UNDAMMING THE FEDERAL PRODUCTION TAX CREDIT: CREATING FINANCIAL INCENTIVES FOR DAM TRADING AND DAM REMOVAL

MARK JAMES, KELSEY R. BAIN, DAVID E. SLOAN

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MARK JAMES,* KELSEY R. BAIN,** AND DAVID E. SLOAN***

"Shad, armed only with innocence and a just cause, with tender dumb mouth only forward, and scales easy to be detached. I for one am with thee, and who knows what may avail a crow-bar against that Billerica dam?" - Henry David Thoreau[1]

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1. HENRY DAVID THOREAU, A WEEK ON THE CONCORD AND MERRIMACK RIVERS 44 (1873).

I. INTRODUCTION

While Thoreau mused about using physical tools to bring down a dam blocking fish migration, there are other tools that can be employed in modern times to bring about the same result. Foremost amongst those tools are economic levers because dam removal is a costly business.[2] Finding new sources of funding to offset the

2. The dam removal project on the Penobscot River in Maine cost between $24 and $26 million to purchase three dams and remove two of them. *See* Jeffrey. J. Opperman et al., *The Penobscot River, Maine, USA: A Basin-Scale Approach to Balancing Power Generation and Ecosystem Restoration*, 16.3 ECOLOGY & SOC'Y 7 (2011). The removal of two dams from the Elwha River cost $325 million ($29.9 million to acquire the dams and $26.6 million to remove the Elwha Dam, the Glines Canyon Dam and the associated transmission line with the remainder of the funds being spent on in other areas like water treatment plants, flood protection, and ecosystem restoration). *See* THOMAS E. HELPER, U.S DEP'T OF INTERIOR BUREAU OF RECLAMATION, RECLAMATION MANAGING WATER IN THE WEST - DAM REMOVAL EXPERIENCES - ELWHA RIVER RESTORATION PROJECT, WASHINGTON (2012), https://www.bpa.gov/power/pg/NW-HydroOperators-Forum/2012/Elwha_River_Restoration_Project_Session_1-Tom_Helper.pdf (PowerPoint presentation given at the session 1 of Nw. Hydro Operators Forum 2012 Fall Program). The proposed cost of removing four dams on the Klamath River is estimated to be in excess of $450 million. *See* David N. Allen, *The Klamath Hydroelectric Settlement Agreement: Federal Law,*

removal costs is a way to empower future dam removal efforts.[3] Building on the trading program developed by Owen and Apse,[4] the premise of this article is simple; trade the revenues from new small-scale hydropower developments for dam removals. Owen and Apse presented a novel scheme for trading dams; grouping dams together to enable one dam to be removed in return for upgrades in the generation capacity at another dam.[5] Building on the idea that new hydropower generation can enable dams to be removed, this article examines the untapped potential of small-scale hydropower in the United States to incentivize dam removal and how existing market participation rules and the production tax credit system are working against an expansion of small-scale hydropower.

This article starts by briefly exploring Owen and Apse's dam trading proposal and the definition of small-scale hydropower. This article then moves to a discussion of recent scientific and regulatory efforts to promote small-scale hydropower: Department of Energy (DOE) commissioned research on the untapped potential of small-scale hydropower,[6] and the Federal Energy Regulatory Commission's (FERC) increased permitting exemption limits for small-

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Local Compromise and the Largest Dam Removal Project in History, 16 HASTINGS W. NW. J. ENVTL. L. & POL'Y 427, 459 (2010).

3. This Article will not examine the process of removing a dam. For an excellent description of the FERC process and the interaction between multiple levels of governments, *see* David H. Becker, *The Challenges of Dam Removal: The History and Lessons of the Condit Dam and Potential Threats from the 2005 Federal Power Act Amendments,* 36 ENVTL. L. 811 (2006).

4. Dave Owen & Colin Apse, *Trading Dams,* 48 U.C. DAVIS L. REV. 1043 (2015).

5. *Id.* at 1080.

6. The Department of Energy (DOE) is actively promoting a hydropower resurgence that would add 50% or almost 50 MW of new generating capacity by 2050. Of the 50 MW, 13 MW would come from upgrades to existing plants, adding power at existing dams and canals, and limited new stream reach development. *See* DEP'T OF ENERGY, HYDROPOWER VISION: A NEW CHAPTER FOR AMERICA'S 1ST RENEWABLE ELECTRICITY SOURCE 5 (2016), http://energy.gov/eere/water/articles/hydropower-vision-new-chapter-america-s-1st-renewable-electricity-source. The report builds on information accumulated in other federal government commissioned work such as DOUGLAS G. HALL ET AL., IDAHO NAT'L LAB., FEASIBILITY ASSESSMENT OF THE WATER ENERGY RESOURCES OF THE UNITED STATES FOR NEW LOW POWER AND SMALL HYDRO CLASSES OF HYDROELECTRIC PLANTS v (2006), http://www1.eere.energy.gov/water/pdfs/doewater-11263.pdf (estimating the total untapped resources that could be developed using small-scale damless hydropower technologies); SHIH-CHIEH KAO ET AL., OAK RIDGE NAT'L LAB., NEW STREAM-REACH DEVELOPMENT: A COMPREHENSIVE ASSESSMENT OF

scale hydropower and conduit power projects.[7] This article describes how the DOE and FERC's efforts have occurred without lessening the environmental protections placed on FERC licensing and relicensing programs.

This article next analyzes how the economics of small-scale hydropower generation can be improved through an examination of two of its main sources of revenue: the federal production tax credit and the competitive non-discriminatory energy markets. New small-scale hydropower generation facilities only receive half of the federal production tax credit while other renewable generation facilities benefit from the full production tax credits.[8] However, when those resources participate in competitive energy markets, they receive equal treatment. This bifurcated treatment limits the development potential of new small-scale hydropower resources and curtails opportunities to create economic incentives for dam trading. By identifying that hydropower does not receive the

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HYDROPOWER ENERGY POTENTIAL IN THE UNITED STATES 5 (2014), http://nhaap.ornl.gov/sites/default/files/ORNL_NSD_FY14_Final_Report.pdf; BOUALEM HADJERIOUA, ET AL., OAK RIDGE NAT'L. LAB., AN ASSESSMENT OF ENERGY POTENTIAL AT NON-POWERED DAMS IN THE UNITED STATES (2012), http://www1.eere.energy.gov/water/pdfs/npd_report.pdf. The DOE actively funds research to develop new small-scale hydropower technologies such as the Pacific Northwest National Laboratory's research program on reducing turbine costs for canal hydropower systems. *See* Frances White, *PNNL to Give Helping Hand to Small Green Energy Businesses,* PAC. NW. NAT'L LAB. (Mar. 10, 2016), http://www.pnnl.gov/news/release.aspx?id=4262. The DOE has produced or commissioned a number of resources promoting the development of small-scale hydropower resources. The DOE has commissioned factsheets to assist developers in deciding whether to develop a resource. *See also* NAT'L RENEWABLE ENERGY LAB., SMALL HYDROPOWER SYSTEMS (2001), http://www.nrel.gov/docs/fy01osti/29065.pdf.

7. To comply with the Hydropower Renewable Efficiency Act of 2013, Pub. L. No. 113-23 FERC increased the size of projects that could be exempted from FERC review. Conduit projects up to 40 MW in size, 16 U.S.C. § 823(a) (2012), and small-scale hydropower installations up to 10 MW in size, 16 USC § 2705(d), are now eligible to be exempted from FERC's licensing process. *See Exemptions from Licensing*, FED. ENERGY REGULATORY COMM'N, https://www.ferc.gov/industries/hydropower/gen-info/licensing/exemptions.asp (last visited Oct. 31, 2016).

8. 26 U.S.C. § 45(b)(4) (2008).

same treatment as other forms of renewable energy, a gap is exposed that when repaired could provide the financial impetus needed to push forward dam removal efforts.[9]

Part II catalogues the untapped generation capacity of non-powered dams, run-of-river projects, and conduit projects. Part III outlines the historical development of FERC's hydropower permitting and licensing program and recent attempts to streamline the program under HREA 2013. The section outlines how environmental protections have been maintained while exemptions have been increased for smaller-scale developments. Part IV describes the development of the production tax credit and how it remains anchored to the time period in which it was created. A pattern of development which has prevented small-scale hydropower projects from receiving the full production tax credit. Part V describes how variable energy resources—wind, solar, and run-of-river hydropower—are treated in each of the competitive non-discriminatory energy markets and the effects on income streams. The section summarizes how FERC Order 764 integrates variable energy resources into the markets while managing grid reliability requirements and how this restricts market access for renewable energy. Part VI proposes that giving the full production tax credit to certain types of small-scale hydropower resources is the best way to create a new economic lever for dam trading and dam removal efforts.

II. PART II

A. Definitions

1. Dam Trading

Dam trading is based on a simple concept—some dams are more valuable than others.[10] The Owen and Apse article lists four potential dam trading scenarios: (1) trading the construction or

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9. This article does not delve into the environmental questions of dam removal, it focuses on understanding how the systems behind two main sources of revenue have evolved in different directions and how correcting the production tax credit may be an opportunity to create a financial lever to trade hydropower upgrades for dam removals.

10. Dave Owen & Colin Apse, *Trading Dams,* 48 U.C. DAVIS L. REV. 1043, 1055 (2015); *see also* James G. Workman, *How to Fix Our Dam Problems*, 24.1 ISSUES IN SCI. & TECH. 31-32 (2007) (general discussion on options for trading dams and comparing the economic benefits of removing the dam against the economic costs of removing the dam).

continued operation of dam in one location for removing a dam elsewhere; (2) trading the sustained or increased operation of a set of dams in a larger location for a larger set of coordinated removal projects; (3) trading dam removals to mitigate other environmentally damaging activities that do not involve dams, like wetland filling; and (4) integrating dam removals into watershed-scale multi-activity trading programs that include but are not limited to dam removals.[11]

This article focuses on the first two categories and developing energy resources and revenues that incentivize the removal of single dam or a set of dams. Capacity upgrades and additions at existing non-powered dams and conduits and new run-of-river systems are turned into tools for leveraging dam removal at other locations.

2. Small-Scale Hydropower

In this article, the term small-scale hydropower captures multiple types of hydropower. The types of hydropower included in the term do not require the additional construction of dams to create reservoirs for generating power; they rely upon existing water flow to generate power. The definition includes upgrades to existing non-powered dams, generating facilities located in man-made conduits, canals, ditches and tunnels, and run-of-river generating facilities which are either placed directly within the free-flowing water currents or weirs to divert a portion of the free-flowing water through a plant before it is returned to the river. A non-powered dam is a dam without any existing generation capacity.[12] Non-powered dams were originally constructed for other purposes, e.g. navigation, flood control, water supply and recreation.[13] Conduits, ditches, tunnels and other man-made conveyances are designed to

11. Owen & Apse, *supra* note 10, at 1080–1081 (2015).

12. HADJERIOUA ET AL., *supra* note 6, at vii.

13. *Id.* at 5.

deliver water to municipal, industrial, and agricultural end-users.[14] Run-of-river projects have minimal or no water storage and rely upon seasonal flows and the adjustment of the level of water entering the plant to produce power.[15]

There is no bright line defining where a project flips from small-scale hydropower into larger-scale hydropower.[16] For the purposes of this article, the maximum size of small-scale hydropower will be confined to the size limitations established in FERC's licensing exemption process, up to 10 MW for hydropower facilities and up to 40 MW for conduit projects.[17]

B. United States – A Nation of Aging Dams

The United States is a nation full of dams. After more than a century of dam building, the United States is home to more than 87,000 registered dams[18] and upwards of 2 million total dams.[19] Federal government agencies, state government agencies, and private owners built dams across the nation to improve navigation in

14. U.S. DEP'T OF ENERGY, PUMPED STORAGE AND POTENTIAL HYDROPOWER FROM CONDUITS - REPORT TO CONGRESS iii (2015), http://energy.gov/sites/prod/files/2015/06/f22/pumped-storage-potential-hydropower-from-conduits-final.pdf.

15. *See* Oliver Paish, *Small Hydro Power: Technology and Current Status*, 6 RENEWABLE AND SUSTAINABLE ENERGY REVIEWS 538 (2002).

16. *See id.*

17. 18 C.F.R. § 4.30(b)(29) (2012) (hydropower facilities); 18 C.F.R. § 4.30(b)(28)(iii) (2015) (conduits).

18. *National Inventory of Dams*, U.S. ARMY CORPS OF ENGINEERS, http://nid.usace.army.mil/cm_apex/f?p=838:5:0::NO (last visited Oct. 31, 2016). When types of dam by primary owners are summed, the number of registered dams exceeds 87,000. Dams are registered in the NID because they meet one of the following safety criteria: (1) High hazard classification – loss of one human life is likely if the dam fails; (2) Significant hazard classification – possible loss of human life and likely significant property or environmental destruction if the dam fails; (3) Equals or exceeds 25 feet in height and exceeds 15 acre-feet in storage; or (4) Equals or exceeds 6 feet in height and exceeds 50 acre-feet in storage. *Id.*

19. N. Leroy Poff & David D. Hart, *How Dams Vary and Why It Matters for the Emerging Science of Dam Removal*, 52 BIOSCIENCE 662 (2002).

