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R STREET POLICY STUDY NO. 105
August 2017

EBBING THE FLOW OF HYDROPOWER RED TAPE

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EXECUTIVE SUMMARY

Whether the United States can retain and expand domestic hydropower will depend significantly on the extent to which it is able to enact regulatory reform. Despite common arguments to the contrary, hydropower is far from "tapped out," as evidenced by a recent U.S. Energy Department (DOE) study that found the potential for hydropower to grow nearly 50 percent beyond its current capacity.[1] Reforms to permitting and regulatory processes—the most commonly cited challenges associated with hydropower development—may unleash much of this potential.[2]

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The amount of red tape necessary to obtain permits to construct or relicense a hydropower project reflects a bureaucratic legacy accumulated through state and federal implementation of expansive federal environmental statutes. In most cases, the Federal Energy Regulatory Commission (FERC) plays an administrative role, while state water-quality agencies have *de facto* power over permitting approvals, denials and delays of hydropower licensure. The current regulatory regime primarily relies on a one-size-fits-all process that overscrutinizes low-impact projects and requires inefficient reviews for most others, even those where stakeholders have resolved disputes. However, hydropower deserves no more regulatory scrutiny than the commensurate maximum potential environmental impact (e.g., water quality, ecosystem effects).

Lengthy and ambiguous permitting processes at the federal and state levels create excessive artificial barriers to entry that render many hydropower projects difficult to finance.[3] Considering the low-air- emissions profile of hydropower, excessive environmental regulation counterintuitively may increase air pollution (hydropower expansion generally displaces at least some fossil-fuel generation). Accordingly, policymakers should focus on the mitigation of artificial costs created by regulatory processes (both direct and indirect, e.g., licensure uncertainty and delays that increase financing costs) rather than artificially reducing natural barriers to investment (e.g., subsidies to counteract high capital costs). This can be accomplished while mitigating environmental concerns in a cost-effective manner.

While some recent legislative and executive actions have reduced certain regulatory burdens, additional reductions could greatly mitigate artificial barriers to hydropower development. Possible reforms could take the form of

1. U.S. Department of Energy, *Hydropower Vision: A New Chapter for America's 1st Renewable Energy Source*, 2016, p. xvii. https://energy.gov/sites/prod/files/2016/10/f33/Hydropower-Vision-10262016_0.pdf. These numbers are based on current hydropower capacity of 101 gigawatts and potential of 150 gigawatts.

2. Federal Energy Regulatory Commission, *Report on Hydroelectric Licensing Policies, Procedures, and Regulations—Comprehensive Review and Recommendations Pursuant to Section 603 of the Energy Act of 2000*, U.S. Department of Energy, May 8, 2001, p. 5. https://www.ferc.gov/legal/maj-ord-reg/land-docs/ortc_final.pdf.

3. U.S. Department of Energy, *Quadrennial Energy Review Transforming the Nation's Electricity System: The Second Installment of the QER*, January 2017, p. 3-18. https://www.energy.gov/sites/prod/files/2017/02/f34/Quadrennial%20Energy%20Review--Second%20Installment%20%28Full%20Report%29.pdf.

major statutory overhauls, targeted statutory reforms and implementation improvements by executive branch agencies. Accordingly, this paper focuses on certain incremental reforms that are well within reach of Congress and the Trump administration.

Specifically, Congress and the administration should prioritize the reduction of uncertainties and delays in hydropower licensure, which largely stem from duplicative processes, poor dispute resolution and lack of schedule discipline, especially from agencies that attempt to implement the Endangered Species Act (ESA) and that delegate water-quality permitting under Section 401 of the Clean Water Act (CWA). Thoughtful improvements in federal implementation may substantially increase licensing predictability and reduce regulatory timeframes without compromises to environmental quality. To this end, suggested executive priorities for the Trump administration include:

1. Implement the 2011 FERC-Army Corps of Engineers memorandum of understanding by providing training and ongoing advice to targeted Corps districts.
2. FERC should launch a public inquiry to gain feedback and seek improvements (e.g., schedule discipline) in its alternative licensing process (ALP), which has fallen short of its significant potential to achieve stakeholder consensus around contentious projects.
3. Revise FERC's hydropower performance goal of 24 months to issue an order. A shorter (e.g., one-year) performance goal is more appropriate for low-impact projects and those that successfully complete an ALP process.
4. Expand that use of conditional licensing to all hydropower projects, recognizing the advantages of FERC's conditional certificates currently used in the natural gas program. This would encourage expedited interagency review, but may require statutory amendments to the Federal Power Act.
5. Improve FERC's relicensing terms (e.g., increase terms to 50 years). Namely, FERC should build upon the agency's recently issued notice of inquiry to obtain public input on license terms.
6. Improve stakeholders' access to information and understanding of regulatory processes (e.g., to build on DOE's 2014 toolkit[4]) and to encourage dispute-resolution mechanisms in lieu of extended litigation.
7. Use the DOE to facilitate discussions among agencies for regulatory implementation reforms.

