.
79. 16 U.S.C. §823a(a)(3)(A).
80. *See*, *e.g.*, ECOsponsible, Inc., 147 FERC ¶ 61052, at P 9-10 (2014) ("[T]he proposed project is not a 'qualifying conduit hydropower facility.' . . . We note that this holding in no way precludes [ECOsponsible, Inc.] from pursuing the development of its project pursuant to the FPA.").
81. Pub. L. No. 113-24, 127 Stat. 498 (2013).
82. Bureau of Reclamation, DOI, Site Inventory and Hydropower Energy Assessment of Reclamation Owned Conduits 6 (2012), *available at* https://www.usbr.gov/power/CanalReport/FinalReportMarch2012.pdf.
83. *See* Alexandra B. Klass, *Expanding the U.S. Electric Transmission and Distribution Grid to Meet Deep Decarbonization Goals*, 47 ELR 10749 (Sept. 2017).
84. *See*, *e.g.*, Wyco Power & Water, Inc., 139 FERC ¶ 61124, at P 12 n.11 (2012).
85. DOE, *supra* note 73, at ii.
86. Pumped Storage Development Council, National Hydropower Association, Challenges and Opportunities for New Pumped Storage Development 13, *available at* http://www.hydro.org/wp-content/uploads/2014/01/NHA_PumpedStorage_071212b12.pdf.
87. Office of Energy Efficiency and Renewable Energy, DOE, Marine and Hydrokinetic Energy Projects—Fiscal Years 2008-2015 (2016) (DOE/EE-0710), *available at* http://energy.gov/sites/prod/files/2016/02/f29/MHK-Projects-Report-2-1-16.pdf.
88. A terawatt is equivalent to 1,000,000 MWs. A terawatt hour is equivalent to 1,000,000 MWs of electricity generated continuously for one hour.
89. *See supra* note 21.
90. *See The Alaskan Way*, Int'l Water Power & Dam Construction, Sept. 27, 2011, http://www.waterpowermagazine.com/features/featurethe-alaskan-way; Campbell Scientific, Case Study No. 102, Alaska: Hydrokinetic Energy (2015), *available at* https://s.campbellsci.com/documents/au/case-studies/102Alaska-hydrokinetic-energy.pdf.
91. *See* DOE Office of Energy Efficiency and Renewable Energy, *Marine and Hydrokinetic Energy Research & Development*, https://energy.gov/eere/water/marine-and-hydrokinetic-energy-research-development (last visited Dec. 11, 2017).

ing the necessary authorizations to build such projects. Both FERC and DOE have implemented programs to promote the development of hydrokinetic projects and help to overcome these challenges.

FERC has unveiled a number of initiatives over the past 12 years to help promote the development of hydrokinetic technologies by lowering the regulatory barriers to permitting such projects. In 2005, for example, FERC created an exception to its licensing requirement for the short-term testing of MHK technology in certain circumstances, when power generated from the device was not transmitted to the electric grid.[92]

In 2007, FERC staff introduced a new pilot licensing process for small-scale hydrokinetic projects to allow developers to test new hydrokinetic technologies, including connection with the interstate grid, on an expedited time line.[93] Projects utilizing the pilot licensing process must be small (under 5 MW) and able to be shut down or removed on short notice, and must not be located in sensitive areas. The pilot process contemplates licensing of such projects in as little as six months, though in practice FERC has taken far longer to issue pilot licenses. The pilot licenses issued thus far have been subject to significant environmental monitoring and safety requirements, and have been issued for license terms up to 10 years.

FERC has also issued a policy supporting the issuance of conditioned licenses for MHK projects in certain cases, which would enable the licensee to receive the license prior to obtaining other federal authorizations for the project, conditioned on receipt of such other authorizations prior to commencing construction.[94]

In addition, FERC has made strides to resolve the confusion for developers caused by the overlap in jurisdiction between FERC and the Bureau of Ocean Energy Management (BOEM) for hydrokinetic projects on the Outer Continental Shelf (OCS). The agencies signed an MOU in 2009 providing for dual jurisdiction for hydrokinetic projects on the OCS. Under the MOU, BOEM has exclusive jurisdiction to issue leases, easements, and rights-of-way, and FERC has exclusive jurisdiction to issue licenses and exemptions for such projects. The agencies subsequently issued guidelines to assist developers interested in pursuing MHK development on the OCS.[95]

DOE has also taken action to promote the development of MHK technology. DOE's Water Power Program provides federal incentives to stimulate the deployment of hydrokinetic technology. From fiscal year (FY) 2008 to FY 2015, DOE issued awards totaling about $136 million for 92 MHK projects in 24 states.[96] These funding opportunities fall under two activity areas—technology development and market acceleration and deployment—and are awarded to a variety of entities, including private industry, nonprofit organizations, educational institutions, investor-owned utilities and public utilities, and local and state governments.[97] DOE also offers loan guarantees to help developers secure financing for MHK technology and testing.

6. Preserving the Existing Fleet

To continue hydropower's contributions to U.S. renewable generation, efforts must also be made to preserve the existing fleet. Between 2016 and 2030, more than 500 projects will begin the FPA-required relicensing process. This represents about one-half of all hydropower projects licensed by FERC, and about 30% of the total hydropower licensed capacity under FERC's jurisdiction.[98] The vast majority of these projects are very small; the median installed capacity of the projects is 2.5 MW. The prospect of incurring the high cost and requirements of relicensing is likely to cause some project owners to determine that the cost of continuing to operate the project exceeds its benefit, and therefore to decommission the project rather than seek a new license.[99] Efforts to modernize regulatory oversight while preserving modern environmental standards will help to keep project owners invested in continued operation of these projects.

III. Resolving Impediments to Hydropower Development Through Legal Reform

As explained in Part II of this Article, many of the current impediments for capturing the significant potential to preserve and expand hydropower in the United States can be traced to the regulatory framework governing the licensing and oversight of these generating facilities. In many respects, the hydropower licensing program under the FPA—enacted nearly a century ago in the Federal Water Power Act (FWPA) of 1920[100]—has been a tremendous

92. Verdant Power LLC, 111 FERC ¶ 61024, *order on clarification*, 112 FERC ¶ 61143 (2005).
93. FERC, Licensing Hydrokinetic Pilot Projects (2008), *available at* https://www.ferc.gov/industries/hydropower/gen-info/licensing/hydrokinetics/pdf/white_paper.pdf.
94. Policy Statement on Conditioned Licenses for Hydrokinetic Projects, 72 Fed. Reg. 68877 (Dec. 6, 2007).
95. BOEM/FERC Guidelines on Regulation of Marine and Hydrokinetic Energy Projects on the OCS (Version 2 2012), *available at* https://www.ferc.gov/industries/hydropower/gen-info/licensing/hydrokinetics/pdf/mms080309.pdf.
96. Office of Energy Efficiency and Renewable Energy, *supra* note 87, at 30-31.
97. *Id.* at 29.
98. *Hearing on Discussion Drafts Addressing Hydropower Regulatory Modernization and FERC Process Coordination Under the Natural Gas Act Before the House Comm. on Energy and Commerce, Subcomm. on Energy and Power*, 114th Cong. 8 (2015) (testimony of Ann Miles, FERC), https://www.ferc.gov/CalendarFiles/20150513110741-Miles-testimony-05-13-2015.pdf.
99. *See* Project Decommissioning at Relicensing; Policy Statement, 60 Fed. Reg. 339, 347 (Jan. 4, 1995) (codified at 18 C.F.R. §2.24); PacifiCorp, 133 FERC ¶ 61232 (2010), *order on reh'g*, 135 FERC ¶ 61064 (2011) (order accepting surrender of license after licensee determined that environmental costs under new license were economically unacceptable); Portland Gen. Elec. Co., 107 FERC ¶ 61158 (2004) (order accepting surrender of license after licensee determined that environmental costs associated with relicensing would make continued operation uneconomical); Pacific Gas and Electric Co.'s License Surrender Application for the Kilarc-Cow Creek Hydro Project, Project No. 606-027 (filed Mar. 12, 2009).
100. Pub. L. No. 66-280, ch. 285, 41 Stat. 1063 (codified at 16 U.S.C. §§791a et seq.).

success.[101] At a time when our nation's electric power-generating infrastructure was in its infancy with pressure to expand, Congress in 1920 created the Federal Power Commission (FPC), FERC's predecessor agency,[102] to facilitate decisionmaking by a single administrative body that was statutorily charged to balance multiple (and sometimes competing) uses of our nation's waterways for purposes of power development, recreation, navigation, aquatic resources, and other public interests.[103]

The emergence of modern environmental requirements—through both the enactment of federal environmental programs such as NEPA, the ESA, and the CWA, as well as amendments to the FPA itself—has resulted in significant procedural and substantive changes in the licensing of nonfederal hydropower. Substantively, modern nonfederal hydropower licensing involves a much more rigorous investigation of environmental effects of the project, with focused emphasis on protection of, mitigation of effects to, and enhancement of resources such as affected aquatic and terrestrial species,[104] water quality,[105] federal land use planning,[106] cultural resources,[107] and coastal zones.[108] While FERC licensing of most nonfederal hydropower remains intact, the single-agency decisional model originally conceived by Congress when enacting the FWPA nearly a century ago has been replaced by today's highly complex licensing scheme that involves consultation, oversight, and regulatory authorities exercised by multiple federal and state resource agencies. As such, FERC's statutory duty to consider and balance the full spectrum of competing resources in the public interest, as required by the FPA, has largely been compromised and replaced by requirements mandated by many different agencies with more focused management priorities.[109]

From a procedural standpoint, the regulatory evolution in nonfederal hydropower to a multiple-agency process has given rise to a protracted and cumbersome licensing process that lacks central coordination. In modern nonfederal hydropower licensing, FERC has limited ability to maintain regularity and efficiency in the licensing process.[110] The result is a regulatory structure that features redundancy in environmental studies and NEPA review; competing and often conflicting regulatory requirements due to overlapping authorities among agencies[111]; and a FERC licensing process that can take a decade to complete[112]—only to repeat a similar approval process before other agencies for other permits and approvals needed for project development, without any societal benefits from this redundant regulatory structure.

These procedural and substantive features in nonfederal hydropower licensing impose a significant disadvantage to hydropower in the marketplace, as compared to other electricity-generation sources. Due to engineering and construction requirements, hydropower inherently faces high front-end development costs (with its value increasing over time due to the lack of fuel costs). When coupled with the current lengthy, expensive, and overlapping regulatory approval process, other generation sources—typically fossil fuel resources such as natural gas, which offer some of the grid benefits of hydropower such as peaking power, load following, and integration of intermittent renewables—often are more attractive than hydropower. Too often, the result is a lost opportunity to capture renewable, non-emitting energy—even at existing non-powered dams where hydropower could be retrofitted to complement ongoing use of existing infrastructure (e.g., water supply dams and flood control facilities).