United States' rivers, control flooding, and store water in arid areas for municipal water systems and irrigation systems.[20] Creating hydroelectric generating capacity was one of the reasons for building a dam but it was not the dominant motivation. As a result, ninety-seven percent of the dams have no generating capacity.[21]

From 2013 to 2015, the United States' 2,198 operating hydroelectric dams[22] produced an average of 259 gigawatt-hours.[23] In fact, small or low-power hydro facilities account for 92 percent of existing hydro turbines in the United States and 20 percent of existing hydropower generation.[24] The U.S. hydropower sector is not static; generation capacity is constantly being added and removed. Between 2005 and 2013, 1.6 GW of net generation capacity was added to the fleet; 85 percent came from upgrades at existing

20. U.S. ARMY CORPS OF ENGINEERS, *supra* note 18 (explaining that the inventory catalogs dams according to its primary use and the top four categories are recreation, flood control, irrigation, and fire protection).

21. The U.S. hydropower fleet contains 2,198 active plants. ROCÌO URÌA-MARTÎNEZ ET AL., OAK RIDGE NAT'L LAB., 2014 HYDROPOWER MARKET REPORT 65 (2015), http://nhaap.ornl.gov/sites/default/files/ORNL_2014_Hydropower_Market_Report.pdf. When divided by the number of dams listed in the National Inventory of Dams, the percentage of hydropower generating dams is approximately 2.5%.

22. *Id.*

23. *Electricity Data Browser,* U.S. ENERGY INFO. ADMIN., http://www.eia.gov/electricity/data/browser/#/topic/0?agg=2,0,1&fuel=vtvv&geo=g&sec=g&linechart=ELEC.GEN.ALL-US-99.A~ELEC.GEN.COW-US-99.A~ELEC.GEN.NG-US-99.A~ELEC.GEN.NUC-US-99.A~ELEC.GEN.HYC-US-99.A~ELEC.GEN.WND-US-99.A~ELEC.GEN.TSN-US-99.A&columnchart=ELEC.GEN.ALL-US-99.A~ELEC.GEN.COW-US-99.A~ELEC.GEN.NG-US-99.A~ELEC.GEN.NUC-US-99.A~ELEC.GEN.HYC-US-99.A~ELEC.GEN.WND-US-99.A&map=ELEC.GEN.ALL-US-99.A&freq=A&ctype=linechart&ltype=pin&rtype=s&maptype=0&rse=0&pin (last visited Oct. 30, 2016).

24. QIN FEN (KATHERINE) ZHANG ET AL, OAK RIDGE NAT'L LAB., SMALL HYDROPOWER COST REFERENCE MODEL 2 (2012), http://info.ornl.gov/sites/publications/files/pub39663.pdf.

plants, while 432 MW of generation capacity was lost through capacity downrates and plant retirements.[25]

The United States has had multiple phases in hydropower dam construction.[26] During the 1890s–1920s, mostly small and medium sized private dams were built.[27] The 1920s–1960s was the period of large dam construction.[28] From the mid 1960s to the 1980s, small dam construction was spurred on by changes in federal energy regulation.[29]

The United States is on the cusp of the fourth phase of its relationship with dams. A phase driven by the aging condition of existing dams and the need for significant investment.[30] The Army Corps of Engineer dams have an average age of more than 50 years.[31] The Bureau of Reclamation dams have an average age of almost 60 years.[32] Together, their combined assets represent 90

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25. *See* URÌA-MARTÌNEZ ET AL., *supra* note 21, at 17–19 (2015). A downrate is when the capacity nameplate is decreased because of a change in flow conditions or when a portion of a plant is retired. A retirement is the complete cessation of operations at a plant.

26. *Id.* at 3.

27. *Id.*

28. *Id.*

29. *Id.*

30. *See generally* AM. SOC'Y OF CIVIL ENGINEERS, 2013 REPORT CARD FOR AMERICA'S INFRASTRUCTURE – DAMS: INVESTMENT AND FUNDING (2013), http://www.infrastructurereportcard.org/a/documents/Dams.pdf (reporting that the Association of State Dam Safety Officials estimate that it will require an investment of $21 billion to repair almost 2,000 deficient high hazard dams and $57 billion to rehabilitate all of the nation's federal and non-federal dams); TASK COMM. OF THE ASS'N OF STATE DAM SAFETY OFFICIALS, THE COST OF REHABILITATING OUR NATION'S DAMS: A METHODOLOGY, ESTIMATE & PROPOSED FUNDING MECHANISMS 14 (2009), http://www.damsafety.org/media/Documents/DownloadableDocuments/RehabilitationCosts2009.pdf (estimating that it would take in excess of $51 billion to repair all non-federally owned dams in the United States identified as needing rehabilitation in 2009).

31. *See* KELSI BRACMORT ET AL., CONG. RESEARCH SER., HYDROPOWER: FEDERAL AND NONFEDERAL INVESTMENT 7 (2015), https://www.fas.org/sgp/crs/misc/R42579.pdf.

32. *Id.* at 9.

percent of federally owned capacity and almost 40 percent of annual hydropower generation.[33] Non-federal dams are aging too and many are approaching the end of their useful lives.[34]

C. The Potential of Small-Scale Hydropower

Interest in renewing the hydropower sector has been bubbling since the late 1990s but it has recently picked up steam.[35] In 1998, the Department of Energy published a report that the total undeveloped hydropower potential in the United States was approximately 32 GW.[36] The amount of viable undeveloped hydropower potential exceeded 30 GW.[37] The Energy Policy Act of 2005 included an order for the Secretaries of the Interior, Army, and Energy to assess the potential for hydroelectric development at federal facilities.[38] In 2007, the Energy Policy Act Section 1834 Study concluded that here were few remaining economically attractive large-scale federal sites for development.[39]

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33. *See id.* at 7–9.

34. *See generally* AM. SOC'Y OF CIVIL ENGINEERS, *supra* note 30.

35. *See generally* BRACMORT, ET AL., *supra* note 31, at 1 (listing a selection of the 25 bills introduced in the 112th Congress and the more than 30 bills introduced in the 113th Congress addressing different aspects of hydropower).

36. *See* ALISON M. CONNER, ET AL., IDAHO NAT'L ENG'G AND ENVTL. RENEWABLE ENERGY PRODUCTS DEP'T, U.S. HYDROPOWER RESOURCE ASSESSMENT: FINAL REPORT 25 (1998), http://www1.eere.energy.gov/wind/pdfs/doewater-10430.pdf.

37. *Id.* at v.

38. EPAct 2005 Section 1834 required the Secretaries to "jointly conduct a study assessing the potential for increasing electric power production at federally owned or operated water regulation, storage, and conveyance facilities." *See* Energy Policy Act of 2005, Pub. L. No. 109-58 § 1834 (2005).

39. DEP'T OF INTERIOR, POTENTIAL HYDROELECTRIC DEVELOPMENT AT EXISTING FEDERAL FACILITIES – FOR SECTION 1834 OF THE ENERGY POLICY ACT OF 2005 5 (2007), https://www.usbr.gov/power/data/1834/Sec1834_EPA.pdf. The report highlights the decreasing number of available and feasible sites that can be developed for hydropower. Economic costs and environmental considerations have reduced the number of sites controlled by the

The rejection of large-scale development swung attention towards studying the potential to develop small-scale hydropower.[40] The development potential of small-scale hydropower is not capped, and the sites represent an opportunity to reinvigorate the hydropower industry while providing clean renewable energy to the grid. In 2006, the Department of Energy released a report on the development opportunities for new low power and small hydro classes.[41] The report found that there was more than 29 GW of feasible project hydropower potential.[42] In 2012, the Department of Energy commissioned Oak Ridge National Laboratory to perform a national assessment of hydropower potential non-powered dams (NPDs) and new stream-reaches.[43] The study assessed 54,391 NPDs and determined that the United States had an untapped 12.1 GW potential.[44] The Hydropower Regulatory Efficiency Act of 2013 required the DOE to identify the range of opportunities for conduit-based hydropower facilities and assess their potential generating capacity.[45] A partial survey of conduits revealed more than 10,000 GWh of unused annual generation.[46]

All of the reports reach the same conclusion; the United States has significant untapped small-scale hydroelectric generation ca-

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Bureau of Reclamation or the U.S. Army Corps of Engineers from more than 261 in 1983 to 64 in 2007. *Id.*

40. *See generally* DEP'T OF ENERGY, *supra* note 6. The report aggregates together more than a decade of DOE commissioned reports on hydropower generating capacity and runs a series of feasibility analyses under different scenarios. *Id.*

41. *See* HALL ET AL., *supra* note 6, at 7. A low power plant was defined as less than 1 MWa of working hydraulic head. Small hydro plants had between 1 MWa and 30 MWa of working hydraulic head. An average megawatt (MWa) is the average number of megawatt-hours over a specified time period, normally a year. *Energy Dictionary,* ENERGYVORTEX.COM, https://www.energyvortex.com/energydictionary/average_megawatt_(mwa).html (last visited Oct. 31, 2016).

42. *See* HALL ET AL., *supra* note 6, at 22.

43. A non-powered dam is a dam that does not produce electricity. HADJERIOUA ET AL., *supra* note 6*,* at 5 (2012).

44. *Id.* at 22.

45. Hydropower Regulatory Efficiency Act of 2013, Pub. L. No. 113-23, 127 Stat. 493 §§ 7(a)(1)(B)(2)(A)–(B) (2013).

46. U.S. DEP'T OF ENERGY*, supra* note 14, at 17.

pacity, but common factors block the development of new resources. The list of common factors includes stringent environmental regulations, a burdensome licensing process, and unfavorable economics.[47] The following sections discuss the economics of small-scale hydropower, and recent legislative changes to reduce FERC permitting costs without lessening environmental standards.

D. Economics of Developing Small-Scale Hydropower Projects

A generalized estimate of the costs to develop a small-scale hydropower project is a difficult beast to pin down. The unique physical characteristics of each project and its source of water limit the opportunity to make large economic generalizations. Several studies have surveyed and compiled individual cost estimates, and therefore can help present a potential range of project costs. A 2010 study identified thousands of potential small-scale hydropower sites that could be developed with minimal environmental impact.[48] To analyze only the environmentally benign options, the study selected only sites that would not require construction of a dam.[49] The study looked at the 30 GW of unused generating capacity identified by the DOE in 2006, and determined that upwards of 13 GW are cost-effective to develop now.[50] Development costs ranged between \$638/kW to \$6,103,161/kW;[51] the median cost of

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47. JORDAN LOFTHOUSE ET AL., INSTITUTE OF POLITICAL ECONOMY AT UTAH STATE UNIVERSITY, RELIABILITY OF RENEWABLE ENERGY: HYDRO 15 (2015), http://www.usu.edu/ipe/wp-content/uploads/2015/11/Reliability-Solar-Full-Report.pdf.

48. Lea Kosnik, *The Potential for Small Scale Hydropower Development in the US*, 38 ENERGY POL'Y 5512, 5514 (2010) (the study started with data collected for the Department of Energy's 2006 Feasibility assessment of the water energy resources of the United States on low head/low power resources. Only sites deemed developmentally feasible were subject to the cost-effectiveness analysis).

49. *See id.* at 5512–13. Kosnik's definition of small-scale hydropower purposefully excluded sites that would require or use a dam in order to restrict the analysis to only the most environmentally benign sites. Evaluated dam sites were run-of-river capable or would utilize a weir system that diverted no more than 50% of river flow.

50. *See id.* at 5512, 5518.

51. *See id.* at 5512, 5516.

development was approximately $5000/kW, and hundreds of sites could be developed for less than $2,000/kW.[52] The DOE's 2012 report assessing hydropower potential at non-powered dams avoided offering cost estimates for installing generating facilities in non-powered dams.[53] The study instead recommended individual case studies to understand cost projections for upgrading non-powered dams.[54] There is limited individual case study cost data, however two on-going large-scale non-powered dam conversion projects on the Ohio and Missouri Rivers provide some insight into potential costs. The projects have cost estimates of $5,555/kW and $6,890/kW.[55] Additionally, an international study reported that small-scale hydropower installation costs ranged between $1,300/kW and $8,000/kW;[56] with the project costs in the United State ranging from less than $1,000/kW to almost $4,000/kW.[57]

An installation price point of $2,000/kW has been identified as the point where hydropower can compete with other renewables.[58] In 2014, the average installed cost for a wind turbine was

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52. *See id.* at 5512–13.

53. *See* HADJERIOUA ET AL, *supra* note 6, at 5 (the study presented the hypothesis that costs would be lower for existing dams because they had already incurred significant construction costs, however the study stated that additional site-specific analysis would be needed to confirm this supposition).

54. *Id.*

55. The Red Rock Dam upgrade on the Missouri River is expected to add as much as 55 MW of generating capacity at a cost of $379 million dollars. Robert Springer, *Hydropower's Untapped Potential,* POWER ENGINEERING (June 18, 2015), http://www.power-eng.com/articles/print/volume-119/issue-6/features/hydropower-s-untapped-potential.html. The Smithland Locks and Dam project on the Ohio River will add 72 MW of generating capacity at a cost of $400 million dollars. *Converting Non-Powered Dams,* NAT'L HYDROPOWER ASS'N, http://www.hydro.org/tech-and-policy/developing-hydro/powering-existing-dams/ (last visited Oct. 31, 2016).

56. IRENA, *Renewable Energy Technologies: Cost Analysis Series, Volume 1: Power Sector-Hydropower* (IRENA, Working Paper No. 3, 2012).