4. See rapidtoolkit.org

While such changes in FERC regulations and policies may reduce the cost of licensing, they are not an adequate substitute for legislative reform.[5] Accordingly, the following congressional and executive priorities must also be undertaken:

1. Consider making FERC the sole federal decisionmaking authority—to include schedule enforcement and for licensing conditions and processes.
2. Introduce regulatory transparency requirements and adjust agency funding terms or performance requirements to expedite reviews, especially by linking performance with delegated state authority under Section 401 of the CWA. Federal performance targets should prioritize ESA and National Environmental Policy Act (NEPA) study development and FERC performance metrics, including by facilitating dispute resolution.
3. Study privatization of federally owned dams and alternative project finance mechanisms for maintenance and upgrades.
4. Exclude *de minimis* projects (e.g., conduits and certain small conventional hydropower) from licensing and exemption requirements altogether and "right-size" the default regulatory treatment of projects with low incremental impact (e.g., build on pilot programs for small projects).
5. Eliminate redundant interagency processes by requiring agencies to cooperate with one another and to use a single NEPA analysis for federally owned projects and single water-quality analysis for nonfederal FERC projects.

INTRODUCTION

A recent U.S. Energy Department (DOE) report found that hydropower could grow from 101 gigawatts (GW) to 150 GW by 2050 (for reference, 1 GW is about the size of a large coal plant or nuclear reactor).[6] The report finds the greatest prospects for hydropower growth between now and 2030 come from powering nonpowered dams and optimizing and upgrading the existing fleet. Conduit projects (e.g., municipal water pipelines) and new stream development capable of

5. Federal Energy Regulatory Commission, *Report on Hydroelectric Licensing Policies, Procedures, and Regulations* (2001), p. 6. https://www.ferc.gov/legal/maj-ord-reg/land-docs/ortc_final.pdf.

6. U.S. Department of Energy, *Hydropower Vision* (2016), p. xvii. https://energy.gov/sites/prod/files/2016/10/f33/Hydropower-Vision-10262016_0.pdf.

meeting the current stringent environmental requirements both also have considerable growth prospects.[7]

Hydropower is one of the most efficient generating technologies.[8] Additionally, it produces few direct emissions, making it, on average, one of the cleanest power sources. These factors bolster its appeal to policymakers and lowers its investment-risk profile, particularly when considered in the context of potential emissions-reductions policies.[9]

However, hydropower development must be balanced with other environmental concerns, which include adverse ecosystem effects on rivers and water-quality concerns for the human and natural environment. Hydropower development also may affect visual aesthetics, recreational values and cultural or historical sites. These effects have led to extensive environmental permitting and review procedures that determine power generation and necessary river flows, reservoir levels and public access, all of which profoundly affect wildlife, fish and recreational activities.[10] Fortunately, since passage of the National Environmental Policy Act in 1970 (NEPA), hydro regulators and stakeholders have had the knowledge and experience to mitigate most adverse environmental effects to acceptable levels. However, hydropower-licensure processes, which are narrowly focused on water resources, do not efficiently weigh the costs and benefits and may ultimately increase emissions through the deterrence of hydro investment that would displace fossil-fuel generation.

Further, developers often find hydropower projects difficult to finance due to high capital costs, lengthy[11] and convoluted permitting processes at the federal and state level and environmental concerns.[12] While high capital costs are a natural barrier to investment, policymakers should focus on mitigating artificial costs created by regulatory processes, while cost-effectively doing the same for environmental concerns. Reforms may yield large benefits, considering that permitting and regulatory processes are the most commonly cited challenges associated with hydropower development.[13]

Cost-effective retention and expansion of domestic hydropower greatly depends on regulatory reform, the education of stakeholders and improved stakeholder collaboration in regulatory reviews. Possible reforms to improve hydropower regulation include major statutory overhauls, targeted statutory reforms and improved performance by federal and state agencies. This paper focuses on the kinds of incremental reforms that are well within reach of Congress and the Trump administration.