Policymakers have developed a number of options to address these significant regulatory impediments to hydropower while maintaining environmental standards. These solutions, described in detail in the sections that follow, range from facilitating greater coordination

101. Sensiba & White, *supra* note 39, at 27.
102. Department of Energy Organization Act, Pub. L. No. 95-91, 91 Stat. 565 (1977).
103. FWPA §10(a), 41 Stat. at 1068; Gifford Pinchot, *The Long Struggle for Effective Water Power Regulation*, 14 Geo. Wash. L. Rev. 9 (1945).
104. 16 U.S.C. §1536 (§7 of the ESA); *id*. §803(j) (§10(j) of the FPA); *id*. §811 (§18 of the FPA); *id*. §1855(b)(2) (§305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act); *id*. §1372 (§102 of Marine Mammal Protection Act).
105. 33 U.S.C. §§1341, 1344 (§§401 and 404 of the CWA).
106. 16 U.S.C. §797(e) (§4(e) of the FPA); 43 U.S.C. §1761 (FLPMA).
107. 54 U.S.C. §306108 (§106 of the NHPA).
108. 16 U.S.C. §1456(c)(3)(A) (§307(c)(3)(A) of the CZMA).
109. Charles R. Sensiba, *Who's in Charge Here? The Shrinking Role of the Federal Energy Regulatory Commission in Hydropower Relicensing*, 70 U. Colo. L. Rev. 603 (1999); Charles R. Sensiba, *Hydropower*, *in* The Law of Clean Energy: Efficiency and Renewables 479, 480-83 (Michael B. Gerrard ed., ABA 2011).
110. *See* City of Tacoma v. Federal Energy Regulatory Comm'n, 460 F.3d 53, 65, 36 ELR 20173 (D.C. Cir. 2006) (holding that FERC cannot set "strict time restriction[s]" on mandatory conditioning agencies). In addition, while §401 of the CWA requires a state agency to act on a request for water quality certification within one year after receipt of an application, states frequently insist that the applicant withdraw and refile its application before the one-year deadline, sometimes numerous times, to give the state additional time to act. *See* PacifiCorp, 149 FERC ¶ 61038, at P 20 (2014) (noting that states that engage in repeated withdrawal and refiling of applications for water quality certification cause delays in the issuance of new licenses); FERC, Report on Hydroelectric Licensing Policies, Procedures, and Regulations Comprehensive Review and Recommendations Pursuant to Section 603 of the Energy Act of 2000, at 16-17 (2001) [hereinafter 603 Report], *available at* https://www.ferc.gov/legal/maj-ord-reg/land-docs/ortc_final.pdf. In addition, though FWS and NMFS regulations require them to conclude formal ESA consultation through the issuance of a BiOp within 135 days, 16 U.S.C. §1536(b)(3)(A); 50 C.F.R. §402.14(e), this deadline is commonly exceeded, causing hydropower licensing to be delayed.
111. *See*, *e.g.*, Letter From Ann F. Miles, Director, Division of Hydropower, FERC, to Steven M. Pirner, Department Secretary, South Dakota Department of Environment and Natural Resources (Aug. 10, 2009) (Project No. 12775-001) (noting that the federal and state agencies had submitted conflicting mandatory conditions and asking the agencies to resolve the conflict); Puget Sound Energy, Inc., 107 FERC ¶ 61331 (2004), *order on reh'g*, 110 FERC ¶ 61200, *reh'g denied*, 111 FERC ¶ 61317 (2005), *aff'd*, Snoqualmie Indian Tribe v. Federal Energy Regulatory Comm'n, 545 F.3d 1207 (9th Cir. 2008) (FERC imposed greater minimum flow requirements than those required by the state water quality certification).
112. 603 Report, *supra* note 110, at 31 (noting that the average processing time from application to license issuance is 52 months). *See also Hearing to Receive Testimony on Opportunities to Improve American Energy Infrastructure Before the Senate Comm. on Energy and Natural Resources*, 114th Cong. 5 (2017) (written testimony of Jeffrey Leahey, Deputy Executive Director, on Behalf of the National Hydropower Association), https://www.energy.senate.gov/public/index.cfm/files/serve?File_id=E3BD2A82-1B13-4B5F-8754-46C181EACB60.

among FERC and other agencies, to ensuring that decisionmakers account for the climate benefits of hydropower in their licensing and permitting decisions. These solutions would also ensure that renewable energy incentives, goals, and requirements include the full range of hydropower, and would help develop critical information to better inform market participants and regulators of the grid benefits provided by hydropower resources, and particularly pumped storage.

A. Fully Recognize Hydropower as a Renewable Energy Resource

Our ability to more fully capture hydropower's potential to assist in a deep decarbonization effort must begin with policies that attempt to level the regulatory playing field between hydropower and other resources. As described below, federal and state policies relating to renewable energy treat hydropower very differently than other renewable generation resources, such as solar, wind, and geothermal, by significantly reducing the classes of hydropower that qualify for renewable energy programs—or by excluding hydropower altogether. Because such policies make sweeping and rather arbitrary judgments related to hydropower's environmental effects, state and federal policymakers should revisit their policies by recognizing that the main thrust of these programs is to displace carbon-based generation, and that the most effective means of ensuring that goal in an environmentally responsible manner is to rely on the comprehensive and rigorous environmental review by FERC and other federal and state resource agencies under the suite of federal laws, such as the FPA, the ESA, the CWA, the CZMA, and the NHPA. In other words, if a hydropower project can be licensed to meet these rigid requirements, it should receive full recognition as a renewable resource.

A number of federal and state renewable energy policies treat hydropower differently than other renewable sources. When establishing renewable energy procurement requirements for the federal government, for example, the Energy Policy Act of 2005 (EPAct 2005) included hydropower only with respect to ocean MHK technologies and "hydroelectric generation capacity achieved from increased efficiency or additions of new capacity at an existing hydroelectric project."[113] This definition excludes from federal renewable energy procurement the entire existing fleet of 2,198 hydropower projects across the United States totaling 101 GW of capacity.[114] It also eliminates any incentive to meet federal renewable energy requirements through developing new hydropower facilities at existing non-powered dams, along water supply conduits, irrigation canals, or other infrastructure, or at environmentally responsible greenfield sites.[115]

Other federal and state policies are just as exclusionary—some more so. Of all the resources defined as "renewable electric energy" in Executive Order No. 13693 (which establishes federal facility requirements for sustainability and emissions reductions, including utilization of renewable electric energy), the only resource that contains any limited applicability is hydropower. The Executive Order defines "renewable electric energy" as

> energy produced by solar, wind, biomass, landfill gas, ocean (including tidal, wave, current, and thermal), geothermal, geothermal heat pumps, microturbines, municipal solid waste, or new hydroelectric generation capacity achieved from increased efficiency or additions of new capacity at an existing hydroelectric project.[116]

The U.S. Environmental Protection Agency's (EPA's) Green Power Partnership (a voluntary program of organizations that use a percentage of their annual electricity from green power and report their green power use to EPA) places similar restrictions on qualifying hydropower projects by narrowly defining hydropower:

> Hydropower is eligible if it meets one or more of the following conditions:
>
> a. Hydropower facilities certified by the Low Impact Hydropower Institute
>
> b. New incremental capacity on a non-impoundment or "new" generation capacity on an existing impoundment that is a run-of-the-river hydropower facility
>
> c. Hydropower facilities that consist of a turbine in a pipeline or a turbine in an irrigation canal
>
> . . .
>
> EPA will consider new incremental capacity on an existing dam on a case-by-case basis, where the "new" output is equal to or less than 5 megawatts.[117]

Similarly, a 2012 MOU between the U.S. Departments of Defense (DOD) and the Interior (DOI) includes a stated purpose of helping "DoD develop renewable energy in the interests of greater installation energy security and reduced installation energy costs. . . ."[118] Eligible technologies dis-

113. 42 U.S.C. §15852(b)(2).

114. Hydropower Vision, *supra* note 7, at 78.

115. One example highlights the current problem. In 2012, the Corps issued Large Scale Renewable and Alternative Energy Production for Federal Installations, Solicitation No. W912DY-11-R-0036, which estimated a $7 billion maximum value of all contracts awarded under the proposal. Despite the urging of the hydropower industry, hydropower was completely excluded from the proposal. *See* Letter From Linda Church Ciocci, Executive Director, National Hydropower Association, to Sarah Tierney, U.S. Army Engineering and Support Center (Mar. 21, 2012), http://www.hydro.org/wp-content/uploads/2012/03/NHA-Comments-Large-Scale-Renewable-Energy-Production-for-Federal-Installations-No-W912DY-11-R-0036.pdf.

116. Exec. Order No. 13693, 80 Fed. Reg. 15869, 15883 (Mar. 25, 2015).

117. U.S. EPA, EPA's Green Power Partnership, Partnership Requirements, app. A, at A-1 (2017), *available at* https://www.epa.gov/sites/production/files/2016-01/documents/gpp_partnership_reqs.pdf.

118. Memorandum of Understanding Between the Department of Defense and the Department of the Interior on Renewable Energy and a Renewable Energy Partnership Plan 1 (2012), https://www.acq.osd.mil/dodsc/library/DoD_DOI%20MOU%20Signed%2020%20Jul%202012.pdf.

cussed in the MOU include wind, solar, geothermal, and biomass. Hydropower is not included in the MOU. While touching on energy storage technologies, moreover, the MOU does not recognize pumped storage—the only utility-scale energy storage technology currently available. The MOU discusses offshore wind potential on the OCS, but does not discuss MHK assessments conducted by DOE.

Finally, while many states with renewable portfolio standards (RPS) allow some forms of hydropower to qualify, most include restrictions based on the capacity of the project and the age of the facility. Some states impose additional restrictions based on operation requirements of the facility, environmental considerations, and technology.[119] By way of example, Arizona only counts hydropower that is

> installed after January 1, 2006, that produces 10 MW or less and is either:
>
> a. A low-head, micro hydro run-of-the-river system that does not require any new damming of the flow of the stream; or
>
> b. An existing dam that adds power generation equipment without requiring a new dam, diversion structures, or a change in water flow that will adversely impact fish, wildlife, or water quality; or
>
> c. Generation using canals or other irrigation systems.[120]

California's RPS for hydropower is quite complex and allows only the following categories of facilities to qualify, most of which must have been in operation prior to 2006:

> (1) Small hydroelectric facilities 30 MW or less.
>
> (2) Conduit hydroelectric facilities 30 MW or less.
>
> (3) Hydroelectric generation units 40 MW or less and operated as part of a water supply or conveyance system.
>
> (4) Incremental hydroelectric facilities.[121]

Even within this narrow list of potentially eligible hydropower categories, California's RPS imposes additional qualification restrictions, such as the presence of other hydropower projects in the vicinity, impacts on stream use, and whether the project is located within or outside of California.[122]

In Connecticut, the RPS only allows

> a run-of-the-river hydropower facility that began operation after July 1, 2003, and has a generating capacity of not more than thirty megawatts, provided a facility that applies for certification under this clause after January 1, 2013, shall not be based on a new dam or a dam identified by the commissioner as a candidate for removal, and shall meet applicable state and federal requirements, including applicable site-specific standards for water quality and fish passage. . . .[123]

These exclusions and limitations of hydropower in renewable energy programs demonstrate that policymakers arbitrarily screen hydropower from these programs based on an environmental standard—a standard that is not imposed on other renewable generation resources, even though no energy project is without environmental effects. There is no uniformity among states as to how those impacts should be addressed in RPS standards. Moreover, the limitations imposed in these programs—while perhaps rooted in a concern over environmental impacts associated with hydropower—are flawed for two primary reasons.

First, these programs impose sweeping and inconsistent limitations on hydropower based on general assumptions related to environmental effects. In Arizona, for example, a 9-MW low-head, run-of-river project that does not require any new dam would qualify for the state's RPS, while a 12-MW project meeting those exact same criteria would not. In California, a 25-MW conduit hydropower project constructed in 2005 may qualify for the state's RPS, while a 35-MW project constructed at the same site 10 years later is unlikely to qualify. In Connecticut, a 15-MW run-of-river project would qualify for the state's RPS, but the exact same project would not be eligible for EPA's program. And none of these projects would qualify as renewable energy for federal procurement under EPAct 2005.