57. *Id.* at 22 (the U.S. survey data includes large and small hydropower developments).

58. Kosnik, *supra* note 48, at 5513.

$1,710/kW,[59] and in 2015, the average installed cost for utility-scale solar was $1,770/kW.[60] In the past 30 years, the regulatory costs, including permitting, licensing, relicensing, compliance with environmental regulations and Section 401 mandates, have risen from 5 percent of total project cost to 25 percent of total project cost.[61] With the costs of both wind and solar projects dropping, finding new economic and legal tools to incent hydropower development is a critical task. Koznik recommended streamlining the permitting process for small-scale hydropower plants as a means of incentivizing the development of the resources.[62] The following section discusses historical regulation of hydropower and a recent legislative change that has altered FERC's regulatory powers to exempt small-scale hydropower and conduit projects from its licensing process.

III. HYDROPOWER REGULATION

In the past 150 years, the United States has undergone multiple phases of dam development and hydropower regulation.[63] This section provides an overview of the regulation of hydropower during that period. This section discusses how environmental considerations were integrated into the licensing and re-licensing processes as a response to the damage caused by the big dam era.[64]

59. RYAN WISER & MARK BOLINGER, LAWRENCE BERKELEY NAT'L LAB., 2014 WIND TECHNOLOGIES MARKET REPORT 42 (2015), http://energy.gov/sites/prod/files/2015/08/f25/2014-Wind-Technologies-Market-Report-8.7.pdf.

60. DONALD CHUNG ET AL., NAT'L RENEWABLE ENERGY LAB., U.S. PHOTOVOLTAIC PRICES AND COST BREAKDOWNS: Q1 2015 BENCHMARKS FOR RESIDENTIAL, COMMERCIAL, AND UTILITY SCALE SYSTEMS 31 (2015), http://www.nrel.gov/docs/fy15osti/64746.pdf.

61. ZHANG ET AL, *supra* note 24, at 3 (citing NHA 2010); *See also* BRACMORT ET AL, *supra* note 31, at 1 (2015) (including a list of non-FERC entities that might have to be consulted with during the licensing process).

62. Kosnik, *supra* note 48, at 5518.

63. URÍA-MARTÍNEZ ET AL., *supra* note 21, at 3 (documenting the four phases of hydropower development).

64. Randal G. Buckendorf, *FERC Interaction with Fish and Wildlife Agencies in Hydropower Licensing Under the Federal Power Act Section 10(j) Consultation Process*, 27 TULSA

This section concludes with an examination of the 2013 Hydropower Regulatory Efficiency Act, and how it is designed to maintain environmental protections while streamlining licensing obligations for low-impact small-scale hydropower and conduit projects.

A. FERC and the Federal Power Act

In 1977, Congress reorganized the Federal Power Commission into the Federal Energy Regulatory Commission (FERC).[65] The Federal Power Act (FPA) granted FERC exclusive regulatory and licensing authority over the construction, operation, and maintenance of hydropower facilities for the "development, transmission and utilization of power."[66] The FPA gives FERC licensing power over all new and existing nonfederal hydroelectric facilities including nonfederal facilities located at Bureau of Reclamation and U.S. Army Corps of Engineer sites.[67] A FERC license is required to operate any hydropower project on navigable waters or waters affecting interstate commerce, dams or reservoirs on federal land, or dams using surplus water or power from a government dam.[68]

FERC may grant up to fifty-year licenses for hydropower projects that serve the public interest, and are "best adapted to a comprehensive plan for improving or developing a waterway."[69] Currently, when deciding whether to grant a license, FERC is required to consider not only the need for the hydropower project but also the availability of alternative energy sources, and other potential

L. J. 433, 437–43 (1992) (describing how Electric Consumers Protection Act of 1986, section 10(j) requires FERC to give balance the interests of fish and wildlife agencies in the hydropower licensing process); Michael C. Blumm & Viki A. Nadol, *The Decline of the Hydropower Czar and the Rise of Agency Pluralism in Hydroelectric Licensing*, 26 COLUM. J. ENVTL. L. 81, 87–88 (2001) (describing how Electric Consumer Protection Act of 1986 required FERC to balance non-power interests with hydropower development interests in its licensing and re-licensing processes).

65. 42 U.S.C. § 7101 et seq. (1983 & Supp. 1985).

66. 16 U.S.C. § 797(e) (2005).

67. *Id.*

68. *Id.*

69. *Id.* §§ 799, 803(a) (2012).

uses for the waterway, including recreational and environmental uses.[70]

B. Hydropower Licensing: A Complicated Path

Hydropower is the one of the most highly regulated forms of energy in the United States.[71] The new licensing and relicensing processes are complicated, involving numerous agencies at both the state and federal level.[72] Licensing of large and small-scale facilities alike may take an applicant upwards of five years to complete and cost them thousands of dollars.[73]

FERC has three processes for licensing or relicensing hydropower facilities.[74] FERC considers the Integrated Licensing Process (ILP) to be the default process for all applications.[75] The ILP is a collaborative process in which FERC works in with other federal and state agencies to craft license conditions.[76]

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70. *Id.* § 797 (2012).

71. *Hydropower – Obstacles to Further Development or Deployment of Hydropower*, CTR. FOR CLIMATE AND ENERGY SOLUTIONS, http://www.c2es.org/technology/factsheet/hydropower (last visited Oct. 31, 2016).

72. Gina S. Warren, *Hydropower: It's a Small World After All*, 91 NEB. L. REV. 925, 958 (2013).

73. *The American Energy Initiative: Hearing on the Hydropower Regulatory Efficiency Act of 2012 Before the H. Energy & Power Subcomm.*, 112th Cong. 12 (2012), http://perma.cc/66YE-MH24.

74. *See Licensing Processes,* FED. ENERGY REGULATORY COMM'N, http://www.ferc.gov/industries/hydropower/gen-info/licensing/licen-pro.asp (last visited Oct. 31, 2016). The three processes are the Integrated Licensing Process (ILP), the Traditional Licensing Process (TLP), and the Alternative Licensing Process (ALP). *Id.*

75. *Id.*

76. Rick Eichstaedt et. al., *More Dam Process: Relicensing of Dams and the 2005 Energy Policy Act*, 50 ADVOCATE 33 (2007) (explaining that agencies such as U.S. Fish and Wildlife may require a process for fish passage on a hydropower project; that federal reservation managers such as the U.S. Forest service, the Bureau of Indian Affairs, or the Bureau of Land management may require protection and utilization of the reservation; that state agencies

C. FERC Exemption Process

FERC can exempt small-scale hydropower projects, conduit projects, and hydrokinetic projects from this complicated application process.[77] To qualify for an exemption, small hydropower projects must have an installed capacity of 10 MW or less.[78] Additionally, they must be constructed on an existing, nonfederal government dam.[79]

Generation must be from a natural water flow without a dam, manmade impoundment or water retention for storage or release.[80] Alternatively, if the project is an existing dam looking to increase capacity it must have an installed capacity of 10 MW or less.[81] For conduit projects to receive a FERC license exemption, the project must be built on an existing conduit.[82] Further, the existing conduit must have originally been constructed for some purpose other than electricity production, and must not be located on federal property.[83] The installed generating capacity for these conduit projects may be up to 40 MW for municipal projects but less than 15 MW for non-municipal projects.[84] Once one of these projects has received an exemption, the license they receive is perpetual, unlike the licenses required for large-scale hydro.[85]

While FERC offers exemptions for small-scale hydropower and conduit projects,[86] the process for these exemptions is rarely any

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may require specific water quality protection standards; and that FERC has no authority to author any such conditions place on the licenses).

77. Warren, *supra* note 72, at 959.

78. *Id.* at 960.

79. *Id.*

80. *Id.*

81. 18 C.F.R. §§ 4.30(b)(29), 4.101 (2012); HREA § 3, 127 Stat. at 493 (2013).

82. *Id.* § 4.30 (2015).

83. *Id.*

84. *Id.*§§ 4.30(b)(30)(ii), 4.90 (2015).

85. 33 C.F.R. § 221.1 app. B (1975).

86. 18 C.F.R. § 4.30(b)(26) (small dams); 18 C.F.R. 4.30(b)(30) (2013) (conduits); FED. ENERGY REGULATORY COMM'N, *supra* note 7.

simpler than traditional licensing and relicensing applications. To receive a FERC exemption, applicants must undergo three stages of consultation unless they can obtain a requirement waiver from all interested resource agencies.[87] Without such a waiver, applicants must successfully proceed through the first two stages of the consultation process before filing the application.[88]

The first step in the consultation process requires applicants to contact all appropriate agencies, affected Indian tribes, and interested members of the public.[89] Thus, an applicant can be required to meet with different federal environmental agencies, including any federal agency charged with the administration of the land in question, all appropriate state fish and wildlife agencies, water resource management agencies, as well as any Indian tribe that may be affected by the project.[90] Following consultation meetings, interested parties have sixty days to submit written comments, a deadline that may be extended to 120 days at the request of any resource agency.[91] After this first step, applicants must conduct environmental and wildlife impact studies, as well as respond to reasonable requests for information made by interested parties.[92] After this lengthy process, assuming no interested parties object, the process ends when the applicant files for the small hydropower exemption.[93]

87. 18 C.F.R. § 4.38(e) (2015).

88. *Id.* § 4.38.

89. *Id.* § 4.38 (b)(2).

90. *See id.* § 4.38. An applicant may be required to meet with the U.S. Fish and Wildlife Service, the National Park Service, and/or the U.S. Environmental Protection Agency. *Id.*

91. *Id.* § 4.38(b)(7).

92. *Id.* § 4.38(c)(1).

93. *Id.* § 4.38.

D. Environmental Considerations

The Electric Consumers Protection Act of 1986 amended the Federal Power Act to increase consideration of environmental values.[94] Prior to the amendment, FERC focused on waterpower development.[95] After the amendment, FERC is required to give equal consideration to developmental and non-developmental values.[96] After the amendment, FERC had to consider how the project ensured the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat).[97] The ECPA also directed FERC to solicit permit condition recommendations from relevant Federal agencies, State agencies, and Indian tribes exercising administration over flood control, navigation, irrigation, recreation, cultural and other relevant resources.[98] FERC was instructed to give due weight to the recommendations and to provide written explanations for their decision to reject or incorporate the recommendations.[99] Some state and federal agencies were given the power to prescribe mandatory license conditions under the authority granted them by other legislation.[100]

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94. Joseph R. Barwick, *Agency Conditions on the Relicensing of Hydropower Projects on Federal Reservations*, 19 ENERGY L. J. 397, 398 (1998); Lydia T. Grimm, *Fishery Protection and FERC Hydropower Relicensing Under ECPA: Maintaining a Deadly Status Quo*, 20 ENVTL. L. 929, 939–40 (1990); *See generally* John D. Echeverria, *The Electric Consumers Protection Act of 1986*, 8 ENERGY L. J. 61 (1987).

95. Grimm, *supra* note 94, at 943.

96. 16 U.S.C.§ 808(a)(2)(G) (1985). FERC was instructed to assess proposed projects for how they improved or developed water resources for use in interstate or foreign commerce and how the improved and utilized water-power resources. *See id.* § 803(a)(1).

97. *Id.* § 803(a)(1).

98. *Id.* § 803(a)(2)(B).

99. *Id.* § 803(j)(2).

100. For example, state and federal agencies with powers granted by the Clean Water Act, 33 U.S.C § 1251(g), can impose mandatory permit conditions on a FERC issued license.

E. Hydropower Regulatory Efficiency Act

In 2013, Congress passed the Hydropower Regulatory Efficiency Act (HREA).[101] Congress struck a balance between maintaining a high degree of environmental oversight over dam projects[102] and eliminating permitting processes for low environmental-impact small-scale projects.[103] HREA reduces the regulatory burden on small-scale hydro and conduit projects by streamlining the permitting process and expanding the size of hydropower projects that can be exempted from the permitting process.[104] HREA increased the maximum eligible capacity to exempt small hydroelectric power plants from FERC licensing from 5 MW to 10 MW.[105]

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101. Hydropower Regulatory Efficiency Act (HREA) of 2013, Pub. L. No. 113–23, 127 Stat. 493 (codified as amended in scattered sections of 16 U.S.C.).

102. FED. ENERGY REGULATORY COMM'N, A GUIDE TO UNDERSTANDING AND APPLYING THE INTEGRATED LICENSING PROCESS STUDY CRITERIA 1 (2012), https://www.ferc.gov/industries/hydropower/gen-info/guidelines/guide-study-criteria.pdf. The FERC licensing process requires consultation with other state and federal agencies, tribes, hydro industry and NGOs to obtain adequate information on environmental impacts of project including effects on soils, water quality, fish and wildlife, cultural, recreation, aesthetics, land use, and tribal resources. Exemptions do not exempt projects from environmental review. *Id.*

103. *See generally* Hydropower Regulatory Efficiency Act (HREA) of 2013, Pub. L. No. 113-23, §§ 1-6, 127 Stat. 493 , 493–96 (2013) (promoting streamlined licensed procedures and licensing exemptions for small hydroelectric power projects and conduit hydropower projects). FERC has identified low impact hydropower projects as projects taking place at existing dams and conduits or causing little change to water flow and use. FED. ENERGY REGULATORY COMM'N, SMALL/LOW IMPACT HYDROPOWER PROJECTS, http://www.ferc.gov/industries/hydropower/gen-info/licensing/small-low-impact.asp (last visited Oct. 31, 2016).