REGULATORY ARCHITECTURE

Historical regulatory development

The roots of hydropower regulation date back to the 1902 Reclamation Act, which funded irrigation projects and established what is now known as the Bureau of Reclamation. In 1920, Congress passed the Federal Water Power Act, now known as the Federal Power Act (FPA).[14] This statute established the Federal Power Commission (FPC—later renamed the Federal Energy Regulatory Commission, or FERC) to better regulate hydropower development. Early efforts focused on regulating projects for multiple developmental uses like power, irrigation, navigation and flood control. Hydropower saw large development in the 1930s and during World War II.

The hydropower industry developed sites with the highest power-generation potential. After World War II, there was a great deal of interest in the ability of inexpensive electricity to fuel economic development in various regions and also to provide improved navigation. Accordingly, some of the largest projects regulated by FERC today were authorized in the early 1950s, when little or no environmental review was required. Falling into this category were projects like New York State's 912 MW St. Lawrence-FDR Project, a part of the St. Lawrence Seaway Project, and the 2,755 MW Niagara Project. The FPC also authorized similar projects in the Pacific Northwest on the Columbia River, including the 1,755 MW Priest Rapids Project.[15]

Specific sections of the FPA, notably sections 4(e) and 18, allow the Interior and Commerce departments to prescribe mandatory fishways at hydro projects, while also authorizing

7. U.S. Department of Energy, *Hydropower Vision* (2016), pp. xvii, 14, 18. https://energy.gov/sites/prod/files/2016/10/f33/Hydropower-Vision-10262016_0.pdf. Indeed, this potential is likely understated in the DOE report due to data limitations.

8. Based on accepted industry knowledge, the authors estimate that modern hydro turbines can convert as much as 90% of the available energy into electricity. The best fossil fuel plants are only about 60% efficient.

9. Some reservoirs may have sizeable methane emissions. Global studies of both temporal and tropical reservoirs have inconsistent measuring techniques and seasonal sampling, which make actual differences in emissions among reservoirs difficult to determine. This area requires more study to reach reliable results.

10. "Written Testimony of David Steindorf on Behalf of the Hydropower Reform Coalition," U.S. House of Representatives Energy and Commerce Committee Hearing on Modernizing Energy Infrastructure: Challenges and Opportunities to Expanding Hydropower Generation, March 15, 2017, 2. http://docs.house.gov/meetings/IF/IF03/20170315/105702/HHRG-115-IF03-Wstate-SteindorfD-20170315.pdf.

11. The lengthy process often disadvantages new hydropower projects relative to other power generating projects.

12. U.S. Department of Energy, *Quadrennial Energy Review* (2017), p. 3-18. https://www.energy.gov/sites/prod/files/2017/02/f34/Quadrennial%20Energy%20Review--Second%20Installment%20%28Full%20Report%29.pdf.

13. Federal Energy Regulatory Commission, *Report on Hydroelectric Licensing Policies, Procedures, and Regulations* (2001), p. 5. https://www.ferc.gov/legal/maj-ord-reg/land-docs/ortc_final.pdf.

14. R Street Institute, "Federal Power Act and Organized Electricity Markets," *Electricity 101 Series* No. 1, August, 2016. http://www.rstreet.org/wp-content/uploads/2016/08/electricity1.pdf.

15. Thomas Russo, "The U.S. Federal Energy Regulatory Commission Lessons Learned in the Last 78 years," Contributing Paper to the World Commission on Dams, 1999, 5. http://www.russoonenergy.com/sites/default/files/WCD-lessons_learned-hydro-trusso.pdf.

land-management agencies like the U.S. Forest Service and Bureau of Land Management to stipulate mandatory conditions for hydropower projects located on federal land.[16] Subsequent statutes, especially those in the 1960s and 1970s, added licensure requirements to hydropower and expanded the role of new agencies in that process. Key statutes include the National Environmental Policy Act (NEPA), the Clean Water Act (CWA), Coastal Zone Management Act (CZMA), Endangered Species Act (ESA), Wild and Scenic Rivers Act (WSRA) and National Historic Preservation Act (NHPA).

In particular, the CWA influences hydropower development, as a state must grant or waive a Section 401 water-quality certification before FERC can grant a license. This has resulted in state water-quality agencies having *de facto* control over hydropower permitting, while FERC plays a mostly administrative role. NEPA also has a significant effect on hydropower development, through its requirement of some federal agencies to consider environmental effects pursuant to NEPA before issuing permits for original (new) projects, as well as before relicensing or amending existing ones.