Second, the coarse environmental requirements imposed by these programs ignore the rigorous and comprehensive environmental review and resulting operating requirements imposed by the FPA and other applicable federal programs. The entire purpose of the licensing process under the FPA, together with the full suite of environmental requirements of other federal programs (which were enacted after many dams in the United States were already constructed), is to evaluate the environmental effects of a project on an individual basis—regardless of its size, operating regime, date of construction, or location—and to develop an operating regime and other requirements that protect, mitigate effects of, and even enhance environmental resources. Hydropower projects meeting these rigid environmental and public interest requirements should not be excluded from a state RPS or other renewable energy program simply because they exceed an arbitrary capacity limit or are not a preferred technology.

Thus, as we look for solutions to deepen our reliance on non-carbon energy sources, federal and state policy-

119. For a general survey of treatment of hydropower in state RPS requirements, see Val Stori, Clean Energy States Alliance, Environmental Rules for Hydropower in State Renewable Portfolio Requirements (2013), *available at* https://www.cesa.org/assets/2013-Files/RPS/Environmental-Rules-for-Hydropower-in-State-RPS-April-2013-final-v2.pdf.

120. Ariz. Admin. Code §R14-2-1802(A)(9) (2016), *available at* http://apps.azsos.gov/public_services/Title_14/14-02.pdf.

121. California Energy Commission, Commission Guidebook: Renewables Portfolio Standards Eligibility 14 (2015) (CEC-300-2015-001-ED8-CMF), *available at* http://www.energy.ca.gov/2015publications/CEC-300-2015-001/CEC-300-2015-001-ED8-CMF.pdf.

122. *See generally id.* at 14-21.

123. Conn. Gen. Stat. §16-1(a)(20)(x) (2017), *available at* https://www.cga.ct.gov/current/pub/chap_277.htm#sec_16-1.

makers should amend existing renewable energy programs and develop new such programs recognizing that all duly licensed and environmentally compliant nonfederal hydropower should be considered renewable. In addition to a national RPS standard that includes all forms of duly licensed nonfederal hydropower or a carbon tax, specific solutions include the following actions:

- Congress should amend EPAct 2005 to clarify that all forms of duly licensed nonfederal hydropower satisfy renewable energy requirements for federal procurement.[124]
- The president should revise Executive Order No. 13693 to clarify that all forms of duly licensed nonfederal hydropower meet the definition of "renewable electric energy."
- Through the use of Executive Orders, directives, and memoranda, the Administration should: (1) establish that all duly licensed nonfederal hydropower, in all its forms, is an energy priority and compatible with agency missions, and a renewable energy resource for purposes of meeting climate goals; and (2) direct federal departments, agencies, and bureaus to review and revise any policies, regulations, MOUs, guidance documents, and other governing documents that are inconsistent with this establishment of policy.
- The Administration should direct all federal departments, agencies, and bureaus with responsibilities for the approval of any aspect of hydropower to review, update, and supplement agency guidance documents, handbooks, and resource plans to reflect hydropower as a priority for combating carbon emissions.
- Through the use of federal research grants and other federal funding provided to the states, Congress and federal agencies should encourage the states to change their restrictive RPS requirements by allowing all duly licensed nonfederal hydropower to qualify.

B. Require All Regulatory Agencies to Give "Equal Consideration" to the Climate Benefits of Hydropower in Their Licensing and Permitting Decisions

Since their enactment nearly 100 years ago, the hydropower licensing provisions of the FPA have evolved over time to reflect advances in scientific understanding and changes in regulatory policies of the public's use of water resources. As originally enacted in 1920, the statute recognized primarily the public uses of power generation and navigation, requiring the FPC to condition licenses as "best adapted to a comprehensive scheme of improvement and utilization for the purposes of navigation, of water-power development, and of other beneficial public uses. . . ."[125] Fifteen years later, with a growing interest in public recreation in our nation's waterways, Congress responded by expanding the FPC's responsibilities to balance hydropower licenses in the public interest by requiring it to include "recreational purposes."[126]

With more modern recognition and focus on environmental resources, Congress in the Electric Consumers Protection Act (ECPA) of 1986 further expanded FERC's responsibilities, requiring its licensing decisions to balance "the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat)," as well as irrigation, flood control, and water supply.[127] In the ECPA, Congress also amended the FPA to emphasize FERC's balancing responsibility when issuing licenses:

> In deciding whether to issue any license under this Part for any project, [FERC], in addition to the power and development purposes for which licenses are issued, shall give equal consideration to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality.[128]

In the most recent expansion of this balancing authority, Congress in EPAct 2005—recognizing the proliferation of "mandatory" licensing conditions imposed by federal and state resource agencies other than FERC[129]—required that agencies exercising mandatory conditioning authority under the FPA[130] also demonstrate through a written statement that they "gave equal consideration to the effects of the condition adopted . . . on energy supply, distribution, cost, and use; flood control; navigation; water supply; and air quality (in addition to the preservation of other aspects of environmental quality). . . ."[131]

As policies and priorities have continued to evolve over the past decade, with increased attention and concern to climate change, Congress could again step in and require

124. This provision is included in the Senate energy bill considered in the 115th Congress, see S. 1460, 115th Cong. §3001(a)(2) (2017), as well as the House hydropower reform bill. *See* H.R. 3043, 115th Cong. §2(b) (2017). H.R. 3043 passed the full House on Nov. 8, 2017.

125. FWPA §10(a), 41 Stat. at 1068 (current version codified at 16 U.S.C. §803(a)(1)).

126. Public Utility Act of 1935, Pub. L. No. 74-333, §206, 49 Stat. 803, 843 (current version codified at 16 U.S.C. §803(a)(1)).

127. Pub. L. No. 99-495, §3(b), 100 Stat. 1243, 1244 (current version codified at 16 U.S.C. §803(a)(1)).

128. *Id.* §3(a), 100 Stat. at 1243 (codified at 16 U.S.C. §797(e)).

129. As discussed *supra* Part II, these include conditions imposed by federal reservation management agencies under FPA §4(e), 16 U.S.C. §797(e), fishway prescriptions imposed by FWS and NMFS under FPA §18, 16 U.S.C. §811, and water quality certification conditions imposed by the states under CWA §401, 33 U.S.C. §1341.

130. 16 U.S.C. §§797(e), 811. Conditions submitted under these authorities are considered "mandatory" because the Supreme Court has held that FERC cannot reject or modify these conditions and prescriptions, and must incorporate them into the FERC license for the project. Escondido Mut. Water Co. v. La Jolla Band of Mission Indians, 466 U.S. 765, 14 ELR 20592 (1984).

131. EPAct 2005 §241(c), 119 Stat. at 676 (adding a new §33 to the FPA, codified at 16 U.S.C. §823d(a)(4), (b)(4)).

FERC, together with federal and state resource agencies exercising authority over hydropower development, to give "equal consideration" to the climate benefits afforded by hydropower.[132] Agencies other than those with mandatory conditioning authority, which are already required to give equal consideration to developmental and nondevelopmental values, also play a significant role in shaping operational requirements of hydropower projects (which have significant effects on a project's ability to generate, follow load, integrate intermittent renewables, and otherwise provide significant climate benefits to the grid).

These agencies issue necessary permits for hydropower development, including dredge and fill permits issued under CWA §404[133] and state water quality certifications under CWA §401.[134] They also require reasonable and prudent measures or alternatives developed during consultation under ESA §7,[135] which are incorporated into a FERC license. While expressly requiring these agencies to give equal consideration to the effects of climate on their decisions affecting hydropower would not dictate their final license conditions,[136] it would ensure that agencies analyze the effects of their actions on climate change, and perhaps lead to more balanced permits and measures that protect hydropower's value as a renewable, non-emitting source of electricity.

C. *Integrate the FERC Licensing Process With Other Regulatory Requirements and Require Greater Coordination and Schedule Discipline*

As described in Part II above, the authorization of nonfederal hydropower is a series of complex, lengthy, and expensive processes before multiple federal and state agencies. FERC's licensing process alone can take 10 years or more to complete,[137] and triggers a number of requirements under NEPA, the ESA, the CWA, the NHPA, the CZMA, and other statutes.[138] Under current law and practice, there are few opportunities to consolidate and coordinate these permitting activities. While agencies' various statutory responsibilities are an important part of the project review process to ensure resource protection and management, there are few mechanisms under current law to coordinate all agencies' programs to reduce duplication of effort, encourage concurrent review and collaboration, and ensure timely action.[139]

The regulations of the Council on Environmental Quality allow for agencies to find efficiencies in the NEPA process by cooperating,[140] "tiering" from prior environmental analyses of other agencies,[141] and issuing supplemental environmental analyses.[142] Other statutes, such as CWA §401, expressly provide that subsequent water quality certifications are unnecessary for the multiple federal authorizations required for a single project or activity.[143] In practice, however, agencies tend not to rely on these opportunities—perhaps because they prefer their own work product over that of other agencies, or they fear that inaction may lead to litigation. FERC, moreover, has a long-standing policy of requiring federal and state resource agencies to choose between participating with FERC as a cooperating agency for NEPA purposes, or protecting its legal rights in the FERC proceeding as an intervenor.[144] While FERC's policy is grounded in public policies prohibiting ex parte communications with parties in a contested proceeding,[145] the effect is to force agencies to decline to participate as a cooperating agency and to conduct their own NEPA review on their own schedule, once the hydropower applicant seeks the required authorization from that agency.

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132. While the reference to "air quality" in FPA §33, 16 U.S.C. §823d, arguably imposes this requirement on agencies exercising mandatory conditioning authorities under FPA §§4(e) and 18 already, these agencies' regulations have narrowly interpreted this responsibility. Resource Agency Hearings and Alternatives Development Procedures in Hydropower Licenses, 81 Fed. Reg. 84389, 84393-94 (Nov. 23, 2016). Congress has responded by introducing legislation in the 115th Congress that would require mandatory conditioning agencies to give equal consideration whenever they exercise their mandatory conditioning authority. *See* S. 1460, 115th Cong. §3001(c) (2017); H.R. 3043, 115th Cong. §3(a) (2017). *See also* Sierra Club v. Federal Energy Regulatory Comm'n, 867 F.3d 1357, 1374-75, 47 ELR 20104 (D.C. Cir. 2017) (holding that FERC is required to estimate and consider the potential downstream negative climate impacts when permitting interstate natural gas pipeline projects).
133. 33 U.S.C. §1344.
134. *Id.* §1341.
135. 16 U.S.C. §1536.
136. "Equal consideration" does not require "equal treatment," but instead requires FERC to "balance the public interest in all of its stated dimensions, give equal consideration to conflicting interests, and reach a reasoned factual decision." California ex rel. State Water Res. Control Bd. v. Federal Energy Regulatory Comm'n, 966 F.2d 1541, 1550, 22 ELR 21397 (9th Cir. 1992).
137. Written testimony of Jeffrey Leahey, *supra* note 112, at 5. While it is true that FERC has introduced the Alternative Licensing Process and other streamlining efforts, it has had no effect on improving the length of the licensing process.
138. *See* Sensiba, *Who's in Charge Here?*, *supra* note 109, at 633 & n.194 (identifying an estimated 40 federal statutes that apply to hydropower licensing).
139. In 2015, Congress enacted the Fixing America's Surface Transportation Act (FAST Act), Pub. L. No. 114-94, 129 Stat. 1312, which is intended to streamline federal permitting for major new infrastructure projects costing $200 million or more. While some of the principles of schedule setting, accountability, and transparency embodied in the FAST Act are needed in hydropower licensing, the Act itself is unlikely to significantly improve the FERC licensing process for hydropower. Much of the hydropower licensing need at FERC—particularly over the next 20 years—will be relicensing of existing, smaller facilities. Because the program is in its infancy, it is not clear whether it even applies to reauthorization of existing facilities, as the program is focused on new infrastructure development. Even if the program is sufficiently broad to capture hydropower relicensing generally, the vast majority of all relicensing work over the next 15 years—which, as explained above, involves primarily small hydropower—will not meet the FAST Act's $200 million threshold requirement. Finally, the FAST Act contains a sunset provision that occurs well prior to the average FERC licensing proceeding, creating significant uncertainty of the program's ability to support any hydropower licensing through conclusion.
140. 40 C.F.R. §1501.6 (2017).
141. *Id.* §1502.20.
142. *Id.* §1502.9.
143. 33 U.S.C. §1341(a)(3).
144. *See*, *e.g.*, Arizona Pub. Serv. Co., 94 FERC ¶ 61076, 61350 (2001):
> [A]n agency cannot intervene as a party in a [FERC] proceeding and at the same time be a cooperating agency for purposes of preparing an environmental analysis under [NEPA]. . . . To allow such a cooperating agency to intervene in a proceeding would put it in the position of having information that was not available to other parties, in violation of our rule prohibiting *ex parte* communications.