104. Shannon Morrissey, *FERC and USACE: The Necessity of Coordination in Implementation of the Hydropower Regulatory Efficiency Act*, 48 U.C. DAVIS L. REV. 1581, 1592 (2015).

105. HREA § 3.

It also eliminated licensing requirements for qualifying conduit hydropower projects.[106] Qualifying conduit facilities must have an installed capacity of no more than 5 MW and may not utilize a dam or other impoundment.[107] Further, HREA only applies to conduit projects that are not federally owned and that were not previously licensed or exempted under the FPA.[108] To construct a qualifying facility, applicants must first file a notice of intent with FERC specifying how the facility will meet these criteria.[109] After this filing, FERC has fifteen days to determine whether the facility qualifies and issue a public notice of intent.[110] HREA also allows FERC to extend the three year preliminary hydropower permits for two additional years, thus reducing the chance that a permit will expire before a permanent license is issued.[111]

IV. HYDROPOWER AND THE PRODUCTION TAX CREDIT

This section provides an overview of current and past treatment of small-scale hydropower in the Renewable Electricity Production Tax Credit (PTC) program.[112] This section begins by examining the status of hydropower tax incentives as of December 2015 as they apply to small-scale hydropower. Next, it utilizes legislative history to explore the reasons for excluding hydropower from the PTC program in 1992 and to examine why small-scale hydropower receives only a half-rate.

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106. HREA § 4 (defining conduit as any tunnel, canal, pipeline, aqueduct, flume, ditch, or similar manmade water conveyance that is operated for the distribution of water for agricultural, municipal, or industrial consumption and not primarily for the generation of electricity).

107. 16 U.S.C. § 823a(3)(C) (2013).

108. HREA § 4(a)(1).

109. *Id.*

110. *Id.*

111. HREA §§ 3–5.

112. This section does not look at Business Energy Investment Tax Credit (ITC), and the Section 1603 grant programs. Both incentive programs provide or provided equal treatment to hydroelectric projects and small irrigation power.

A. Current Status of the PTC

The federal production tax credit is an inflation-adjusted per kilowatt hour (kWh) tax credit for electricity produced by a qualified energy resource and sold by the taxpayer to an unrelated person during the taxable year.[113] The credit is paid for a period of ten years for all facilities placed into service after August 8, 2005.[114] To receive the tax credit, a facility must belong to one of the listed categories of "qualified energy resources,"[115] and it must meet the resource specific guidelines to become a "qualified facility."[116] Qualified energy resources include three components of small-scale hydropower: small irrigation power, hydropower, and marine and hydrokinetic resources.[117] A small irrigation power project is power generated without any dam or impoundment of water through an irrigation system canal or ditch, which has a nameplate capacity rating between 150 kW and 5 MW.[118] A qualified hydropower facility includes existing dams and non-powered dams.[119] Existing dams are eligible for additional production attributable to efficiency improvements or additions or capacity.[120] Nonhydroelectric dams are eligible if the "hydroelectric project is licensed by the Federal Energy Regulatory Commission and meets other applicable environmental, licensing, and regulatory requirements."[121] The hydroelectric project must also be operated so that the elevation of

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113. *Renewable Electricity Production Tax Credit,* U.S. DEP'T OF ENERGY, http://energy.gov/savings/renewable-electricity-production-tax-credit-ptc (last visited Oct. 31, 2016).

114. 26 U.S.C. § 45(a) (2012).

115. *Id.* U.S.C. § 45(c).

116. *Id.* U.S.C. § 45(d).

117. *Id.*

118. *Id.* §§ 45(c)(5)(A)–(B).

119. *Id.* § 45(c)(8)(A).

120. 26 U.S.C. § 45(c)(8)(B) (2012).

121. *Id.* § 45(c)(8)(C)(i).

the surface of the water is maintained at its pre-project level, absent changes permitted for the purpose of improving environmental quality.[122] Marine and hydrokinetic renewable resources include "free flowing water in rivers, lakes, and streams"[123] and "free flowing water in an irrigation system, canal, or other man-made channel including projects that utilize nonmechanical structures to accelerate the flow of water for electric power production purposes."[124] A qualified marine and hydrokinetic renewable energy facility must have a nameplate capacity rating of at least 150 kilowatts with no size cap.[125]

The current federal production tax credit is 2.3 cents per kilowatt-hour of electricity generated for wind, solar, closed-loop biomass, and geothermal.[126] The credit rate for small-scale hydropower—small irrigation power, qualified hydropower facilities, and marine and hydrokinetic renewable resources—is 1.2 cents per kilowatt-hour of electricity or half the credit rate.[127] The credit rate for qualified hydropower, and marine and kinetic renewable resources is set to expire and will only apply to facilities constructed before or commencing construction before January 1, 2017.[128] The credit rate for small irrigation power is not available for projects placed into service after October 3, 2008.[129]

122. *Id.* § 45(c)(8)(C)(iii).

123. *Id.* § 45(c)(10)(ii).

124. *Id.* § 45(c)(10)(iii).

125. *Id.* § 45(d)(11)(A).

126. INTERNAL REVENUE SERVICE, 2015 INSTRUCTIONS FOR FORM 8835: RENEWABLE ELECTRICITY, REFINED COAL, AND INDIAN COAL PRODUCTION CREDIT (2015), https://www.irs.gov/pub/irs-prior/i8835--2015.pdf. The 1992 Energy Policy Act established and set the credit rate set at 1.5 cents per kilowatt hour. The rate is annually indexed. 26 U.S.C. § 45(b)(2) (1992). Eligible resources receiving full production tax credit are wind, solar, closed-loop biomass, and geothermal. Eligible resources receiving half of the credit are small irrigation power, landfill gas, trash, hydropower, and marine and hydrokinetic resources.

127. 26 U.S.C. § 45(b)(4) (2012).

128. *Id.* §§ 45(d)(9)(A)(i), (11)(B).

129. *Id.* § 45(d)(5).

B. History of the Production Tax Credit – EPAct 1992

The Energy Policy Act of 1992 (EPAct 1992) established the goals and the basic administrative structure of the PTC.[130] The PTC encourages the development of renewable energy facilities by paying an annual inflation adjusted per-kilowatt-hour subsidy for energy generated by qualified facility.[131] Administered through the Department of the Treasury's Internal Revenue Service (IRS),[132] the PTC has been amended and extended six times by Congress since 1992, adding new qualified resources and creating a split-level credit rate for different types of qualified resources.[133]

All forms of small-scale hydropower facilities—qualified hydropower, small irrigation power, and marine and hydrokinetic resources—were excluded from EPAct 1992's list of qualified renewable energy facilities.[134] As defined in the statute, in 1992 a qualified renewable energy facility was restricted to "a facility . . . which generate[d] electric energy for sale in, or affecting, interstate commerce using solar, wind, biomass, landfill gas, livestock methane . . . or geothermal energy . . . ."[135] The first hydropower resources would not be added until 2004 when small irrigation projects were added to the list of qualified renewable energy facilities.[136]

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130. Energy Policy Act of 1992, Pub. L. No 102-486, 106 Stat. 2776 (codified in 42 U.S.C. §§ 13201–13574 (2012)).

131. *Production Tax Credit for Renewable Energy,* UNION OF CONCERNED SCIENTISTS, http://www.ucsusa.org/clean_energy/smart-energy-solutions/increase-renewables/production-tax-credit-for.html#.Vv_vg7n2bIU (last visited Oct. 31, 2016).

132. *Renewable Electricity Production Tax Credit (PTC)*, DATABASE OF STATE INCENTIVES FOR RENEWABLES & EFFICIENCY, http://programs.dsireusa.org/system/program/detail/734 (last visited Oct. 31, 2016).

133. UNION OF CONCERNED SCIENTISTS, *supra* note 131.

134. *See* 42 U.S.C. § 13317 (2005).

135. *Id.* § 13317(b).

136. American Jobs Creation Act of 2004, Pub. L. No. 108-357, § 710, 118 Stat. 1552 (2004).

1. Legislative History – EPAct 1992

The legislative history of EPAct 1992 helps explain why small-scale hydropower was excluded from the production tax credit program. While EPAct 1992 was an energy promotion bill, Congress was seeking to promote "the development and utilization of certain renewable energy sources."[137] A House Committee on Ways and Means report reveals that the decision on which renewable energy resources to subsidize was made according to the conditions in the energy market and renewable energy sector in 1992.[138]

> A production-type credit is believed to target exactly the activity that the committee seeks to subsidize (the production of electricity using specified renewable energy sources). The credit is intended to enhance the development of technology to utilize the specified renewable energy sources and to promote competition between renewable energy sources and conventional energy sources.[139]

Congress established a system that reflected the conditions of the energy sector at that time. Hydropower was viewed as a mature resource with little additional development potential because of a lack of available sites and serious environmental concerns created by existing dams.[140] In 1992, solar and wind were viewed as an endless source of environmentally friendly renewable energy and hydropower meant big dams that flooded virgin territory, cut-off fish migration, and turned free-flowing rivers into captive bodies of water. Moreover, the Energy Information Agency's 1992 Energy Outlook presented the view that wind, solar, waste, wood, and geothermal were the renewable resources ripest for growth.[141] The

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137. H.R. REP. NO. 102-474, at 42 (1992) (*reprinted in* 1992 U.S.C.C.A.N. 2232, 2253).

138. *Id.*

139. *Id.*

140. Michael L. Beatty, *The Energy Challenge for the United States*, 39 ROCKY MTN. MIN. L. INST. 1 (1993).

141. ENERGY INFORMATION ADMIN., SHORT-TERM ENERGY OUTLOOK QUARTERLY PROJECTIONS - SECOND QUARTER PROJECTIONS 1 (1992). The Outlook reported on the potential growth of geothermal, wind, wood (biomass), waste (landfill gas and livestock methane), and solar from 1991–1993. *Id.*

Outlook excluded any discussion of hydropower as an option for new renewable energy generation.[142]

2. Adding Small-Scale Hydropower to the Production Tax Credit Program

Small-scale hydropower has been added incrementally to the production tax credit program as the program has been amended and extended.[143] The American Job Creation Act of 2004 added small irrigation power to the list of qualified resources.[144] EPAct 2005 added qualified hydropower facilities as a qualifying resource for the PTC,[145] but it maintained the distinction between hydropower and other forms of renewable energy.[146] In 2008, the Emergency Economic Stabilization - Energy Improvement and Extension - Tax Extenders and Alternate Minimum Tax Relief added marine and hydrokinetic resources to the list of qualified energy resources.[147] Marine and hydrokinetic resources absorbed the resources in the small irrigation power category and expanded the definition to include ocean and wave resources.[148]

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142. *Id.*

143. American Jobs Creation Act of 2004, Pub. L. No. 108-357, § 710, 118 Stat. 1552 (2004).

144. *Id.*

145. Energy Policy Act of 2005, Pub. L. No. 109-58, § 1301, 119 Stat. 986, 987 (2005); *see also* MOLLY F. SHERLOCK, CONG. RESEARCH SERV., THE RENEWABLE ELECTRICITY PRODUCTION TAX CREDIT: IN BRIEF (2014), http://www.lankford.senate.gov/imo/media/doc/The%20Renewable%20Electricity%20Production%20Tax%20Credit%20In%20Brief.pdf.

146. Energy Policy Act of 2005, Pub. L. No. 109-58, § 1301, 119 Stat. 986, 987 (2005).

147. Emergency Economic Stabilization Act of 2008, Pub. L. No. 110-343, § 102, 122 Stat. 3810 (2008).

148. The definition of small irrigation power covers power generated without any dam or impoundment of water through an irrigation system canal or ditch and with a nameplate capacity rating which is not less than 150 kilowatts but is less than 5 megawatts. 26 U.S.C. § 45(c)(5). The definition of marine and hydrokinetic resources includes "free flowing water in

3. Legislative History of Hydropower and the Half Credit Rate

In 1992, Congress selectively chose which resources would be included in the production tax credit program.[149] Testimony before Congressional Committees and on the floor of the House demonstrates the change in attitude.[150] In 2005 and 2008, Congress shifted away from incenting new generation capacity in specific resource categories to promoting multiple renewable energy sources as a means of increasing fuel diversity, and reducing dependence on foreign oil.[151] However, there is an absence of testimony or legislative history on why small-scale hydropower resources were assigned a half credit rate.[152] The absence of testimony could be attributed to a split in the timing of when resources were added to the list of qualified energy resources and when the half credit rate

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an irrigation system, canal, other man-made channel, including projects that utilize nonmechanical structures to accelerate the flow of water for electric power production purposes." *Id.* § 45(c)(10)(iii).

149. *See* Database of State Incentives for Renewables & Efficiency, *supra* note 132.