Current regulatory climate

Contemporary hydropower regulation falls into two broad categories based on ownership: federal and nonfederal, the latter of which is regulated by FERC.[17] Regulation follows myriad laws at the federal, state and tribal levels. The regulatory process involves numerous stakeholders, including federal and state agencies, Indian tribes and nongovernmental organizations (NGOs) that represent industry, environmental, recreational and cultural/historical interests. All parties may influence the outcome and pace of the regulatory processes.

The public sector owns the majority of U.S. hydropower capacity, whereas the private sector owns the majority of individual projects (public plants are typically larger than private plants).[18] The federal government owns and operates about half of hydropower capacity. The Bureau of Reclamation and the U.S. Army Corps of Engineers own and manage 90 percent of federal hydropower capacity,[19] which Congress usually authorizes and funds.[20]

However, as infrastructure ages, continued hydropower production and development at federal facilities face major challenges, especially at Army Corps facilities.[21] Congressional appropriations and, in some cases, authorizations are generally needed to finance major upgrades and expansions beyond immediate maintenance.[22] Federal facilities also face constraints from negotiated operating terms that are designed to balance competing uses of water resources that often affect multiple states.[23] However, economic valuation does not directly determine water allocation among competing demands, such as navigation, public water supply, irrigation, flood control and recreation. This results in scarce water resources not necessarily going to their most productive uses, especially for many large hydropower projects that have substantial multi-use economic benefits.

For nonfederal projects, FERC develops a NEPA document that considers the trade-offs between developmental uses and environmental impacts, using in-house expertise as well as the expertise of federal and state fish, wildlife and water-quality certifying agencies. For example, a state water-quality agency will often cite Section 401 and its legal obligation to maintain water-quality standards as justification for specific conditions. Other agencies, including those with mandatory FPA Section 4(e) and 18 authorities, rely on their expertise and written evidence to support their own conditions.

FERC is required by FPA Section 10(a) to consider both developmental and nondevelopmental uses in order to ensure the best comprehensive development of the waterway. However, FERC historically has not relied on a cost-benefit analysis to weigh trade-offs between power and other developmental uses, and environmental benefits and mitigation costs. Instead, FERC relies on substantial evidence—which includes written recommendations and mandatory conditions from agencies and the public, and an independent NEPA review—before making a licensure decision. FERC scrutinizes all agency conditions, including those that are mandatory, when it decides whether to issue a license. However, it must include the mandatory conditions in any license issued, even if it disagrees with them. Further, all of its licensing decisions are subject to administrative and court appeals.

FERC licenses and oversees nonfederal hydropower projects—those owned or developed by public and private utilities, independent power producers and private power marketers. FERC regulation is considered "cradle to grave," which means that it includes licensing new projects, relicensing existing ones and providing dam safety and environ-

16. The full text of the Federal Power Act is available at: https://legcounsel.house.gov/Comps/Federal%20Power%20Act.pdf.

17. FERC also regulates non-federal uses at federal dams.

18. Kelsi Bracmort, et al., *Hydropower: Federal and Nonfederal Investment*, Congressional Research Service, July 7, 2015, p. 4. https://fas.org/sgp/crs/misc/R42579.pdf.

19. National Hydropower Asset Assessment Program, "Existing hydropower assets dataset," Oak Ridge National Laboratory, 2015. https://nhaap.ornl.gov/existing_hydropower_assets.

20. Bracmort, et al. (2015), p. 10. https://fas.org/sgp/crs/misc/R42579.pdf.

21. Ibid., p. 19.

22. Ibid., p. 10.

23. Ibid., p. 13.

mental oversight throughout the term of a license.[24] Industry stakeholders express concerns that "regulatory process inefficiencies, overlaps and interpretations" lead to both delays and unnecessary costs, which result in long-term hydropower business risks.[25] Further, outcome uncertainty, litigation risk and delays in the licensing processes often adversely affect both costs and financing options. In contrast, amendments and exemptions to licenses are generally simpler and quicker for FERC to process than new ones (the vast majority of amendments take six months or less to process).[26] Still, some owners appear reluctant to amend their license out of concern that agencies will require additional conditions and thus erode any power benefits.

The slow rate of FERC licensure for nonfederal projects has received criticism. However, most delays result from factors outside of FERC's control.[27] This is because the statutory scheme disperses decisionmaking among federal and state agencies that act independently of FERC's proceedings.[28] While FERC has some control over the costs of license applications and environmental mitigation expenditures, it cannot override other federal and state agency requirements with respect to Section 401 and 404; Section 408 of the Rivers and Harbors Act; or land management agencies' decisions. State water-quality certifications and CZMA frequently drive these costs and override FERC's ability to balance all relevant factors affecting the public interest.