145. 18 C.F.R. §385.2201 (2017).

Together, the disjointed, sequential, and uncoordinated regulatory landscape causes significant delays, increased costs, and inconsistent agency directives, and stifles new hydropower project development and relicensing. For example:

- Although ESA regulations require formal consultation to conclude with a BiOp within 135 days,[146] the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) routinely fail to meet this regulatory deadline—in some cases by an inordinate amount of time. For several pending hydropower licensings in the Southeast, BiOps on shortnose and Atlantic sturgeon have been delayed for many years. Despite urgings from the applicants and FERC, NMFS has yet to issue its BiOps and allow the licensing of these projects to proceed.
- At a hydropower project in California, a BiOp on green sturgeon has delayed for more than six years implementation of a groundbreaking comprehensive hydropower relicensing settlement—agreed to by more than 50 agencies and stakeholders, including FWS and NMFS—which would provide approximately $1 billion in numerous environmental, recreational, and other public benefits.
- Although CWA §401 imposes a one-year statutory deadline for states to make a decision on water quality certification, hydropower applicants are routinely pressured by the state to withdraw and refile their applications to reset the clock and give the state another year to act. Illustrating this issue, FERC noted in a 2014 order that of the 43 then-pending license applications for which FERC staff had completed environmental analysis, 29 (67%) were delayed due to state water quality certification. Thirteen of these projects are in California. Since that FERC order, FERC was finally able to move forward and issue licenses for some of these projects—but only for two California projects, which had been waiting for seven years for the state to issue a water quality certification.[147]
- For new project development on certain federal lands, a hydropower operator must obtain a special use permit under FLPMA. Often, the FLPMA permitting agency does not participate as a cooperating agency in FERC's preparation of the NEPA document, requiring the agency to undertake a separate NEPA analysis. Because this occurs after the FERC licensing, the sequential processing of the FLPMA permitting causes additional delays.
- The Corps rarely participates in the FERC licensing process for proposed hydropower projects at federal dams under its jurisdiction. Its absence often requires the developer to begin anew—after FERC issues the license—with the conduct of studies and environmental reviews, as the Corps completes its environmental review under NEPA and issues permits and authorizations under the CWA and Rivers and Harbors Act of 1899. The sequential nature of these permitting activities adds significant time, adds additional costs of repeating studies, adds uncertainty and increased risk that disfavors investment, and delays deployment of new hydropower resources. While FERC and the Corps in 2016 entered into an MOU in an effort to address some of these problems, it is unclear at the time of publication whether this MOU will result in any improvement.[148]

Congress and federal regulators have been grappling with these challenges for decades. In the Energy Act of 2000, for example, Congress directed FERC to investigate ways to reduce the cost and time of the hydropower licensing process.[149] Upon completing a comprehensive investigation of impediments in the licensing process—reviewing data as far back as the 1980s—FERC concluded that CWA water quality certification, as well as other factors, cause significant delay.[150] In response to Congress' direction to provide recommendations to address the delays, FERC (among other things) encouraged more centralized management of the approval process and better coordination among agencies involved.[151]

More recently, a FERC commissioner testified in Congress that continued delays in receiving the multiple federal and state agency approvals required before FERC can issue a license are significantly impeding the relicensing of existing facilities and suppressing new hydropower project proposals—in some cases for several years:

> It is a fact that the licensing process of hydropower projects (and the re-licensing of existing projects) is an expensive and multi-year process. However, most of the cost and time involved in this process can be traced to the requirements of the federal hydropower licensing law. This existing law

146. 16 U.S.C. §1536; FWS, Endangered Species, *Consultations Frequently Asked Questions—What Steps Are Involved in a Section 7 Consultation?*, https://www.fws.gov/Endangered/what-we-do/faq.html#2 (last updated Nov. 1, 2017).

147. PacifiCorp, 149 FERC ¶ 61038, at P 13 n.15 (2014).

148. Memorandum of Understanding Between United States Army Corps of Engineers and the Federal Energy Regulatory Commission on Non-Federal Hydropower Projects (2016), https://www.ferc.gov/legal/mou/2016/07-21-16.pdf.

149. Pub. L. No. 106-469, §603, 114 Stat. 2029, 2041.

150. *See* 603 Report, *supra* note 110, at 16-17 (noting that "the section 401 certification process is often very time-consuming, despite the intent of the CWA that a State should act on a certification request in a year or less"); Hydropower Vision, *supra* note 7, at 143:

> The median time from the filing [of] a license application to its conclusion for recent applications is 43 months. Many proceedings, however, take substantially longer. Many specific factors contribute to delays, but the underlying source of most delays is a statutory scheme that disperses decision making among federal and state agencies acting independently of [FERC]'s proceedings. The most common cause of long delayed proceedings is untimely receipt of state water quality certification under the [CWA].

(Citation omitted.)

151. *See* 603 Report, *supra* note 110, at 88-89.

> emphasizes both extensive environmental reviews of a project's impacts and a role for federal and state resource agencies. There are no consequences to these agencies if they miss deadlines that are part of [FERC]'s licensing process or of the laws and regulations they must comply with before [FERC] can issue a license, such as the [ESA] and the [CWA]. For those members interested in promoting hydropower development, an examination of this and related laws and specifically the roles and responsibilities of resource agencies could help streamline the licensing process and allow greater certainty for those seeking to develop this abundant renewable resource.[152]

Echoing these concerns and potential solutions, the *Hydropower Vision* report finds:

> Costs, risks, and implementation timeframes may be reduced by providing stakeholders with an increased knowledge base, easier access to information relevant to their projects, and increased capabilities for collaboration. Achieving the same or improved outcomes more quickly and predictably will reduce the risks and costs to developers and encourage investment in new projects by the financial community, without a reduction in environmental protection.[153]

While the problems in hydropower authorization are well-documented, consensus solutions have been fleeting. While industry advocates generally prefer solutions aimed at eliminating redundant studies and actions, reducing time frames for agency decisionmaking, and establishing clear deadlines for action, the environmental community and resource agencies tend to favor robust study over schedule and take the position that imposing absolute deadlines on agencies would be tantamount to stripping resource agencies of their statutory responsibilities to protect and manage environmental resources.

Balancing these two viewpoints, the following solutions would provide meaningful improvements to the process, reduce time and expenses to hydropower developers, and protect agencies' statutory responsibilities:

- Congress should reform the hydropower licensing and permitting program by statutorily designating FERC as the lead agency, for purposes of NEPA review, for all licenses and permits required under federal law.[154]
- To address state-law requirements requiring the state to conduct any required environmental review in conjunction with state action authorized under federal law, Congress should provide for states to participate as a cooperating agency with FERC, while providing opportunity for states to complete additional reviews under state law that are beyond the scope of NEPA.
- To prevent ex parte communications between decisional staff within FERC and cooperating agencies, Congress should direct all cooperating agencies to promulgate regulations that separate cooperating and decisional staff in the hydropower process. All agencies that designate decisional, separated staff should not be precluded from intervening in the FERC licensing process.[155]
- To help reduce redundancy in environmental studies and ensure sufficient time to complete all needed studies, Congress should direct FERC and all other resource agencies to develop a single comprehensive study plan at the beginning of the federal approval process, which will inform agency decisionmaking under all licensing and permitting requirements under federal law.[156]
- To help ensure that agencies have needed resources to fulfill their responsibilities under federal law, Congress should provide mechanisms for agencies to receive direct funding from hydropower license applicants, such as through collection agreements or an amendment to FPA §17 that would provide for their administrative costs associated with hydropower licensing to be remitted directly to the agencies, without further appropriations.[157]
- To help promote timely participation by the hydropower applicant and participating resource agencies, Congress should empower FERC to establish a centralized schedule for the completion of all licenses and permits required for a nonfederal hydropower project. When establishing the schedule, FERC should be required to collaborate with resource agencies and the applicant, to be sure that the schedule is reasonable and provides sufficient opportunity for

152. *Hearing Before the House Comm. on Energy and Commerce*, *Subcomm. on Oversight and Investigations*, 112th Cong. 5-6 (2011) (testimony of Philip D. Moeller, Commissioner, FERC), https://www.ferc.gov/EventCalendar/Files/20110707120333-Commissioner%20Moeller's%20Testimony.pdf.

153. Hydropower Vision, *supra* note 7, at 380.

154. This is a provision under consideration in both the House and Senate in the 115th Congress. *See* S. 1460, 115th Cong. §3001(c) (2017); H.R. 3043, 115th Cong. §3(a) (2017). It also is consistent with reforms to the gas pipeline certification program under the Natural Gas Act pursuant to EPAct 2005. 15 U.S.C. §717n; Regulations Implementing the Energy Policy Act of 2005; Coordinating the Processing of Federal Authorizations for Applications Under Sections 3 and 7 of the Natural Gas Act and Maintaining a Complete Consolidated Record, 71 Fed. Reg. 62912 (Oct. 27, 2006).

155. A similar provision is under consideration in the Senate in the 115th Congress. *See* S. 1460, 115th Cong. §3001(c) (2017).

156. A similar provision is under consideration in the House in the 115th Congress. *See* H.R. 3043, 115th Cong. §3(a) (2017). Both the Senate and House are considering measures to improve environmental study requirements in hydropower licensing. *See id.*; S. 1460, 115th Cong. §3001(c) (2017).

157. 16 U.S.C. §810. However, safeguards would need to be put in place to ensure that agency costs are reliable and actually incurred in the administration of responsibilities for nonfederal hydropower, in light of long-standing litigation uncovering significant problems in agency recordkeeping and accounting practices. Both the House and Senate are considering measures that would allow agencies to receive direct funding from hydropower licensing applicants. *See* S. 1460, 115th Cong. §3001(c) (2017); H.R. 3043, 115th Cong. §3(a) (2017).

all participants to complete their responsibilities in a timely manner.[158]

- To ensure that all participants meet the deadlines set forth in the centralized schedule, Congress should include appropriate enforcement mechanisms. As noted above, this has been an area of considerable disagreement among various policymakers and stakeholders; while most understand the need to include incentives to keep the process moving forward, some are strongly opposed to imposing deadlines that would, by missing the deadline, result in the loss of agency authority. Agencies also need to have sufficient scientific information completed prior to fulfilling their statutory obligations.