150. A theme of reducing dependence on foreign oil was repeatedly found in statements supporting EPAct 2005. *See e.g., Energy Policy Act of 2005: Hearing on H.R. 6 before H. Comm. on Energy and Commerce,* 109th Cong. (2005) (statement of Thomas R. Kuhn, President of Edison Electric Institute) (discussing the need for increased fuel diversity including hydropower, nuclear, and other renewables); 151 CONG. REC. H2383-10 (2005) (statement of Rep. Blackburn) (discussing the need to support American controlled sources of energy such as biodiesel, ethanol, wind, and hydropower);151 CONG. REC. S6980-04 (2005) (statement of Sen. Kennedy) supporting investment in technology such as solar and hydroelectric to reduce imports of foreign oil. For the amendments found in the Emergency Economic Stabilization - Energy Improvement and Extension - Tax Extenders and Alternate Minimum Tax Relief, a predominant theme was supporting technology development and commercialization. *See* 154 CONG. REC. S9238-02 (2008) (statement of Sen. Levin) advocating that the tax incentives are an essential element in bringing renewable technologies to market; 154 CONG. REC. S9238-02 (2008) (statement of Sen. Domenici) (stating that new technologies often need government assistance in order to become economically viable and one of the best ways for the government to provide assistance is through the tax code);154 CONG. REC. H10702-06 (2008) (statement by Rep. Dreier) (promoting the role of tax credits in increasing the use of renewable and alternative energy and consequently creating new jobs in those sectors).

151. *See supra* text accompanying footnote 150.

152. A search of the legislative history for each bill extending the production tax credit, starting after the creation of the half-credit rate, found no substantive discussion on the protocols for assigning a full credit rate or half credit rate to a qualified energy resources.

was implemented. The half credit rate was added by an amendment placed in the American Jobs Creation Act of 2004.[153] Qualified resources have been added throughout the production tax credit program.[154]

An examination of the legislative history of the American Jobs Creation Act of 2004 reveals twin imperatives that may explain why the half credit rate was added to the production tax credit program.[155] The first imperative was to incent new energy production while protecting the environment.[156] The second imperative was to maintain fiscal discipline.[157] Under the first imperative, the number of eligible resources was expanded with the addition of open-loop biomass, small irrigation power facilities, geothermal, solar, landfill gas facilities, and trash combustion facilities.[158] At the same time, the new half credit rate was created and applied.[159] Open-loop biomass, small irrigation power facilities, landfill gas, and trash combustion facilities were given the half credit rate only

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153. American Jobs Creation Act of 2004, Pub. L. No. 108-357, § 710, 118 Stat. 1556 (2004).

154. The production tax credit was created in 1992 and only covered wind, solar, biomass and geothermal. Energy Policy Act of 1992, Pub. L. No. 102-486, § 1212, 106 Stat. 2969 (1992). Small irrigation projects were added in 2004. American Job Creation Act of 2004, Pub. L. No. 108-357, § 710, 118 Stat. 1556 (2004). Qualified hydropower projects were added in 2005. Energy Policy Act of 2005, 42 U.S.C. §§ 15801–16538 (2005). Marine and hydrokinetic resources were added in 2008. Emergency Economic Stabilization Act of 2008, Pub. L. No. 110-343, § 102, 122 Stat. 3810 (2008).

155. *See* American Jobs Creation Act of 2004, Pub. L. No. 108-357, § 710, 118 Stat. 1418 (2004).

156. *Id.*

157. *See* 150 CONG. REC. S10764-02 (2004) (statement of Sen. Dorgan on incentivizing energy production within the United States); 150 CONG. REC. S11019-05 (2004) (statement of Sen. Reid on the need to diversify the nation's energy supply by increasing the amount of renewable resources).

158. American Jobs Creation Act of 2004, Pub. L. No 108-357, § 710, 118 Stat. 1152-1555 (2004).

159. *Id.*

for a five year period.[160] Geothermal and solar were eligible for the full credit rate.[161] Qualified hydropower facilities, added in 2005, and marine and hydrokinetic renewable resources, added in 2008, were both assigned the half credit rate.[162]

The production tax credit is the product of a piecemeal construction process. Resources were added at different intervals that match up with changing political opinions. A half credit rate was inserted a decade after the incentive was created. A system was developed that affords different values to energy produced from different renewable energy generators. As the next section demonstrates, the competitive energy markets are non-discriminatory in nature, selecting resources based upon their ability to deliver low-cost energy. Revenues are linked to market access not the tax code designation. Market access is organized based upon the variability and reliability of the energy resource.

V. VARIABLE ENERGY RESOURCES AND WHOLESALE ENERGY MARKETS

A commissioned small-scale hydropower generating facility delivers its energy onto the electrical grid. The same process happens for other types of renewable energy facilities. Electricity generated is delivered to the grid through wholesale energy markets. In most areas of the country, renewable energy generators sell their energy into these competitive markets.[163] Unlike the production tax credit, a kilowatt of electricity from small-scale hydropower generators does not receive half of the money paid for a kilowatt of electricity generated from a wind turbine.[164]

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160. *Id.*; *See also* SHERLOCK, *supra* note 145.

161. American Jobs Creation Act of 2004, Pub. L. No. 108-357, § 710, 118 Stat. 1552 (2004).

162. 26 U.S.C. § 45(b)(4) (2008).

163. *See Today in Energy, About 60% of the U.S. Electric Power Supply is Managed by RTOs*, U.S. ENERGY INFO. ADMIN., (Apr. 4, 2011), https://www.eia.gov/todayinenergy/detail.cfm?id=790 (noting that in 2009, RTOs and ISOs managed 60 percent of the electricity consumed in the United States).

164. Energy markets do not differentiate between sources of electrons. Deregulated energy markets are non-discriminatory by law. Electricity sold on the energy market at the same time receives the same clearing price regardless of its source. FERC Order 888 requires

This section delves into the treatment of variable energy resources including small-scale hydropower in federally regulated regional wholesale energy markets.[165] Tracing the development of regional markets reveals how markets are managed and the key factors affecting future development. This section reviews key FERC Orders that have shaped the energy markets and how those markets treat renewable energy generators like small-scale hydropower. A comparison of the market rules for variable energy resources in each of the RTOs/ISO illustrates how small-scale hydropower is treated relative to other renewable energy resources. Lastly, an examination of market access of variable energy resources in two different regions highlights future treatment of hydropower resources and the need to correct other revenue sources.

A. FERC Powers

Section 201 of the Federal Power Act gives FERC oversight over the "sale of [electric] energy at wholesale."[166] Section 201 defines "sale of electricity at wholesale" as "a sale of electric energy to any person for resale."[167] Under the Act, the Commission has exclusive jurisdiction over the "transmission of electric energy in interstate commerce" and "the sale of electric energy at wholesale in interstate commerce."[168] Sections 205 and 206 give the Commis-

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transmission service providers to offer non-discriminatory access to third-party generators allowing them to participate in competitive marketplaces. *See* 18 C.F.R. Part 35, 385, Promoting Wholesale Competition Through Open Access Non-discriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities, 75 F.E.R.C. P61,080 (F.E.R.C. 1996).

165. This paper restricts its discussion of the treatment of hydropower in energy markets to deregulated energy markets that fall under the review of the Federal Energy Regulatory Commission and the Electric Reliability Council of Texas (ERCOT). ERCOT is not regulated by FERC as it only operates an intrastate market.

166. 16 U.S.C. § 824(a) (2012).

167. *Id.* § 824(d).

168. *Id.* § 824(b)(1).

sion jurisdiction over the rates, terms, and conditions of transmission in interstate commerce.[169] The Commission also regulates utilities transmitting electric energy in interstate commerce and under Section 211 requires that the unregulated utilities provide open access to their transmission facilities.[170]

1. Creation of Regional Wholesale Energy Markets

The Commission exercised its authority when it issued Orders 888[171] and 889[172] in 1996 and started the process of creating regional wholesale energy markets. Order 888 functionally unbundled wholesale transmission by mandating that all transmitting utilities provide open transmission access to all FERC and non-FERC regulated generators.[173] Transmitting utilities had to file an open access non-discriminatory transmission tariff that contained minimum terms and conditions of non-discriminatory service.[174] Order 889 provided the rules for implementing Order 888.[175] Order 889 established the Open Access Same-Time Information System (OASIS) which shared information on available transmission capacity and reserve transmission capacity.[176] Historically, the electricity industry had traded electricity through bilateral contracts and power pool arrangements.[177] Order 888 introduced the concept

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169. Ark. Power & Light Co. v. FPC, 368 F.2d 376, 383 (8th Cir. 1966) (citing *Ind. & Mich. Elec. Co.*, 33 F.P.C. 739 (1965)).

170. 16 U.S.C. § 824(j-1) (2012).

171. 18 C.F.R. Part 35, 385, Promoting Wholesale Competition Through Open Access Non-discriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities, 75 F.E.R.C. P61,080 (F.E.R.C. 1996).

172. 18 C.F.R. Part 37, Open Access Same-Time Information System (formerly Real-Time Information Networks) and Standards of Conduct, 75 F.E.R.C. P61,078 (F.E.R.C. 1996).

173. 18 C.F.R. Part 35, 385, Promoting Wholesale Competition Through Open Access Non-discriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities, 75 F.E.R.C. P61,080 (F.E.R.C. 1996).

174. *Id.*

175. 8 C.F.R. Part 37, Open Access Same-Time Information System (formerly Real-Time Information Networks) and Standards of Conduct, 75 F.E.R.C. P61,078 (F.E.R.C. 1996).

176. *Id.*

of independent system operators (ISOs) but it did not mandate their formation.

In 1999, FERC issued Order 2000[178] on the formation of Regional Transmission Operators (RTOs). RTOs are entities "authorized by the federal government to manage the reliability of the electric transmission system and the operation of the wholesale electricity market in a defined control area."[179] RTOs act independently from generation and power marketing interests and have exclusive responsibility to grid operations, short-term reliability, and transmission service within a region.[180] ISOs and RTOs coordinate, control, and monitor the competitive energy markets.[181] The RTOs and ISOs must balance energy generation from different generation sources to provide grid reliability and low energy prices for consumer.[182] The ISOs and RTOs schedule generation for transmission and have the right to re-dispatch generation as needed to ensure reliable operation of the transmission system.[183]

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177. Power pools were relationships formed between transmission owners to facilitate the economic dispatch of generation. *Glossary*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/tools/glossary/?id=electricity (last visited Oct. 31, 2016).

178. 18 C.F.R. Part 35, Regional Transmission Organization, 89 F.E.R.C. P61,285 (F.E.R.C. 1999).

179. *PJM's Role as an RTO,* PJM (Mar. 14, 2016), https://www.pjm.com/~/media/about-pjm/newsroom/fact-sheets/pjms-role-as-an-rto-fact-sheet.ashx.

180. *Id.*

181. *Id.*

182. 18 C.F.R. Part 35 at 71, 614, Regional Transmission Organization, 89 F.E.R.C. P61,285 (F.E.R.C. 1999).

183. WALTER R. HALL II ET AL., CAPTURING THE POWER OF ELECTRIC RESTRUCTURING 22 (Joey Lee Miranda, ed., 2009).

There are seven deregulated energy markets, ISOs and RTOs,[184] operating in the United States.[185] Six of these operate under FERC approved tariffs: California ISO (CAISO), New York ISO (NYISO), Midcontinent ISO (MISO), ISO New England (ISO-NE), Southwest Power Pool (SPP), and PJM Interconnection (PJM); the Electric Reliability Council of Texas operates under a non-FERC authorized tariff.[186] ISOs and RTOs serve more than two-thirds of electric customers in the United States[187] and supply 60% of the wholesale electricity sold in the United States.[188]

B. ISO and RTO Wholesale Electric Markets

The ISOs and RTOs are designed to eliminate undue discrimination and promote competition in wholesale electric power markets.[189] The ISOs and the RTOs operate competitive energy, capacity, and ancillary services markets to provide access for generators

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184. A Regional Transmission Authority (RTO) is an organization formed with the approval of the Federal Energy Regulatory Commission. An Independent System Operator (ISO) is an organization formed at the direction or recommendation of the Federal Energy Regulatory Commission. Both are subject to FERC regulation. Under FERC Order 2000, an ISO could voluntary opt to become an RTO provide they met a specified list of minimum characteristics and functions which includes restrictions on active ownership by market participants. 18 C.F.R. Part 35 at 2, 15, Regional Transmission Organization, 89 F.E.R.C. P61,285 (F.E.R.C. 1999).

185. *Regional Transmission Organizations (RTO)/Independent System Operators (ISO),* FED. ENERGY REGULATORY COMM'N, http://www.ferc.gov/industries/electric/indus-act/rto/ercot.asp (last visited Oct. 31, 2016).

186. *Electric Reliability Council of Texas*, FED. ENERGY REGULATORY COMM'N, http://www.ferc.gov/industries/electric/indus-act/rto/ercot.asp (last visited Oct. 31, 2016).

187. *About the IRC: Shaping Our Energy Future*, ISO/RTO COUNCIL, http://www.isorto.org/about/default. (last visited Oct. 31, 2016).

188. *See About 60% of the U.S. Electric Power Supply is Managed by RTOs,* ISO/RTO COUNCIL, https://www.eia.gov/todayinenergy/detail.cfm?id=790 (last visited Oct. 31, 2016) (noting that in 2009 RTOs and ISOs managed 60 percent of the electricity consumed in the United States).

189. CAL. ISO, INQUIRY CONCERNING THE COMMISSION'S POLICY ON INDEPENDENT SYSTEM OPERATORS 1–2 (No. PL98-5-000) (1998), https://webcache.googleusercontent.com/search?q=cache:HNw1nGrHozEJ:https://www.caiso.com/Documents/1998121809194918752.doc+&cd=1&hl=en&ct=clnk&gl=us; *See also FERC Conf. on ISOs*, CLEANTECH.ORG (Mar. 16, 1998), http://www.cleantech.org/1998/03/16/ferc-conf-on-isos/ (listing "dual goals of eliminating undue discrimination and promoting competition in electric power markets.").

to supply energy and energy services to the grid.[190] They develop rules for participating in the markets and qualify generators to participate in each of the markets.[191] Energy markets are the largest market, and they facilitate the physical delivery of energy from generator to distributor.[192] Capacity markets ensure that there will be an adequate supply of energy available, at all times, to meet load requirements.[193] Generators receive payment for the ability to provide energy regardless of whether they deliver any energy. Ancillary services markets facilitate efficient system functions.[194] Ancillary services include voltage regulation, reactive power, loss compensation, loading following, system protection, energy imbalance, operating reserves (spinning and non-spinning), and black-start capacity.[195]

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190. All of the RTO/ISOs operate energy markets. Three RTO/ISOs - NYISO, PJM, and ISO-NE – operate mandatory capacity markets, MISO operates a voluntary capacity market and CAISO, ERCOT and SPP do not operate capacity markets. *See* AM. PUB. POWER ASS'N, RTO CAPACITY MARKETS AND THEIR IMPACTS ON CONSUMERS AND PUBLIC POWER, (2016), http://publicpower.org/files/spdfs/Final%20APPA%20Issue%20Brief%20for%20RTO%20Capacity%20Markets%20and%20Their%20Impacts%20on%20Consumers%20and%20Public%20Power.pdf; *Electric Power Markets: Texas (ERCOT)*, FED. ENERGY REGULATORY COMM'N, http://www.ferc.gov/market-oversight/mkt-electric/texas.asp (last visited Oct. 31, 2016). Each RTO/ISO operates an ancillary services market, however market design differs between operators. *See* ZHI ZHOU ET AL., ARGONNE NAT'L LAB, SURVEY OF U.S. ANCILLARY SERVICES MARKETS vi (2016), http://www.ipd.anl.gov/anlpubs/2016/01/124217.pdf.

191. JONATHAN A. LESSER & LEONARDO R. GIACCHINO, FUNDAMENTALS OF ENERGY REGULATION, 396 (2nd ed. 2013).

192. Todd Ryan, *ISO Rules for Intermittent Generation*, TEPPER SCHOOL OF BUS. 3 (2010), https://wpweb2.tepper.cmu.edu/rlang/RenewElec/ISO%20Intermittent%20Rules.pdf.

193. *Id.* at 5.

194. *Id.*

195. *Guide to Market Oversight: Glossary*, FED. ENERGY REGULATORY COMM'N, http://www.ferc.gov/market-oversight/guide/glossary.asp#A (last visited Oct. 31, 2016).

1. Grid Reliability

ISO and RTO's market operations are guided by the twin principles of reliability and low cost, both of which impact the integration of renewable energy sources. The 2003 blackout in Eastern North America resulted in a significant reevaluation of reliability protocols. The governments of the United States and Canada commissioned a task force to examine the causes of the blackout and to issue recommendation for improving grid reliability. In 2004, the U.S.-Canada Power System Outage Task Force produced its report emphasizing reliability as one of the guiding principles for grid operators. [196] The report's recommendations included appointing an independent organization to oversee grid reliability, requesting that FERC should not approve the operations of new RTOs or ISO until they met minimum functional requirements, and requiring any entity operating as part of the bulk power system to be a member of the regional reliability councils where it operates.[197]

EPAct of 2005 added Section 215 to the Federal Power Act requiring the establishment of an Energy Reliability Organization. This mandate led to the formation of the North American Electric Reliability Corporation (NERC). NERC is responsible for developing and enforcing reliability standards for North America's bulk power system.[198] All transmission organizations, including RTOs and ISOs, must comply with the Reliability Standards.[199] Failure to comply with a reliability standard can lead to penalties for the user, owner, or operator of the bulk power system.[200]

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196. U.S.-CAN. POWER SYS. OUTAGE TASK FORCE, FINAL REPORT ON THE AUGUST 14, 2003 BLACKOUT IN THE UNITED STATES AND CANADA: CAUSES AND RECOMMENDATIONS ii (2004), http://energy.gov/sites/prod/files/oeprod/DocumentsandMedia/BlackoutFinal-Web.pdf.

197. *Id.* at 3.

198. 16 U.S.C. § 824o(a)(2) (2012). FERC also reviews and approves NERC's standards, *see id.* U.S.C. § 824o(d)(2).

199. HARRY SINGH, TRANSMISSION MARKETS, CONGESTION MANAGEMENT, AND INVESTMENT, IN COMPETITIVE ELECTRICITY MARKETS: DESIGN, IMPLEMENTATION, PERFORMANCE 141, 152 (Fereidoon P. Sioshansi ed., 2008).

200. 16 U.S.C. § 824o(e)(2).

The electric system is interconnected and dynamic.[201] To balance generation and demand either requires continuous scheduling, or it requires "dispatching" generators on a pre-approved schedule and making real-time adjustments to match the power produced with the power being consumed.[202] The electric system is also comprised of many different types of generation with different energy profiles.[203] Generation can be variable and/or flexible.[204] Generators can vary in their ability to follow load, to ramp up or ramp down in response to condition changes, to provide predictable amounts of energy on demand, and to maintain energy generation for extended periods of time.[205] All of these types of generation have to be incorporated and balanced to create an adequate and reliable supply of electricity.[206]

2. Variable Resources and Grid Reliability

Variable energy resources pose particular stresses on grid reliability for three main reasons. First, variable energy resources

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201. U.S.-CAN. POWER SYS. OUTAGE TASK FORCE, *supra* note 196, at 8.

202. FED. ENERGY REGULATORY COMM'N, SECURITY CONSTRAINED ECONOMIC DISPATCH: DEFINITION, PRACTICES, ISSUES AND RECOMMENDATIONS 5 (2006), http://www.ferc.gov/industries/electric/indus-act/joint-boards/final-cong-rpt.pdf.

203. U.S. electricity demand is supplied by a number of different resources including coal, natural gas, nuclear, hydropower, solar, and wind. *Frequently Asked Questions, What is the U.S. electricity generation by energy source?*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/tools/faqs/faq.cfm?id=427&t=3. (last visited Oct. 31, 2016).

204. Jaquelin Cochran et al., *Flexibility in 21st Century Power Systems*, NAT'L RENEWABLE ENERGY LAB 1 (2014).

205. *Id.*

206. Transmission system operators must manage their different generation sources in order to ensure compliance with NERC directives on the reliability of the Interconnected Bulk-Power System., NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION, UNDERSTANDING THE GRID 2 (2013), http://www.nerc.com/AboutNERC/Documents/Understanding%20the%20Grid%20DEC12.pdf.

are difficult to forecast because they have unique generation profiles that are site and production method specific.[207] Second, variable energy resources don't have full control over their fuel sources.[208] Third, the number of variable energy resources being connected to the grid has risen drastically in the past decade.[209]

The increasing amounts of renewable energy being connected to the grid stress the ability of the RTOs and ISOs to maintain grid reliability.[210] Grid management practices were developed at a time when most generation could be scheduled with a high degree of precision, and most generating facilities were able to maintain consistent production levels.[211] New generation capacity is increasingly composed of variable energy resources (VERs) that cannot meet these standards.[212] Consequently, VERs were suffering under the existing regulations regulating market access.[213]

FERC recognized that the makeup of generation on the grid was rapidly changing, and the operating protocols were no longer sufficient to provide non-discriminatory access for all generators.[214] In 2012, FERC issued Order 764, Integration of Variable Energy

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207. Cochran et al., *supra* note 204, at 1.

208. FERC defines a Variable Energy Resource by referencing the energy source. An VER is (1) renewable; (2) cannot be stored by the facility owner or operator; and (3) has variability beyond the control of the facility owner or operator. Examples provided include wind, solar, and hydrokinetic generating facilities. *See* 18 C.F.R. Part 35, Integration of Variable Energy Resources, 133 F.E.R.C. P61,149 *1 (F.E.R.C. 2010).

209. *Wind adds the most electric generation capacity in 2015, followed by natural gas and solar*, U.S. ENERGY INFO ADMIN, http://www.eia.gov/todayinenergy/detail.cfm?id=25492 (last visited Oct. 31, 2016).

210. CARNEGIE MELLON U. SCOTT INST. FOR ENERGY INNOVATION, MANAGING VARIABLE ENERGY RESOURCES TO INCREASE RENEWABLE ELECTRICITY'S CONTRIBUTION TO THE GRID, 9–10 (2013), http://www.cmu.edu/epp/policy-briefs/briefs/Managing-variable-energy-resources.pdf.

211. 18 C.F.R. Part 35, Integration of Variable Energy Resources, 139 F.E.R.C. P61, 246 *1 (F.E.R.C. 2012).

212. *Id.*

213. *Id.* at 10.

214. 18 C.F.R. Part 35 at 41.

Resources,[215] to provide additional guidance to the ISOs and RTOs on how to adapt their operations to improve non-discriminatory access for VERs.[216]

3. FERC Order 764

FERC Order 764 targeted barriers to integration of variable energy resources by amending the *pro forma* Open Access Transmission Tariff (OATT) and the *pro forma* Large Generator Interconnection Agreement (LGIA).[217] The OATT was amended to require each public utility transmission provider to:

> "(1) Offer intra-hourly transmission scheduling";[218]

The LGIA was amended to:

> "(2) Incorporate provisions into the *pro forma* Large Generator Interconnection Agreement requiring interconnection customers whose generating facilities are variable energy resources to provide meteorological and forced outage data to public utility transmission provider for the purpose of power production forecasting."[219]

FERC also adopted a definition of Variable Energy Resources and amended Article 1 of the *pro forma* LGIA to include the following definition:

> "Variable Energy Resource shall mean a device for the production of electricity that is characterized by an energy

215. *Id.*

216. *Id.*

217. *Id.* at 5.

218. *Id.* at 41.

219. *Id.* at 116.

> source that: (1) is renewable; (2) cannot be stored by the facility owner or operator; and (3) has variability that is beyond the control of the facility owner or operator."[220]

FERC Order 764 is non-discriminatory and does not classify nor identify specific renewable resources for differential treatment.[221] FERC defined VERs according the characteristics of their energy source, which created flexibility in which resources would receive the designation.[222] FERC specifically declined to define VERs either according to operating characteristics or by reference to their lack of ability to store output, self-curtail production, or have firm deliveries.[223] In paragraph 211 of the Order, FERC noted that it is the "variability of the energy source, not the operating characteristics of the plant or the nature of output that is critical for identifying the resources that are subject to meteorological and forced outage data requirements." [224]

Importantly, for small-scale hydro, run-of-river, and conduit generation facilities, FERC declined to limit the scope of the VER definition. Multiple public utilities proposed limiting the VER definition to solar and wind resources thus excluding run-of-river hydro, tidal, and other new emerging VER technologies.[225] While the utilities sought certainty in requiring power production forecasts, the Commission opted to keep the definition open-ended and flexible.[226] The Commission made it clear that it would not limit the ability of public utility transmission providers to determine

220. 18 C.F.R. Part 35 at 3.

221. *Id.* at 129.

222. *Id.*

223. *Id.*

224. *Id.* at 153.

225. *Id.* at 149.

226. 18 C.F.R. Part 35 at 154.

whether individual systems necessitated power production forecasting for other types of VERs.[227] The Commission would not provide categorical exemptions that would limit the responsiveness of public utility transmission providers.[228]

4. ISO and RTO Variable Energy Resources Definitions

Order 764 left to the ISOs and RTOs to define what resources would be considered variable and to develop rules for their market participation.[229] The ISOs and RTOs amended their tariffs to comply with Order 764, and as is shown below the amended tariffs are remarkably similar in their definitions of variable energy resources.[230]

a. ERCOT

ERCOT defines an Intermittent Renewable Resource as:

> "A Generation Resource that can only produce energy from variable, uncontrollable Resources, such as wind, solar, or run-of-the-river hydroelectricity."[231]

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227. *Id.*

228. *Id.*

229. *Id.*

230. Note, some RTOs and ISOs use the term "intermittent" in place of "variable." The choice of term does not affect the treatment of the resource and only reflects the decision to continue to use terminology developed prior to Order 764. See ISO-NE's comments on "intermittent" versus "variable" in FERC Order 764 and FERC's response, Integration of Variable Energy Resources 18 C.F.R. Part 35 at 151, 155–56.

231. *Glossary-I*, ERCOT, http://www.ercot.com/glossary/i (last visited Oct. 31, 2016).

b. MISO

MISO splits variable energy resources into two categories: Intermittent Resources and Dispatchable Intermittent Resources.[232]

Dispatchable Intermittent Resources are defined as:

> "Dispatchable Intermittent Resources (DIRs) are Generation Resources whose maximum limit is dependent on a forecast of their variable fuel source. Resources that are fueled by wind, solar, or other types of variable energy can be DIRs."[233]

Intermittent Resources are defined as:

> "A Resource that is not capable of being committed or decommitted by, or following Setpoint Instructions of, the Transmission Provider in the Real-Time Energy and Operating Reserve Market."[234]

c. Southwest Power Pool

The Southwest Power Pool defines Intermittent Generation, Dispatchable Variable Energy Resource, and Non-Dispatchable Variable Energy Resource.[235]

Intermittent Generation is defined as:

> "A resource . . . that cannot be . . . scheduled [and] controlled to produce the anticipated [e]nergy . . . ."[236]

Dispatchable Variable Energy Resource is defined as:

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232. MIDWEST INDEP. TRANSMISSION SYS. OPERATORS INC., FILING OF MULTI-PARTY FACILITIES CONSTRUCTION AGREEMENTS (2009), https://www.misoenergy.org/_layouts/MISO/ECM/Download.aspx?ID=1917.