To address these issues, Congress has a range of options based on past experience:

- *Absolute deadlines*: Similar to the reforms in the Fixing America's Surface Transportation (FAST) Act, Congress should enact a comprehensive restructuring of the hydropower approvals process—in which hydropower applicants provide direct funding to resource agencies, FERC, and other agencies to develop a single, comprehensive study plan at the very beginning of the process, and agencies work with FERC in establishing reasonable deadlines for action. This seems to resolve agencies' current challenges with timely action, justifies an expectation that they will act in a timely manner, and ensures that they have all needed information to render a decision.[159] Mandating these safeguards, in turn, seems to warrant requiring accountability by setting statutory imposed deadlines, such as those that already apply to state water quality certification under CWA §401 and state consistency determination under the CZMA.[160]
- *Budgetary penalties*: Similar to its approach for ensuring timely action by the Corps under the Water Resources Reform and Development Act of 2014, Congress could impose budgetary penalties against agencies that fail to meet deadlines established in the centralized schedule.[161]
- *Publication, dispute resolution, and reporting*: Consistent with the regulatory process improvements in the FAST Act, Congress could encourage timely agency decisions through publication of agency status reports under the federal permitting dashboard, periodic reporting to Congress and agency heads, and dispute resolution.[162]
- *Judicial review*: Consistent with its approach in EPAct 2005 in the context of natural gas pipeline certification, Congress could extend jurisdiction to the U.S. courts of appeals over "[t]he failure of an agency to take action on a permit required under Federal law,"[163] and direct the court to "set a reasonable schedule and deadline for the agency to act on remand."[164]

D. *Promote Upgrades and Optimization of Existing Hydropower Projects Through Streamlined FERC Amendment Procedures and Jurisdictional Changes at Federal Dams*

As noted in Part II above, there is immense potential to increase hydropower generation in the United States simply through upgrading equipment at existing hydropower facilities, expanding installed capacity at such facilities, and optimizing operation of existing facilities through modern technologies. DOE estimates that by 2030, up to 9.4 GW of new hydropower generation could be added through these efforts,[165] with the addition of up to another 13 GW by 2050[166]—enough to power more than seven million homes and avoid almost 54 million metric tons of CO_2 emissions annually.[167]

To realize this potential, however, several regulatory challenges must be resolved. At FERC-licensed projects, expansion and many modernization and efficiency improvements require FERC to amend the license.[168] FERC's regulations governing license amendments impose a time-consuming and burdensome "three-stage consultation" process for any amendment proposing to increase

158. This is a provision under consideration in both the House and Senate in the 115th Congress. *See* S. 1460, 115th Cong. §3001(c) (2017); H.R. 3043, 115th Cong. §3(a) (2017).

159. Both the House and Senate are considering measures that would allow agencies to receive direct funding from hydropower licensing applicants, establish FERC as the lead agency, and require FERC to work with resource agencies to develop a centralized schedule for all federal authorizations. *See* S. 1460, 115th Cong. §3001(c) (2017); H.R. 3043, 115th Cong. §3(a) (2017). The House is also considering a measure that would require FERC and other resource agencies to engage in early consultation, issue identification, and dispute resolution. *See* H.R. 3043, 115th Cong. §3(a) (2017).

160. CWA §401(a)(1), 33 U.S.C. §1341(a)(1) (one-year deadline); CZMA §307, 16 U.S.C. §1456(c)(3) (six-month deadline). Similar to the FAST Act, neither the House nor Senate bills under consideration in the 115th Congress contain an absolute waiver of statutory authority in the event of agency delay. The Senate is considering a provision that would refer the matter to the Office of Management and Budget, in consultation with the Council on Environmental Quality. *See* S. 1460, 115th Cong. §3001(c) (2017). The House is considering a provision that would allow FERC to grant limited extensions of time in the schedule, but the current version of the bill, which has cleared the House Committee on Energy and Commerce, contains no affirmative schedule enforcement mechanism. *See* H.R. 3043, 115th Cong. §3(a) (2017).

161. Water Resources Reform and Development Act of 2014, Pub. L. No. 113-121, §1005, 128 Stat. 1193, 1207-08. While Congress could reduce funding to federal agencies that miss deadlines, there would be additional challenges in withholding federal funding from state agencies that fail to comply.

162. *See generally* 42 U.S.C. §4370m-2.

163. 15 U.S.C. §717r(d)(2).

164. *Id.* §717r(d)(3).

165. Hydropower Vision, *supra* note 7, at 4.

166. *Id.* at 7, 31.

167. *See supra* note 21.

168. *See* 16 U.S.C. §803(b) (prohibiting, except in emergency situations, any "substantial alteration or addition not in conformity with the approved plans . . . without the prior approval of [FERC]"); *id.* §799 (providing that licenses "may be altered or surrendered only upon mutual agreement between the licensee and [FERC]").

a project's installed capacity by 2 MW or more and the hydraulic capacity by at least 15%[169]—which is essentially the same burdensome process that governs new project development or relicensing at the end of a 30- to 50-year license term. Thus, even modest proposals to expand capacity can lead to excessive costs, time delays, and tremendous risk and uncertainties associated with resource agencies' authority to impose mandatory conditions that have nothing to do with the proposed project expansion.

Moreover, FERC's policies and statutory constraints under the FPA itself often do not allow the licensee sufficient time to recoup the significant investment that frequently accompanies project expansion activities. For larger hydropower projects, modernization and efficiency improvements often cost hundreds of millions of dollars, and yet FERC is required under the FPA to limit license terms to 50 years.[170] Thus, a project that is operating under a 40-year license (the default license term under FERC's policy) can only qualify for a 10-year extension for these types of additional investments made during the license term.[171] Given these risks, expenses, and constraints, licensees of nonfederal hydropower have little regulatory incentive to explore opportunities to expand their projects or seek operational changes that could optimize performance.

Other challenges face upgrades and optimization at federal hydropower facilities. At a time of reduced agency budgets, limited appropriations render these expensive activities infeasible. And while a tremendous proportion of the potential to expand hydropower through improvements and upgrades exists at federal hydropower facilities, federal policies simply do not incentivize expansion of hydropower.[172] Although private development is possible at some of these facilities, in many cases, congressional authorization reserved federal authority to develop the hydropower resources, thus precluding FERC's licensing jurisdiction for nonfederal development.[173] Even where FERC does have licensing jurisdiction for nonfederal development at a federal dam, the Corps often opposes the project proposal and FERC responds by rejecting the proposal.[174]

These policies have significantly hindered most efforts to upgrade existing hydropower projects, taking advantage of infrastructure already in place, to develop additional renewable, non-emitting electric power generation. Of the more than 1,030 hydropower projects currently under a FERC license, relatively few have completed major upgrades, and they accounted for very little new capacity. Although DOE, DOI, and the U.S. Department of the Army entered into an MOU in 2010 for the express purpose of advancing hydropower on federal lands and at federal dams,[175] efforts under this MOU have resulted only in the addition of 33 MW at 10 Bureau of Reclamation hydropower facilities and 19.4 MW at three Corps dams.[176]

The following solutions are available to address these significant impediments to realizing the benefits of capturing additional hydropower at existing hydropower facilities:

- Congress should reform FERC's license amendment process by implementing a fast-track procedure for efficiency upgrades, modernization activities, and upgrades that are not anticipated to produce significant environmental effects. Recognizing the benefits of expanding hydropower at existing infrastructure, Congress should also require agencies' conditioning authority to be focused only on environmental effects of the upgrades.[177]
- Congress should authorize FERC, when approving a project upgrade or efficiency improvement, to extend license terms beyond 50 years to allow the project owner sufficient time to recoup the cost of investment.[178] Alternatively, Congress could direct FERC to consider the significant investment of project upgrades and improvements when it establishes the new license term during the project's next relicensing.[179]
- Congress should consider opportunities to use private capital to upgrade and expand federal hydropower facilities, including the possibility of shifting jurisdiction to FERC to issue licenses for nonfederal hydropower development at sites that currently are reserved for federal development.

E. Focus Licensing Requirements for New Pumped Storage Projects, Particularly Closed-Loop Systems

As explained in Part I above, both the DDPP and DOE reports point to a significant expansion of pumped stor-

169. 18 C.F.R. §§4.38, 4.201(b) (2017).
170. 16 U.S.C. §799.
171. FERC's policy statement on establishing license terms also provides that it will consider substantial investments made under the prior license, excluding maintenance or other measures required by that license or other legal authority, in determining a new license term. Policy Statement on Establishing License Terms for Hydroelectric Projects, 82 Fed. Reg. 49501, 49503 (Oct. 26, 2017).
172. *See supra* Part III.A.
173. *See generally* Uncompahgre Valley Water Users Ass'n v. Federal Energy Regulatory Comm'n, 785 F.2d 269 (10th Cir. 1986). FERC and the Bureau of Reclamation, and FERC and the Corps, have MOUs in place to decide jurisdictional questions at federal dams. *See supra* notes 64, 67, and 148.
174. Rivertec Partners LLC, 156 FERC ¶ 62161 (2016); Advanced Hydropower, Inc., 155 FERC ¶ 61007 (2016); Symphony Hydro LLC, 150 FERC ¶ 62092 (2015).
175. Energy, Interior & Army MOU, *supra* note 67.
176. Memorandum of Understanding for Hydropower Among the Department of Energy, the Department of the Interior, and the Department of the Army (Five-Year Extension) (2015), https://energy.gov/sites/prod/files/2015/03/f20/Memorandum-of-Understanding-for-Hydropower-Five-Year-Extension.pdf.
177. This is a provision under consideration in both the House and Senate in the 115th Congress, although only the House bill seeks to limit agency conditioning authority. *See* S. 1460, 115th Cong. (2017); H.R. 3043, 115th Cong. (2017).
178. This was a provision of Rep. Cathy McMorris-Rodgers' (R-Wash.) draft hydropower bill released in 2015 during House Energy and Commerce Committee deliberations.
179. This is a provision under consideration in both the House and Senate in the 115th Congress. *See* S. 1460, 115th Cong. §3001(c) (2017); H.R. 3043, 115th Cong. §2(e) (2017).

age resources in the United States as essential to decreasing our reliance on traditional, fossil fuel electricity-generation sources and transitioning to renewable sources of electricity.[180] Especially in light of the proliferation of non-dispatchable renewables such as solar and wind, pumped storage will be needed to balance the electric system and integrate these resources to the grid.[181]

Currently, the same FERC licensing process and standards that pertain to conventional hydropower apply to pumped storage projects. Even though pumped storage projects serve a far more focused role of energy storage, grid security, and transmission support, the multiple public interests of the FPA (e.g., environmental enhancements, public recreation, water supply, irrigation, and other considerations[182]) apply to the licensing of these projects. Although pumped storage projects typically feature at least one artificial water body as the upper reservoir and by their very nature involve significant fluctuations in water levels to respond to grid needs, FPA licensing standards typically require these projects, just like conventional projects, to promote public recreation and environmental enhancements.[183]

This can result in higher up-front capital costs and negatively affect project operations and long-term project economic viability—adding to what already is a tremendously challenging economic climate for developers of pumped storage.[184] These added burdens on pumped storage projects, together with the same delays, inefficiencies, and other impediments facing conventional hydropower discussed in Part II above, have created a climate that discourages and disincentivizes expansion of pumped storage—even though the DDPP and DOE reports both indicated the need and opportunity for these projects in the future to support a growing demand for renewables.

As a general matter, the legal reform solutions offered in this section would reduce impediments to both conventional and pumped storage hydropower development. The unique and focused purpose for pumped storage projects, however, offers additional solutions for Congress and policymakers to consider:

- Congress could define new licensing parameters that apply only to pumped storage projects, or even just closed-loop systems. For example, in some parts of the United States, particularly the West, the FPA licensing requirements are often triggered only because a project's "primary" transmission line traverses federal lands.[185] FERC maintains, further, that a closed-loop pumped storage project using only groundwater is subject to mandatory licensing jurisdiction if it is partially located on federal lands, even though groundwater does not qualify as a "stream" under FPA §23(b).[186] To limit the licensing burdens on pumped storage—and to rely instead on traditional environmental permitting requirements—Congress could decide to redefine the extent to which FPA mandatory licensing should apply to pumped storage.[187]
- Congress could create a more-efficient specialized licensing process for some categories of pumped storage, particularly closed-loop systems—recognizing that these projects serve a specialized purpose in which the full array of public benefits under the FPA do not fit, and that these projects tend to have less impact (if any) on surface water resources. The streamlined process could reduce the regulatory time frame, as well as the environmental scope of review and agency conditioning authority—again recognizing that while environmental effects should be avoided or mitigated, other enhancement activities should not apply to this more specialized infrastructure.[188]
- In the 14 western states in which the Bureau of Reclamation administers federal projects, pumped storage development often involves the use of at least one federal impoundment administered by the Bureau of Reclamation. These development opportunities raise the question of whether these projects require licensing by FERC, an LOPP from the Bureau of Reclamation, or both. Congress could reduce the uncertainty of developments at Bureau of Reclamation facilities by clarifying jurisdictional limits and reducing overlapping responsibilities between FERC and the Bureau of Reclamation at these sites.[189]

F. Facilitate Development of Hydropower at Existing Non-Powered Dams Without Interfering With Existing Use of the Dams

As explained in Part II above, much of the development potential for new hydropower in the United States is at existing dams that currently are not equipped with hydropower-generating facilities. A 2012 DOE assessment of existing non-powered dams concluded that, of the more than 80,000 existing dams in the United States, more than 50,000—nearly two-thirds of all non-powered dams—

180. *See supra* Part I.
181. *Id.*
182. *See* 16 U.S.C. §§797(e), 803(a)(1).
183. *See*, *e.g.*, Exelon Generation Co., 153 FERC ¶ 62232 (2015) (order issuing new license to pumped storage project with recreation facilities, including a campground, park, and wildlife management area); New York Power Auth., 41 F.P.C. 712 (1969) (order issuing new license to pumped storage project with recreation facilities, including a visitors center, overlook, and fishing access site).
184. *See infra* Part IV.
185. A "primary" transmission line is a line used solely to transmit power from a licensed project to a load center, and without the line there would be no way to transmit all the project power to market. *See* Pacific Gas & Elec. Co., 85 FERC ¶ 61411, 62559 (1998).
186. Mike Swiger et al., *Pumped Storage: 5 Misperceptions About Licensing*, Int'l Water Power & Dam Construction, June 2017, at 14, *available at* http://www.vnf.com/webfiles/Pumped%20storage.pdf.
187. Reducing the scope of FERC's mandatory licensing jurisdiction over these projects need not preclude FERC from issuing a voluntary license under FPA §4(e). In some cases, a developer might decide the regulatory burdens of a FERC license are preferable to state regulation. *See id.*
188. S. 1460, 115th Cong. §3003 (2017); H.R. 2880, 115th Cong. (2017); H.R. 8, 114th Cong. §1204 (2015).
189. S. 1460, 115th Cong. §3007 (2017); H.R. 1967, 115th Cong. (2017).

are suitable for hydropower development.[190] DOE's more recent *Hydropower Vision* report finds the potential for adding 12 GW of hydropower at existing non-powered dams by 2050.[191]

Despite this significant potential to avoid millions of metric tons of CO_2 emissions each year by capitalizing on existing infrastructure, current regulatory requirements—many unique to nonfederally owned dams—are a significant impediment to this opportunity. While FERC licensing of nonfederal hydropower at federal dams expressly cannot interfere with ongoing federal operations at the dam,[192] the same is not true of new projects at existing nonfederal dams. At nonfederal dams, owners of an existing facility that is used for municipal water supply, irrigation, recreation, navigation, or other public purposes face a distinct risk that FERC's licensing decisions, which are statutorily required to balance a number of public uses in the public interest,[193] will result in changes to reservoir operations that could significantly interfere with the very purpose for which the dam and reservoir were constructed in the first place.[194] In addition to FERC, other federal and state resource agencies have the opportunity to further condition dam operations to address issues such as fish passage, aquatic resources, and water quality.[195] Such changes could include, for example, minimum flow requirements for aquatic resources that are different from the dam's current release schedule for downstream municipal water supply.

Because the dam, reservoir, and shoreline areas are all statutorily included as part of the FERC-licensed project,[196] moreover, FERC regulations require the project developer to obtain fee simple property ownership or interest in perpetuity to occupy these lands for purposes of the project,[197] and the FPA extends a federal right of eminent domain for the licensee to obtain these lands.[198] FERC's policies and regulations require these lands and waters to be maximized for public recreation,[199] and shoreline development and use are governed under FERC-approved shoreline management plans that govern and restrict private development.[200] These requirements could significantly change development and management regulations and standards of shoreline areas of the existing reservoir—such as reservoir level requirements, dock permitting limits, and affirmative FERC approval of marinas, boathouses, and other infrastructure.

The comprehensive licensing scheme under the FPA simply does not work for new hydropower development at existing non-powered dams. Because these dams and reservoirs already operate to meet a specific purpose (e.g., municipal water supply), the prospect of applying the full range of environmental, land use, recreational, and other requirements only causes owners of these facilities to oppose potential hydropower development. Although these dam owners could potentially benefit from an added revenue stream created by new hydropower development, the risk of losing the ability to manage the dam and reservoir for their original and primary purposes tends to be a far stronger concern. Over the past decade, only 33.1 MW of installed capacity has been installed at existing nonfederal dams, enough to power 10,462 homes and avoid 79,496 metric tons of CO_2 emissions annually.[201]

Unless regulatory changes are implemented that recognize and protect the primary purposes of existing dams and reservoirs, the potential of these sites will not be recognized. Releases from these reservoirs will continue for the purposes for which they were originally constructed, but without the added benefit of non-emitting electric power generation, and without modest improvements to environmental management that could be accomplished through appropriate regulation.

Solutions to help promote the development of new hydropower facilities at existing, non-powered dams include[202]:

- Rather than requiring hydropower development to be licensed, Congress should create a new "exemption" program for the purpose of authorizing new hydropower development at non-powered dams, similar to the exemption programs already available under FPA §33 and the Public Utility Regulatory Policies Act of 1978.[203] While a FERC-issued exemption would bring the project under federal regulation, it would do so in a manner that respects the existing use of the dam and reservoir. Because a FERC-issued exemption does not carry the federal right of eminent domain, the existing owner of the dam and reservoir would be protected by ensuring landowner consent for development of hydropower resources at the site.

190. Assessment of Energy Potential at Non-Powered Dams, *supra* note 17, at vii.
191. Hydropower Vision, *supra* note 7, at 95, 251.
192. *See* Alabama Power Co., 157 FERC ¶ 62218, at P 22 (2016); Seneca Generation, LLC, 152 FERC ¶ 62045, at P 26, *reh'g denied*, 153 FERC ¶ 61234 (2015); City of Broken Bow, 140 FERC ¶ 62237, at P 33 (2012).
193. *See* 16 U.S.C. §§797(e), 803(a)(1).
194. East Tex. Elec. Coop., Inc., 136 FERC ¶ 62171, at P 66-68 (2011), *order on reh'g & clarification*, 140 FERC ¶ 61228 (2012).
195. *See* 16 U.S.C. §§811, 1536; 33 U.S.C. §1341.
196. 16 U.S.C. §796(11).
197. 18 C.F.R. §2.7(a) (2017); Form L-5, Terms and Conditions of License for Constructed Major Project Affecting Navigable Waters and Lands of the United States, 54 F.P.C. 1832, 1834 (1975) (Standard Article 5).
198. 16 U.S.C. §814.
199. 18 C.F.R. §2.7 (2017). *But see* City of Rockingham v. Federal Energy Regulatory Comm'n, 702 Fed. Appx. 106 (4th Cir. 2017), *cert. denied*, No. 17-526, 2018 WL 942441 (2018) (unpublished opinion) (adopting FERC's interpretation of its recreation policy that it must require recreational resources that are "reasonable in light of the facts present in the case" and not "the best [recreation] at any cost"), *petition for cert. filed*, No. 17-526 (Oct. 10, 2017).
200. *See generally* Office of Energy Projects, FERC, Guidance for Shoreline Management Planning at Hydropower Projects (2012), *available at* https://www.ferc.gov/industries/hydropower/gen-info/guidelines/smpbook.pdf.
201. *See supra* note 21. By far, the largest of these projects is the Lake Livingston Project in Texas, which alone is 24,000 kilowatts and represents nearly 75% of all new capacity at non-powered dams constructed over the past decade.
202. During the 115th Congress, a bill has been introduced in the House that includes these proposed solutions. *See* H.R. 2872, 115th Cong. (2017).
203. 16 U.S.C. §§823a-3, 823d.

- To ensure that hydropower operations remain compatible with the existing uses of the dam and reservoir, Congress should limit the conditioning authority of FERC and other agencies to preclude conditions that would materially modify existing water release schedules. FERC and resource agencies should be empowered to impose operating conditions that address environmental effects of developing and operating the hydropower facility.
- Consistent with FERC's approach in licensing nonfederal hydropower at federal dams, Congress should direct that the exempted project includes only the hydropower facility and any associated transmission lines. Such an approach would avoid intrusive regulation of recreation facilities, reservoir operations, and shoreline lands that are unnecessary to ensure the production of new hydropower at the site.

G. Prioritize Research and Development for MHK Technologies and Implement a Smarter Permitting Scheme

Despite the enormous potential of MHK technologies to increase hydropower's contribution to overall decarbonization, their development for commercial-scale applications continues to face numerous challenges. Chief among those challenges is the high cost of developing and deploying MHK technologies, which must be built to withstand the harsh conditions of marine and in-river environments. As a result, there are significant challenges to siting MHK projects, particularly where there is a lack of transmission and, for offshore locations, competing ocean uses, which can spur local opposition. In addition, in many cases, the potential effects of an MHK project on the environmental resources of the areas where the MHK resource is most available are not well-known.

Given these substantial hurdles, commercial deployment of MHK technologies has been cost-prohibitive to date, and significant investment in the market is needed. Although DOE's Water Power Program has provided some stimulation in recent years to the deployment of MHK technology as described in Part II above, the industry remains hindered by a lack of funding for its research and development. DOE's Water Power Technologies Office remains one of the smallest programs within DOE's Office of Energy Efficiency and Renewable Energy. While funding has increased steadily over the past decade with few exceptions, the Water Power Program—which funds both hydropower and MHK resources—received just $70 million for FY 2016.[204] This was the lowest amount of funding provided to all renewables, including for far more established resources like wind and solar, which for FY 2016 received nearly $100 million and nearly $250 million, respectively.[205]

Substantial and sustained investment is necessary to accelerate the MHK technology market, as it has stimulated the development of other renewable energy sources like wind and solar. Prioritizing MHK funding will aid in research and development efforts and ultimately lower costs for MHK technology development—the only way to tap into the vast potential of the MHK resource in aiding hydropower's contribution to decarbonization.

The difficulties in permitting MHK projects have also posed a hurdle to its development. Although FERC implemented a number of initiatives to promote and streamline the testing and authorization of MHK projects, those initiatives, on their own, have been insufficient to jumpstart MHK development. The process for approving even pilot projects has proved just as lengthy and difficult as for conventional hydropower projects. Accordingly, vast improvements to the regulatory process are required to streamline the approvals needed to overcome impediments to MHK development. Meaningful changes to the hydropower licensing process, including all of the legal reforms described in Part III.C. above, would equally benefit the MHK industry. Implementation of an expeditious permitting scheme is crucial to securing the funding necessary for MHK technology deployment at the commercial scale.