233. *Id.*

234. *Id.*

235. SOUTHWEST POWER POOL, INTEGRATED MARKETPLACE DICTIONARY & QUICK REFERENCE GUIDE 20 (2011), https://www.spp.org/documents/15765/integrated%20marketplace%20dictionary%20102611.pdf.

236. MIDWEST INDEP. TRANSMISSION SYS. OPERATORS INC., s*upra* note 232, at 20.

> "A Variable Energy Resource that is capable of being incrementally dispatched down by the Transmission Provider."[237]

Non Dispatchable Variable Energy Resource is defined as:

> "A Variable Energy Resource that is not capable of being incrementally dispatched down by the Transmission Provider but may be completely taken off-line by the Transmission Provider."[238]

A Variable Energy Resource is defined as:

> "A Resource powered solely by wind, solar energy, run-of-river hydro or other unpredictable fuel source that is beyond the control of the resource operator."[239]

d. ISO-NE

ISO-NE has split definitions of Intermittent Power Resources and Intermittent Settlement Only Resources.

An Intermittent Power Resource (IPR) is defined as:

> A resource whose output amount and availability are intermittent and not subject to the control of ISO New England or the plant operator because of the intermittent source of fuel (e.g., wind, solar, run-of-river hydro) the resource uses or contractual obligations (e.g. qualifying facilities). IPRs can be resources having less than 5 MW operating within the distribution system.[240]

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237. SOUTHWEST POWER POOL, *supra* note 235, at 20.

238. *Id.* at 38.

239. *Id.* at 56.

240. *Glossary and Acronyms,* ISO NEW ENGLAND, http://www.iso-ne.com/participate/support/glossary-acronyms#i (last visited Oct. 31, 2016).

e. NYISO

NYISO defines an Intermittent Power Resource as:

> A device for the production of electricity that is characterized by an energy source that: (1) is renewable; (2) cannot be stored by the facility owner or operator; and (3) has variability beyond the control of the facility owner or operator. In New York, resources that depend upon wind, or solar energy or landfill gas for their fuel have been classified as Intermittent Power Resources. Each Intermittent Power Resource that depends on wind as its fuel shall include all turbines metered at a single scheduling point identifier (PTID).[241]

f. PJM

PJM defines an Intermittent Power Resources as:

> ". . . [g]eneration [c]apacity [r]esources with output that can vary as a function of its energy source[s], such as wind, solar, [landfill gas,] run of river hydroelectric power and other renewable resources."[242]

g. CAISO

CAISO has two definitions: Eligible Intermittent Resource and Variable Energy Resource.

An Eligible Intermittent Resource is defined as:

> "A Variable Energy Resource that is a Generating Unit or Dynamic System Resource subject to a Participating Gen-

241. *Open Access Transmission Tariff OATT: 1.9 Definitions – I,* N.Y. INDEP. SYS. OPERATORS, http://www.nyiso.com/public/webdocs/markets_operations/committees/mc_bpwg/meeting_materials/2015-04-16/OATT%201%209%20FERC%20FEE.pdf (last visited Oct. 31, 2016).

242. PJM, PJM OPEN ACCESS TRANSMISSION TARIFF (2010), http://www.pjm.com/media/documents/merged-tariffs/oatt.pdf.

erator Agreement, Net Scheduled PGA, Dynamic Scheduling Agreement for Scheduling Coordinators, or Pseudo-Tie Participating Generator Agreement."[243]

A Variable Energy Resource is defined as:

"A device for the production of electricity that is characterized by an Energy source that: (1) is renewable; (2) cannot be stored by the facility owner or operator; and (3) has variability that is beyond the control of the facility owner or operator."[244]

As in FERC Order 764, the RTO and ISO definitions are nondiscriminatory and flexible. While the majority of the definitions identify wind and solar—the dominant variable energy resources—they remain open to other resource types like small-scale hydropower. What matters is the ability to dispatch the resource, the dividing line between flexible and variable generation resources. That is what determines if a resource falls into the variable energy resource classification and how it can participate in RTO/ISO energy, capacity, and ancillary services markets.[245] Variable energy resources can face issues participating in capacity and ancillary markets in the same manner as flexible generation resources. For example, PJM revised its capacity rules requiring generators to demonstrate resource adequacy throughout the year, not just at peak periods.[246] Therefore, variable energy resources may

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243. CAL. INDEP. SYS. OPERATORS., FIFTH REPLACEMENT ELECTRONIC TARIFF – Appendix A Master Definition Supplement (2016), http://www.caiso.com/Documents/AppendixA_Definitions_asof_Jun3_2016.pdf.

244. *Id.*

245. Dispatchable resources can be called upon the system operator to increase or decrease generation. They can be called upon demand and are compensated accordingly for the ability to adjust generation to ensure resource adequacy and grid reliability through the capacity and ancillary services markets. Richard P. O'Neill et al., *Dispatchable Transmission in RTO Markets*, 20 IEEE TRANSACTIONS ON POWER SYSTEMS 171 (2005).

246. Order of Proposed Tariff Revisions 151 F.E.R.C. P61,208 (F.E.R.C. 2015).

be limited from fully participating in capacity markets and deprived of a possible source of revenue.[247]

Market participation sets the income that a resource can earn. By grouping variable energy resources together,[248] they end up with similar financial potential because they can participate in the same markets.[249] Since the majority of their income is derived from the energy market, because of limited access to the capacity markets and almost no access to the ancillary services market, wind, solar, and small-scale hydro have similar earning potentials per MWh of energy produced.[250]

Small-scale hydro, run-of-river hydro, and conduit hydro facilities are not dispatchable like large-scale hydro facilities.[251] Wind,

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247. Jennifer Chen, *Enviros Look to Court to Undo Costly Electricity Market Rule,* NATURAL RES. DEFENSE COUNCIL, https://www.nrdc.org/experts/jennifer-chen/enviros-look-court-undo-costly-electricity-market-rule (last visited Oct. 31, 2016).

248. In Order 764, FERC did not distinguish between energy sources only energy characteristics. Energy sources sharing similar characteristics should receive similar nondiscriminatory treatment. Integration of Variable Energy Resources 18 C.F.R. § 35 (2012).

249. The market participation rules developed by the RTO/ISOs echo FERC's mandate for nondiscriminatory access. Resources falling under the Variable Energy Resource or Intermittent Resource definition will receive similar treatment in and access to the competitive markets thus resulting in similar financial opportunities. *See id*.

250. Three of the seven RTOs/ISOs do not operate capacity markets, thus preventing any access. *See* Ryan, *supra* note 192. For the three RTOs/ISOs that operate capacity markets, participation is often curtailed to avoid potential penalties. *See id*. at 4. Most variable energy resources are net users of ancillary services and not net providers of ancillary services. Energy produced by most variable energy resources does not have the characteristics - on-demand ability to decrease or increase generation - needed to gain access to the ancillary service markets... As such, they require increased ancillary services and therefore are net user of ancillary services. EXECUTIVE OFFICE OF THE PRESIDENT OF THE UNITED STATES, INCORPORATING RENEWABLES INTO THE ELECTRIC GRID: EXPANDING OPPORTUNITIES FOR SMART MARKETS AND ENERGY STORAGE 15 (2016), https://www.whitehouse.gov/sites/default/files/page/files/20160616_cea_renewables_electricgrid.pdf.

251. Dispatchable refers to the ability of operators to control generation from the resource. The storage capacity of large-scale hydro - created by the combination of dam and reservoir - allows operators to control the flow of water to match demand. *See Large-Scale Hydropower Basics,* DEP'T.OF ENERGY (Aug. 14, 2013), http://energy.gov/eere/energybasics/articles/large-scale-hydropower-basics. By default, any resource that lacks control over its fuel resource is non-dispatchable. Small-scale hydro installations without storage capacity produce electricity when the fuel source is present making them a non-dispatchable resource. FERC defines these type of resources as variable energy resources *See* 18 C.F.R. Part 35, Integration of Variable Energy Resources, 139 F.E.R.C. P61,246 (F.E.R.C. 2012).

solar, small-scale hydro, run-of-river hydro, and conduit hydro facilities share similar dispatchability patterns; they can be dispatched down, but not up.[252] Their power production can be moderated or reduced to prevent over-supplying the grid.[253] However, they are not normally capable of increasing generation to follow increasing demand.[254] Some small-scale hydro generation facilities can increase generation for a limited period of time depending upon the volume of stored water.[255] Yet, the stored water may be designated, by the operating permit, for other purposes thus rendering it unavailable for electricity generation.[256] Hydrokinetic facilities can only take advantage of the energy source available at the time of generation; there is no capacity to store the resource for later use.[257]

C. Variable Energy Resources and Market Access

The income earning potential of VERs is restricted by their limited market access. The following examples from CAISO and PJM illustrate how variable energy resources participate in energy and capacity markets. As discussed, capacity markets exist to ensure resource adequacy and they are matched to system peaks. The CAISO demonstrates how some ISOs and RTOs can require variable energy resources to bid into their capacity markets as part of their participation in the day-ahead energy markets.[258] The PJM

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252. *See* Charlotte Helston, *Run of River*, ENERGYBC.CA, http://www.energybc.ca/profiles/runofriver.html (last visited Oct. 31, 2016).

253. *Id.*

254. *Id.*

255. *See id.*

256. Dam operating permits can often contain conditions requiring the release of water to aid in fish migration. *See Why are the salmon in trouble? - Dams*, U.S. FISH & WILDLIFE SERVICE, https://www.fws.gov/salmonofthewest/dams.htm (last visited Oct. 31, 2016).

257. Helston, *supra* note 252.

258. *Market Processes and Productions*, CAL. INDEP. SYS. OPERATORS, https://www.caiso.com/market/Pages/MarketProcesses.aspx (last visited Oct. 31, 2016).

example shows the financial impact of requiring VERs to get a capacity rating based on expected performance during system peaks.[259]

1. CAISO Market

The California ISO illustrates how VERs participate in electricity markets and are financially constrained by their inability to dispatch. CAISO operates two different energy markets: the real-time market and day-ahead market.[260] The day-ahead market includes an "integrated forward market used to clear supply-and-demand bids and a residual unit commitment to ensure that sufficient capacity is committed to meet CAISO forecast demand."[261] The combination ensures that demand is matched with generation and there is sufficient generation capacity to respond to changes in demand.[262] Generators can hedge the price they receive by bidding into the day-ahead market providing greater economic certainty than the fluctuations of the real-time market.[263] Real-time economic dispatch occurs every five minutes.[264] Ancillary services — regulation, spinning reserve, and non-spinning reserve — are mostly procured in the day-ahead market.[265] To enter this market, variable energy resources must meet the same stringent test as other conventional resources, a bar that is difficult to overcome.[266]

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259. *Id.* at 14; ISO/RTO COUNCIL, VARIABLE ENERGY RESOURCES, SYSTEM OPERATIONS AND WHOLESALE MARKETS 14 (2011), http://www.isorto.org/Documents/Report/20110830_IRCBriefingPaper_IntegratingVariableEnergyResourcesIntoOrganizedMarkets.pdf.

260. ISO/RTO COUNCIL, *supra* note 258.

261. NORTH AMERICAN ELECTRIC RELIABILITY CORP & CAL. INDEP. SYS. OPERATORS., 2013 SPECIAL RELIABILITY ASSESSMENT: MAINTAINING BULK POWER SYSTEM RELIABILITY WHILE INTEGRATING VARIABLE ENERGY RESOURCES – CAISO APPROACH 6 (2013), http://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC-CAISO_VG_Assessment_Final.pdf.

262. CAL. INDEP. SYS. OPERATORS, *supra* note 258.

263. PUBLIC UTILITY COMM'N OF TEXAS, A PRIMER ON WHOLESALE MARKET DESIGN - MARKET OVERSIGHT DIVISION WHITE PAPER 15 (2002).

264. CAL. INDEP. SYS. OPERATORS, *supra* note 258.

265. *Id.*

266. To provide ancillary services in the CAISO market place, generators must be registered and complete a certification test. Only resources greater than 500 kw in size can apply,

CAISO has created a Participating Intermittent Resource Program (PIRP) for intermittent resources that want to bid into the day-ahead energy markets.[267] To participate in the program, an Eligible Intermittent Resource[268] must be certified as a PIRP.[269] One element of certification requires the installation of forecasting equipment to increase the predictability of the resource's output[270]. As discussed in Section B.4.g, Eligible Intermittent Resources can be a Variable Energy Resource, which includes wind, solar, and small-scale hydropower facilities such as run-of-river and conduit projects that lack control over their fuel source.[271] Therefore, there is no differentiation between the resources on the markets they can participate, which translates into a similar level of payment for the energy produced.