IV. Resolving Market Impediments to Hydropower Development

Improving the arcane federal licensing process for hydropower is a necessary, but not sufficient, condition to maintaining and expanding the country's hydropower resources. Both existing and new hydro must compete with other electric power-generating sources in today's partially deregulated electricity markets. Although hydropower has an advantage over some fuel sources in that its fuel—water—is free and replenishing, conventional and pumped storage hydropower require significant investments of capital upfront and long lead times for permitting and construction. Low prices for natural gas and oil, as well as lower costs for other renewables such as wind and solar, drive down the market price of electricity, making new hydropower less attractive for investors and threatening to strand investments in existing hydropower plants.

Tax incentives are one way to make new hydropower development more attractive for investors; but to date, federal tax incentives have been limited and appear to be phasing out for the foreseeable future. A federal or state carbon tax would also make hydropower more competitive with fossil fuel electric power-generating sources, and could be a long-term solution to providing the right incentives to

204. *See* DOE Office of Energy Efficiency and Renewable Energy, *Water Power Program Budget*, https://energy.gov/eere/water/water-power-program-budget (last visited Dec. 11, 2017).

205. Kelsi Bracmort, Congressional Research Service, DOE's Office of Energy Efficiency and Renewable Energy (EERE): Appropriations Status CRS-8 (2017), *available at* https://fas.org/sgp/crs/misc/R44262.pdf.

develop more emissions-free hydropower.[206] For the more immediate future, however, electricity market reforms at the federal and state levels that properly compensate hydropower for its benefits to the electric system could be the key to ensuring hydropower's continued economic viability.

As discussed earlier in this Article, hydropower provides not only reliable generation, but key grid support services to the electrical bulk power system.[207] These ancillary services and essential reliability services include peaking power,[208] frequency control,[209] reserve generation,[210] load following and balancing,[211] and black-start capabilities.[212] In addition, hydropower projects with water storage capability, in particular pumped storage hydropower projects, support integration into the grid of variable generation sources such as wind and solar because hydropower can supply energy when these intermittent sources of generation are not available.[213] Prior to the advent of deregulated wholesale electricity markets, vertically integrated utilities could recover the cost of providing these services through electric rates.

FERC's landmark Order No. 888 in 1996 required open-access transmission tariffs to remove impediments to competition in the wholesale bulk power markets.[214] Since then, FERC has encouraged and regulated the development of regional transmission organizations (RTOs) and independent system operators (ISOs), which control the dispatch of generation sources and electric transmission systems. In general, FERC's policy has been to accept as just and reasonable single clearing price auctions for energy and capacity in the organized markets that favor least cost, dispatchable resources, without regard to fuel source.[215]

However, encouraging competitive markets in wholesale power can disfavor generation sources, such as hydropower, that provide system benefits to the grid that are not compensated by RTO/ISO pricing mechanisms. DOE in its *Hydropower Vision* report captures the problem thusly:

> The full accounting, optimization, and compensation for hydropower generation, grid ancillary services and essential grid reliability services in power markets is difficult, and not all benefits and services provided by hydropower facilities are readily quantifiable or financially compensated in today's market framework. In both traditional and restructured market environments, many hydropower services and contributions are not explicitly monetized, and, in some cases, market rules undervalue operational flexibility.[216]

Or, as a former administrator of the Bonneville Power Administration summarized it: "Market rules generally undervalue operational flexibility, which is a prime attribute of hydropower. Because the services are not appropriately compensated, these valuable attributes are not optimized and potentially wasted."[217]

Storage technologies, including pumped storage hydropower, are particularly needed to balance the increasing deployment levels of intermittent renewable energy sources such as wind and solar power. Former DOE Secretary Steven Chu put it succinctly in characterizing hydropower pumped storage as "astoundingly efficient. . . . In this future world where we want renewables to get to 20%, 30%, or 50% of our electricity generation, you need pumped hydro storage. It's an incredible opportunity and it's actually the lower cost clean energy option."[218] A 2014 Argonne National Laboratory study concluded that "providing further support for the development of new [pumped storage hydropower] units and [adjustable speed] upgrades to existing [pumped storage hydropower] units will contribute to grid reliability and will facilitate a larger expansion of variable renewable energy, thereby reducing power system emissions in the United States."[219]

206. Chi-Jen Yang & Robert B. Jackson, *Opportunities and Barriers to Pumped-Hydro Energy Storage in the United States*, 15 Renewable & Sustainable Energy Revs. 839, 843 (2011). Although a federal carbon tax seems unlikely in the foreseeable future given the current makeup of the Administration and Congress, some states are currently debating the issue. *See* Clearing Up No. 1793 (Energy NewsData, Seattle, Wash.), Mar. 31, 2017, at 9 (reporting on Washington H.B. 1646).
207. *See* Hydropower Vision, *supra* note 7, at 96-111.
208. "Peaking power" refers to generating plants that can be brought online quickly to meet high, or peaking, demand. *Id*. at 81, 99.
209. Alternating current is transmitted from the power generating source to the end-user at a standard frequency, 60 hertz, in the United States. "Frequency control" refers to the maintenance of frequency within a normal band and control time error and is attained through adjustment of the mechanical power of the generators using speed governor feedback and area generation control. *See id*. at 101.
210. "Spinning reserve" refers to available capacity in the system that can be brought online to avert a system collapse when system load and generation are significantly imbalanced, such as when a generating unit or interconnection to a neighboring system fails. *See id*.
211. "Load-following" refers to a power plant that can quickly adjust its power output as demand for electricity fluctuates throughout the day. "Load balancing" refers to the process and measures for controlling system generation to match the prevailing load throughout the daily and weekly cycle of demand in the electrical distribution system. *Id*.
212. "Black start" refers to the capability of a generating station to begin operation independently, without reliance on external energy sources, and to power up other generating stations on the associated interconnected grid in the event of a blackout. *Id*.
213. *Id*. at 103.
214. Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities, FERC Order No. 888, 61 Fed. Reg. 21540 (May 10, 1996), F.E.R.C. Stats. & Regs. [Regs. Preambles 1991-1996] ¶ 31036 (1996), *order on reh'g*, FERC Order No. 888-A, 62 Fed. Reg. 12274 (Mar. 14, 1996), F.E.R.C. Stats. & Regs. [Regs. Preambles] ¶ 31048, *order on reh'g*, FERC Order No. 888-B, 81 FERC ¶ 61248 (1997), *order on reh'g*, FERC Order No. 888-C, 82 FERC ¶ 61046 (1998), *aff'd in relevant part sub nom*. Transmission Access Policy Study Group v. Federal Energy Regulatory Comm'n, 225 F.3d 667 (D.C. Cir. 2000), *aff'd sub nom*. New York v. Federal Energy Regulatory Comm'n, 535 U.S. 1 (2002).
215. Southwest Power Pool, Inc., 112 FERC ¶ 61303, at P 23 (2005); Midwest Indep. Transmission Sys. Operator, Inc., 102 FERC ¶ 61196, at P 32 (2003).
216. Hydropower Vision, *supra* note 7, at 50-51.
217. *Hearing on "Powering America: Valuing Reliability in a Transforming Electricity Industry" Before the House Comm. on Energy and Commerce, Subcomm. on Energy*, 115th Cong. 2 (2017) (written testimony of Steve Wright, General Manager, Chelan County Public Utility District No. 1, on behalf of the National Hydropower Association), http://docs.house.gov/meetings/IF/IF03/20171003/106457/HHRG-115-IF03-Wstate-WrightS-20171003-U3.pdf.
218. Pumped Storage Development Council, *supra* note 86, at 3 (quoting Secretary Chu).
219. Decision and Information Sciences Division, Argonne National Laboratory, Pumped Storage Hydropower: Benefits for

Yet, while pumped storage accounts for almost all existing electricity storage in the United States, only one small pumped storage facility (Olivenhain-Hodges in California) has been built since 1995.[220] As a 2013 DOE report explained, there are significant market barriers to new pumped storage facilities due to a lack of adequate revenue streams to support their development:

> Restructured markets base pricing on the generation costs of the marginal unit, which is appropriate for generators that have significant operating costs but creates a difficult situation for capital intensive and low operating cost resources like energy storage. Deployment of energy storage resources can collapse ancillary service market prices and energy market price differences, resulting in revenue streams for storage that are not commensurate with the value these resources provide to the system. Other market issues that present barriers include: the lack of markets and associated products [grid services]; and the lack of transparent price signals for most products in non-ISO/RTO markets and for cost-based products in ISO/RTO markets.[221]

Pumped storage hydropower, like electricity storage generally, "sits in the gray area between generation and transmission."[222] Congress has recognized that pumped storage can reduce the need for transmission upgrades. EPAct 2005 directed FERC to "encourage, as appropriate, the deployment of advanced transmission technologies," which are defined to include "energy storage devices" including pumped storage.[223] Yet, FERC in 2008, while finding that the proposed Lake Elsinore Advanced Pumped Storage (LEAPS) project in California qualified as "advanced transmission technology" and could displace the need for new transmission, denied the developers' request for the project to be categorized as a transmission facility for purposes of rate recovery. FERC was concerned that power bid into the system from the facility, which would be under the operational control of the California Independent System Operator, Inc. (CAISO), could receive preferential treatment, thus undermining competitive pricing.[224] In addition, the CAISO actively opposed the project.

Pumped storage hydropower projects use more energy than they generate. The economic value of pumped storage used to be the arbitrage between the relatively low cost of pumping power at night (due to reduced demand and surplus generation on the system from baseload coal and nuclear plants) and the high price of generation during the day (when demand is higher). However, low-cost gas-fired electricity generation and an excess of availability of power from wind and solar in some regions of the country have reduced or eliminated this pricing arbitrage.[225] From a grid reliability standpoint and to avoid curtailment of the excess wind and solar, utility-scale storage such as pumped storage hydropower is needed—yet, the economic incentives are lacking.

Thus, development of pumped storage projects has been stifled because of the lack of a market for the ancillary services they provide and their inability to be classified as transmission assets entitled to cost recovery.[226] While a number of projects in the past 20 years have received FERC preliminary permits[227] and even proceeded to FERC licenses,[228] these projects have been unable to attract financing and have not been built.

FERC's Order No. 890 in 2007, Preventing Undue Discrimination and Preference in Transmission Service, required that non-generation resources be evaluated on a comparable basis to services provided by generation resources.[229] On January 19, 2017, FERC issued a policy statement affirming that storage resources (including pumped storage) can potentially serve as transmission assets and receive multiple revenue streams in an organized market.[230] This represented an evolution and improvement in FERC's approach since it issued the 2008 LEAPS order.

Finally, FERC, on February 15, 2018, issued a final rule aiming to allow energy storage resources (including pumped storage) to more fully participate in organized electricity markets by removing barriers to these resources in the capacity, energy, and ancillary services markets operated by RTOs and ISOs.[231] The rule requires each RTO and ISO to revise its tariff to establish a participation model consisting of market rules that, recognizing the physical and operational characteristics and importance to grid reliability of electric storage resources, accommodates their

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Grid Reliability and Integration of Variable Renewable Energy xi (2014) (ANL/DIS-14/10), *available at* http://www.ipd.anl.gov/anlpubs/2014/12/106380.pdf.