2. PJM Market

In PJM, VERs can participate in energy markets and capacity markets.[272] However, PJM, in a recent rule change, limits potential participation from VER participation in capacity markets by moving to single Capacity Performance Resource standard. [273] Under

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they must be able to reach the maximum amount of regulation within 10 minutes; they must be able to decrease or increase real power levels immediately in response to a request from CAISO; and the must be able to offer the resource for a minimum of 30 minutes., CAL. INDEP. SYS. OPERATORS, FIFTH REPLACEMENT ELECTRONIC TARIFF – Appendix K Ancillary Service Requirements Protocol (ASRP), Part A – Certification for Regulation (2016) http://www.caiso.com/Documents/ConformedTariff_asof_Sep7_2016.pdf.

267. CAL. INDEP. SYS. OPERATORS, FIFTH REPLACEMENT ELECTRONIC TARIFF – Appendix Q Eligible Intermittent Resource Protocol, § 2.2.5 (2014), https://www.caiso.com/Documents/AppendixQ_EligibleIntermittentResourcesProtocolEIRP_May1_2014.pdf.

268. CAL. INDEP. SYS. OPERATORS, *supra* note 243.

269. CAL. INDEP. SYS. OPERATORS, *supra* note 267.

270. *Id.*

271. CAL. INDEP. SYS. OPERATORS, *supra* note 243.

272. PJM, PJM'S SUPPORT FOR VARIABLE RESOURCES (2016), http://learn.pjm.com/Media/about-pjm/newsroom/fact-sheets/support-variable-resources.pdf.

273. Ord. on Rehearing and Compliance, 155 F.E.R.C. P61,157 (F.E.R.C. 2016).

the Capacity Performance Resource standard, generators must be able to deliver their promised capacity throughout the year, not just at winter and summer peaks.[274] For Variable Energy Resources with significant seasonal fluctuation in their fuel sources, this change forces them to reduce their participation in the capacity markets to avoid potential penalties for non-delivery of contracted energy.[275] The result is that wind, solar, and small-scale hydropower resources will rely heavily upon energy markets because of their inability to reliably guarantee future generation.

In both examples, energy markets provide most of the income for variable energy resources. Tax incentive programs play a significant role in shifting the economics of a project when the markets provide the same level of access.

VI. PROPOSAL

This article recommends giving small-scale hydropower the full production tax credit to leverage new sources of revenue that can be employed in a dam trading program. The potential of this change can be seen by observing current wholesale energy prices, the prices set by a competitive marketplace. In September 2016, the average wholesale electric price in the RTOs and ISOs described in this article was between 1.8 and 7.5 cents per kWh.[276] With the full PTC worth $0.023/kWh, the credit revenues can represent a significant portion of a facility's revenues.

The hydropower licensing and permitting exemptions, recently updated in the Hydropower Regulatory Efficiency Act of 2013 (HREA 2013), would be used as a guide for amending the federal production tax credit program.[277] The federal production tax credit is chosen as the best option for increasing the revenue of

274. Ord. of Proposed Tariff Revisions, 151 F.E.R.C. P61,208 § B(1) (2015).

275. Chen, *supra* note 247.

276. *Electricity Monthly Update – Regional Wholesale Markets: September 2016*, U.S. ENERGY INFORMATION ADMIN., http://www.eia.gov/electricity/monthly/update/wholesale_markets.cfm (last visited Dec. 6, 2016).

277. *See* Hydropower Regulatory Efficiency Act (HREA) of 2013, Pub. L. No. 113–23, 127 Stat. 493 (codified as amended in scattered sections of 16 U.S.C.). While this paper has focused on the areas of the country with RTOs and ISOs, the economic arguments work equally well throughout the country.

small-scale hydropower projects because, as evidenced in the discussion above, it is the revenue stream that is most susceptible to change and the least connected to the physical delivery of energy onto the grid. In fact, extending the PTC to cover small-scale hydropower and other renewable energy sources for which the incentive is scheduled to expire at the end of 2016 has already been raised in the Senate.[278]

Streamlined or special licensing processes already exist for the all the identified hydropower resource categories discussed in this Article: run-of-river hydrokinetic projects, conduit projects, and non-powered dam upgrades. In passing HREA 2013, Congress has already identified the size of facilities that it deems worthy of special treatment because of their low environmental impact. Congress targeted small hydropower dams up to 10 MW[279] and conduits up to 40 MW.[280]These can be exempt from all or some of FERC's licensing processes. Conduit facilities with 5 MW or less of generation capacity shall be exempt,[281] and FERC has the power to fully or partially exempt conduit facilities up to 40 MW.[282] Similar limits could be applied to run-of-river projects and non-powered dam upgrades by providing an exemption between 10 MW and 40 MW.

New revenues can be generated by correcting the imbalanced treatment of small-scale hydropower in the federal production tax

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278. Gale E. Chan et al., *Energy Tax Extenders in FAA Bill Unlikely*, NAT'L L. REV. (June 30, 2016), http://www.natlawreview.com/article/energy-tax-extenders-faa-bill-unlikely (describing failed effort in Senate to include production tax credit extensions for renewable energy sources omitted from Consolidated Appropriations Act of 2015); David Henry, *Energy Groups Push for Renewal of Tax Credits*, THE HILL (Sept. 7, 2016), http://thehill.com/policy/energy-environment/294800-energy-groups-push-for-renewal-of-tax-credits (describing new lobbying efforts by hydropower, biomass and geothermal trade groups to get production tax credit extension).

279. 16 U.S.C. § 2705(d) (2013).

280. *Id.* U.S.C. § 823a(b)(2).

281. *Id.* U.S.C. § 823a(a)(3)(C)(ii).

282. FED. ENERGY REGULATORY COMM'N.*, supra* note 7.

credit program. By preventing hydropower resources from receiving the full tax credit, the government has put hydropower at a competitive disadvantage to wind. As discussed, there are legitimate reasons for constraining or restricting some forms of hydropower from receiving the full tax credit, but there are few reasons for completely excluding all hydropower generation. Large-scale hydropower has forever changed the American landscape and, in doing so, wrought considerable damage to America's rivers, flora, and fauna. Small hydropower, run-of-river, and conduit facilities can take advantage of the renewable energy contained in America's rushing waters without significantly impairing riparian environments; it may even open up new opportunities to remove dams.

Studies at the federal level have identified potential sites for non-powered dam, run-of-river and conduit generating facilities. Estimates for unused generation potential at non-powered dams and run-of-river facilities exceed 25 GW.[283] Conduits hold another 10,000 GWh of unused generation capacity.[284]

The aging, existing dam infrastructure is ripe for overhaul. Losing the generation capacity would stress efforts to reduce the carbon emissions of the energy industry. Maintaining the existing state of dams will perpetuate the long-term environmental effects. Both issues can be addressed by focusing on small-scale projects with considerable aggregated generation capacity. Additionally, many small aging dams remain in place because of the significant cost of removing them. The financial incentives available from small-scale hydro generating facilities could spur more dam removal initiatives.

The government could encourage development of new sources of renewable power without creating additional environmental harm by limiting the range of projects that would be eligible for the full production tax credit. Generation facilities could be part of making upgrades to existing dams or they could provide additional financial support for the removal and replacement of an aging dam. The aging dam could be replaced with a run-of-river facility or an upgraded non-powered dam.

283. *See* HADJERIOUA, ET AL., *supra* note 6; Kosnik, *supra* note 48, at 5512, 5518 (25 GW is a combination of the DOE's estimate of 12 GW of undeveloped potential at non-powered dams and Koznik's estimate of 13 GW of undeveloped run-of-river potential).

284. U.S. DEP'T OF ENERGY, *supra* note 14, at 17.

The process could be accomplished without weakening environmental protections. FERC's licensing process and the application of other environmental regulations serve a purpose: to ensure that dams are built or modified in a manner that limits their environmental impact. Sustaining existing regulations and licensing process in place would ensure that dams must meet the same strict test. An exemption is in perpetuity and demands substantial consideration of the lifetime impacts of a project. A dam can operate for decades, therefore, careful consideration of the full impact of a lifetime of operation should happen. Small-scale hydropower projects still impact their environment and those impacts must be considered.[285] Although, so do wind and solar projects.[286]

Removing a dam is a lengthy, time-consuming process that follows the same procedure as applying for a new license to construct a dam or to renew of a dam license.[287] As noted, FERC has oversight over dam removal, but it must consult with multiple federal and state agencies to assess the license removal application.[288] The decision to remove or upgrade a dam will still depend on the individual factors such as project location, the river system, and the history of the dam. The environmental integrity of the process will be maintained by preserving the individual assessment of each proposal and project.

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285. RICHARD J. CAMPBELL, CONG. RESEARCH SERV., SMALL HYDRO AND LOW-HEAD HYDRO POWER TECHNOLOGIES AND PROSPECTS 9 (2010).

286. *See* U.S. DEP'T OF ENERGY, U.S. DEPARTMENT OF ENERGY'S WIND PROGRAM FUNDING IN THE UNITED STATES: ENVIRONMENTAL PROJECTS REPORT (2015), http://energy.gov/sites/prod/files/2015/06/f23/Environmental-Projects-Report-6-22-15.pdf; NAT'L ACAD. PRESS, ENVIRONMENTAL IMPACTS OF WIND-ENERGY PROJECTS 1, 3–9 (2007), https://www.nap.edu/read/11935/chapter/1; Union of Concerned Scientists, *Environmental Impacts of Solar Power* (2013), http://www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/environmental-impacts-solar-power.html#.VxKbqfkrLcs.

287. FED. ENERGY REGULATORY COMM'N, HOW TO SURRENDER A LICENSE OR EXEMPTION (2015), https://www.ferc.gov/industries/hydropower/gen-info/comp-admin/surrender.asp.

288. 16 U.S.C. § 799 (1998); *id* U.S.C. § 803 (1992).

Many of the dams are performing other vital functions such as flood control, navigation, irrigation, and municipal water supply.[289] These dams will persist whether they have hydropower generating capacity. Thus, the opportunity to add the capacity provides an environmental benefit of low-carbon energy. Adding power to existing NPDs would accomplish two things. First, it would leverage the removal of other dams in the system as part of the licensing process. Second, it would subject the NPD to the stricter environmental regulation of the FERC licensing process.

The insertion of electricity generation planning into dam removal efforts is already happening. The removal, or planned removal, of dams on the Elwha,[290] Klamath,[291] and Penobscot Rivers[292] all involved dams that have existing generation in place. They also all involved the assessment of a system of dams and allowed for additional options to be developed.[293] Adding the financial incentive of the PTC could help tip the economics in favor of replacing the old dam with a hydroelectric generation facility that does not impose the same burden on the ecosystem.

The decision to remove a dam includes economic and environmental components. Correcting the tax credit imbalance helps move the economics in favor of river restoration and dam removal. Correcting the differential treatment will not result in the onset of a new era of dam construction if limits are placed on the expansion of the PTC. What it could do is incent the next round of dam removals.

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289. *Benefits of Dams,* FED. EMERGENCY MGMT. AGENCY, https://www.fema.gov/benefits-dams (last visited Oct. 31, 2016).

290. *See Case Study – Restoration of the Elwha River Ecosystem*, U.S. DEPT. OF AGRIC., http://www.nrcs.usda.gov/wps/portal/nrcs/detail/ga/plantsanimals/?cid=stelprdb1044696 (last visited Oct. 31, 2016) (the Elwha River dam removal project removed two dams both of which were producing hydropower).

291. *See Klamath Hydroelectric Settlement Agreement*, KLAMATH RESTORATION AGREEMENTS, http://www.klamathrestoration.org/index.php/klamath-hydroelectric-settlement-agreement (last visited Oct. 31, 2016) (the Klamath River dam removal proposal would remove four dams owned by PacifiCorp and used for the production of electricity).

292. *See Project Overview*, PENOBSCOT RIVER RESTORATION TRUST, http://www.penobscotriver.org/content/4152/project-overview (last visited Oct. 31, 2016) (the Lower Penobscot River Basin Comprehensive Settlement included dam removals, upgrades to the generation capacity at existing dams, and the construction of a fish bypass at one dam and the improvement of bypasses at four other dams).

293. *Supra* notes 290–292, and accompanying text.

VII. CONCLUSION

America's relationship with dams has gone through many phases in the past 150 years: from little dams used to enhance navigation, to big hydroelectric dams that fueled an economic boom, to little hydropower projects that pull energy from moving water without minimal environmental impact. The next phase of dam removal and dam replacement is just beginning.

America's regulatory system, energy markets, and taxation system have struggled to adapt to the changes. Each system assumes characteristics specific to the time it was developed. Permitting and licensing are designed for large hydro projects, tax incentives do not view hydropower as a desirable form of renewable energy, and energy markets split hydropower into large dams and run-of-river projects. The combination of opposing systems limits the potential of small-scale and conduit hydropower projects. HREA's update to the regulatory system has streamlined permitting and licensing requirements. The energy markets continue to perfect the predictability of generation from renewable energy facilities. The tax system remains attached to the time period in which it was developed.

Congress chose to first exclude, and then partially include small-scale hydropower projects in the production tax credit program.[294] The hydropower PTC will cease at the end of 2016 while the wind PTC will continue in a modified form for several more years.[295] Congress should grant the same terms to small hydropower and conduit power, as it afforded to wind power. The licensing process has been streamlined, the markets are working to integrate more variable energy resources, and the next step should be to correct the economic imbalance created by the production tax credit. Doing so would create a new economic tool for restoring America's rivers.

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294. *Renewable Energy Production Tax Credit (PTC)*, DEP'T OF ENERGY http://energy.gov/savings/renewable-electricity-production-tax-credit-ptc (last visited Oct. 31, 2016).

295. *Id.*