220. Melanie Guittet et al., *Study of the Drivers and Asset Management of Pumped-Storage Power Plants Historical and Geographical Perspective*, 111 Energy 560, 566 (2016).
221. Dhruv Bhatnagar et al., Sandia National Laboratories, Market and Policy Barriers to Energy Storage Deployment 10 (2013) (SAND2013-7606), *available at* http://www.sandia.gov/ess/publications/SAND2013-7606.pdf.
222. Yang & Jackson, *supra* note 206, at 840.
223. 42 U.S.C. §16422.
224. Nevada Hydro Co., 117 FERC ¶ 61204 (2006), *order on reh'g*, 122 FERC ¶ 61272 (2008).
225. Guittet et al., *supra* note 220, at 561.
226. Sydney P. Forrester et al., *Policy and Market Barriers to Energy Storage Providing Multiple Services*, 30 Elec. J. 50, 51 (Nov. 2017).
227. More than 150 preliminary permits for pumped storage projects have been issued in the past 20 years. *See*, *e.g.*, FERC, *Pumped Storage Projects* (see subheading Existing and Proposed Projects for maps of existing and proposed pumped storage projects), https://www.ferc.gov/industries/hydropower/gen-info/licensing/pump-storage.asp (last updated Jan. 23, 2017).
228. *See*, *e.g.*, GB Energy Park, LLC, 157 FERC ¶ 62196 (2016); Eagle Crest Energy Co., 147 FERC ¶ 61220 (2014), *order denying reh'g and denying stay*, 153 FERC ¶ 61058 (2015).
229. Preventing Undue Discrimination and Preference in Transmission Service, FERC Order No. 890, 72 Fed. Reg. 12266 (Mar. 15, 2007), F.E.R.C. Stats. & Regs. [Regs. Preamble 2006-2007] ¶ 31241, *order on reh'g & clarification*, FERC Order No. 890-A, 73 Fed. Reg. 2984 (Jan. 16, 2008), F.E.R.C. Stats. & Regs. [Regs. Preamble 2006-2007] ¶ 31261 (2007), *order on reh'g & clarification*, FERC Order No. 890-B, 123 FERC ¶ 61299 (2008), *order on reh'g*, FERC Order No. 890-C, 126 FERC ¶ 61228 (2009), *order on clarification*, FERC Order No. 890-D, 129 FERC ¶ 61126 (2009), *appeal vol. dismissed*, National Rural Elec. Coop. Ass'n v. Federal Energy Regulatory Comm'n, No. 08-1278 (D.C. Cir. Feb. 17, 2010).
230. Utilization of Electric Storage Resources for Multiple Services When Receiving Cost-Based Rate Recovery, 82 Fed. Reg. 9343 (Feb. 6, 2017).
231. Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators, 162 FERC ¶ 61127 (2018).

participation in the organized wholesale electricity markets. While leaving significant aspects of integrating these resources into organized markets to the ISOs and RTOs, the rule moves toward a standard, and more expansive, role for these resources in electricity markets.[232] The final rule will become effective 90 days after it is published in the *Federal Register*.

On the state level, the California Public Utilities Commission (CPUC) in 2013 required its regulated utilities to contract for 1,325 MW of energy storage to balance renewable development, but only storage projects up to 50 MW can qualify. That decision ruled out hydropower pumped storage because pumped storage projects are not feasible at that size.[233] California legislation, A.B. 33, signed into law September 26, 2016, requires the CPUC to evaluate the potential for all types of long-duration bulk energy storage resources, including pumped hydroelectric storage, to help integrate renewable generation into the electric grid.[234] The legislation cites the requirement of California S.B. 350[235] for a 50% renewables portfolio by 2030, raising the specter of widespread curtailment of solar generation to prevent system imbalance.

Such curtailments can occur where there is an excess of supply (e.g., during midday in southern California when solar production peaks) but "conventional generators cannot reduce their output due to technical constraints."[236] To ensure the continued viability of wind and solar alternatives to fossil fuel-powered electricity generation, RTOs and ISOs could develop markets and price incentives for the ancillary benefits provided by hydropower and pumped storage hydropower as a way to ensure grid reliability.[237] As reliance on intermittent renewables grows, this provides an elegant solution. Otherwise, curtailments appear inevitable.[238] As discussed above, FERC appears willing to push the RTOs and ISOs in that direction.

Federal tax incentives for new hydropower development were limited in scope, appear to have run their course, and are unlikely to be revived in the near future.[239] The Internal Revenue Code previously provided a production tax credit (PTC) for renewable energy, including qualified hydropower, marine, and hydrokinetic production, for facilities on which construction began before January 1, 2017.[240] Generally, qualified hydropower production was limited to: (1) incremental production gains from efficiency improvements or capacity additions to existing hydroelectric facilities; and (2) production from new capacity installed at non-hydroelectric dams. The credit was available for the 10-year period beginning on the date a qualified project was placed in service. Wind and geothermal facilities received a PTC of 1.5 cents per kilowatt hour, while qualified hydropower facilities only received 50% of that amount.[241] As an alternative to the PTC, a hydropower project could elect to receive an investment tax credit (ITC) under the Internal Revenue Code equal to 30% of the qualified investment in the project.[242] The ITC was also only available for projects on which construction began before January 1, 2017. Congress did not extend the PTC or ITC for hydropower, marine, or hydrokinetic projects before they expired in 2016.

EPAct 2005[243] established a program to support the expansion of hydropower at existing dams and impoundments through incentive payments. Payments could be made to owners or authorized operators of qualified hydropower facilities for energy generated and sold from such facilities for a period up to 10 years, subject to appropriations. While this program was unfunded for many years, Congress in the 2014 omnibus appropriations bill included a $3.6 million appropriation for the program[244]; another $3.6 million was appropriated in the Consolidated Appropriations Act of 2016 for generation during calendar year 2015.[245] Only facilities in operation by September 30, 2015, qualified for the program,[246] thus limiting its future impact.[247]

Although some commenters call for continuation and even expansion of federal tax incentives for hydropower,[248] these programs are unlikely to offer a long-term or comprehensive solution.[249] Rather, maintaining the existing

232. *Id*.

233. CPUC, Decision Adopting Energy Storage Procurement Framework and Design Program, D.13-10-040 (Oct. 21, 2013).

234. A.B. 33, 2015-2016 Reg. Sess. (Cal. 2016).

235. S.B. 350, 2015-2016 Reg. Sess. (Cal. 2015).

236. Juan I. Perez-Diaz et al., *Trends and Challenges in the Operation of Pumped-Storage Hydropower Plants*, 44 Renewable & Sustainable Energy Revs. 767, 768 (2015).

237. *Id*.

238. Andrew Follett, *California Wastes Tons of Wind and Solar Power Due to Lack of Energy Storage*, Daily Caller, July 24, 2016, http://dailycaller.com/2016/07/24/california-wastes-tons-of-wind-and-solar-power-due-to-lack-of-energy-storage/. *See generally* Collin Doughty et al., California Energy Commission, Bulk Energy Storage in California 9-11, 13-14 (2016) (CEC-200-2016-006), *available at* http://www.energy.ca.gov/2016publications/CEC-200-2016-006/CEC-200-2016-006.pdf; *see also* James H. Nelson & Laura M. Wisland, Union of Concerned Scientists, Achieving 50 Percent Renewable Electricity in California 1 (2015), *available at* http://www.ucsusa.org/sites/default/files/attach/2015/08/Achieving-50-Percent-Renewable-Electricity-In-California.pdf.

239. Peter Maloney, *With Tax Reform on the Table, Senators Prepare Second Push for Energy Storage Incentives*, Utility Dive, Feb. 7, 2017, http://www.utilitydive.com/news/with-tax-reform-on-the-table-senators-prepare-second-push-for-energy-stora/435595/.

240. I.R.S. Notice 2016-31, at 2 (2016), *available at* https://www.irs.gov/pub/irs-drop/n-16-31.pdf; *see* Protecting Americans From Tax Hikes Act of 2015, Pub. L. No. 114-113, div. Q, 129 Stat. 2242.

241. Mark James et al., *Undamming the Federal Production Tax Credit: Creating Financial Incentives for Dam Trading and Dam Removal*, 53 Idaho L. Rev. 93, 97, 116 n.126 (2017).

242. 26 U.S.C. §48.

243. 42 U.S.C. §15881.

244. *See* Consolidated Appropriations Act of 2014, Explanatory Statement 26 (2014), *available at* http://docs.house.gov/billsthisweek/20140113/113-HR3547-JSOM-D-F.pdf.

245. *See* Consolidated Appropriations Act, 2016, Pub. L. No. 114-113, 129 Stat. 2242 (2015).

246. Guidance and Application for Hydroelectric Incentive Payments, 81 Fed. Reg. 24591, 24591 (Apr. 26, 2016).

247. There is a provision included in the Senate energy bill before the 115th Congress that would extend this program to qualified projects that add a turbine or other generating device between 2018 and 2027. *See* S. 1460, 115th Cong. (2017).

248. *See*, *e.g.*, James et al., *supra* note 240, at 97-98.

249. However, if Congress is going to revive the renewable energy tax credits, hydropower should be treated equally with solar, wind, and other renewables, which has not been the case. *See id*.

hydropower fleet and expanding hydropower resources may depend on reform of the organized markets to more accurately value and compensate hydropower owners and developers for the grid services they provide as well as energy and capacity. This is particularly true for utility-scale pumped storage hydropower, which not only provides grid support, but has the potential to facilitate expansion of wind and solar resources by balancing and integrating these renewable sources into the electric system. Both FERC and some states appear to be making slow progress toward appropriately compensating the grid services provided by hydropower projects. These market reforms should include the following:

- RTOs and ISOs should enact market rules to accommodate the participation of energy storage (including hydro pumped storage) in energy markets, consistent with FERC's final rule.
- RTOs and ISOs should establish new products and reform existing products that would adequately compensate ancillary services such as those provided by hydropower.
- State public utility commissions should direct their regulated electric utilities to evaluate the need for and benefits of grid-scale storage such as pumped storage hydro.[250]
- States should consider including pumped storage hydro as transmission assets entitled to cost-of-service rate recovery in their transmission planning as an alternative to construction of new transmission lines.

V. Conclusion

Hydropower is the largest renewable resource in the United States and is an essential component to decarbonize the electric grid. It is one of the few baseload renewable resources, and provides operational flexibility to integrate other, intermittent renewables into the grid. As electricity demand continues to grow in the future, robust hydropower resources will be essential to achieving a reduced carbon electric grid—not only because of their current market share and proven capabilities for more than a century, but also because of their ability to maintain a stable, functional grid, and to ensure integration of intermittent renewables such as wind and solar. Quite simply, the United States will be unable to achieve renewable energy targets for the electric grid without hydropower.

There is ample opportunity to expand hydropower in the United States in an environmentally responsible way. These opportunities include upgrades at existing hydropower facilities, installation of new generating equipment at existing infrastructure, construction of pumped storage projects, and even selective development of new conventional hydropower at greenfield sites—with the assistance of new technologies and management strategies to protect and mitigate impacts to environmental resources. In addition, with so many upcoming relicensing proceedings before FERC, it is crucial that project owners remain invested in continued operation of these projects to maintain the current hydropower fleet.

Without regulatory and market reforms to benefit hydropower, however, new and continued investment in hydropower in the United States will not be realized and our ability to decarbonize the electric grid will be diminished. Regulatory reforms are needed to recognize hydropower as a renewable energy resource and the climate benefits it provides, consolidate and coordinate licensing activities, provide certainty and schedule discipline in regulatory proceedings, implement new efficient approval processes for upgrades to existing hydropower projects where appropriate, promote development of needed pumped storage through a streamlined and focused licensing process, incentivize new hydropower at existing dams by focusing the licensing process and protecting current uses of existing infrastructure, and promote MHK technologies. From a markets perspective, reforms are needed to value and compensate hydropower operators for the essential grid services they provide. These reforms will incentivize new hydropower developers and existing owners alike to invest in new hydropower generation.

250. *See* Clearing Up No. 1821 (Energy NewsData, Seattle, Wash.), Oct. 13, 2017, at 7.