Further, untimely receipt of state Section 401 certificates is the most common cause of proceeding delays.[29] Water-quality certifications under the CWA and, to a lesser degree, biological opinions under the ESA are the worst culprits.[30] These statutes contain deadlines for agency action, but the authorizing agency may extend them if, for example, a state agency concludes that inadequate information exists to reach a decision (sometimes made after extensive delay). In fact, some states, such as California, often sit on water-quality applications for years before asking the applicant to refile. This occurs even when all stakeholders have signed a comprehensive settlement agreement, which cannot take effect until FERC receives the certificate and acts on the license application. Delays also stem from federal agencies. For example, the Fish and Wildlife Service routinely misses its schedule for biological opinions under the ESA.[31]

As of 2015, FERC waited an average of five years for water-quality certification or biological opinions after completing its final NEPA.[32] More than one-third of its pending hydropower relicense applications are awaiting approvals from other agencies.[33] Larger, more complex applications face particularly acute challenges to a timely and efficient review under the current shared decisionmaking paradigm.[34]

Regulatory inefficiencies and uncertainty have major implications for all forms of existing hydropower project relicensure. Over the next 10 years, existing FERC licenses will expire for about 250 projects, totaling 16,000 MW, or 20 percent of existing capacity.[35] The average existing project will take five to eight years to relicense, including at least three years of pre-filing activity and another two years or more after the application is filed.[36]

These regulatory delays and uncertainties also hinder new hydropower development, as such investment requires a degree of certainty in economic viability early in the development process that only increases as the process progresses.[37] Hydropower development at previously undeveloped sites will likely remain very limited without advances in technologies and project development methods.[38]

Further, nonfederal development at federal facilities faces redundant review processes that require both a FERC license and a Corps Section 408 permit. Such regulatory duplication unnecessarily constrains prospects for powering nonpowered dams, which is currently a prime potential hydropower growth area, as the Army Corps owns 81 of the

24. The term is 50 years for original licenses and 30-50 years for reissued ones.

25. U.S. Department of Energy, *Hydropower Vision* (2016), p. 13. https://energy.gov/sites/prod/files/2016/10/f33/Hydropower-Vision-10262016_0.pdf

26. "Testimony of John Katz, Deputy Associate General Counsel to the U.S. House of Representatives Committee on Energy and Commerce Subcommittee on Energy and Power," Hearing on Legislation Addressing Pipeline and Infrastructure Modernization, May 2017, 15. http://docs.house.gov/meetings/IF/IF03/20170503/105916/HHRG-115-IF03-Wstate-KatzJ-20170503.pdf. While amendments and exemptions take less time to process, the hydropower developer must determine if the projects as licensed or exempted are still financially feasible.

27. Bracmort, et al. (2015), pp. 13-16. https://fas.org/sgp/crs/misc/R42579.pdf.

28. Federal Energy Regulatory Commission, *Report on Hydroelectric Licensing Policies, Procedures, and Regulations* (2001), p.5. https://www.ferc.gov/legal/maj-ord-reg/land-docs/ortc_final.pdf.

29. Ibid., p.5.

30. "Testimony of John Katz" (2017), 14. http://docs.house.gov/meetings/IF/IF03/20170503/105916/HHRG-115-IF03-Wstate-KatzJ-20170503.pdf.

31. This is based on personal conversations with industry experts.

32. U.S. Department of Energy, *Hydropower Vision* (2016), p. 144. https://energy.gov/sites/prod/files/2016/10/f33/Hydropower-Vision-10262016_0.pdf

33. "Testimony of John Katz" (2017), 8. http://docs.house.gov/meetings/IF/IF03/20170503/105916/HHRG-115-IF03-Wstate-KatzJ-20170503.pdf.

34. Ibid., 10.

35. U.S. Department of Energy, *Quadrennial Energy Review* (2017), p. 3-19. https://www.energy.gov/sites/prod/files/2017/02/f34/Quadrennial%20Energy%20Review--Second%20Installment%20%28Full%20Report%29.pdf

36. Ibid.

37. U.S. Department of Energy, *Hydropower Vision* (2016), p. 144. https://energy.gov/sites/prod/files/2016/10/f33/Hydropower-Vision-10262016_0.pdf

38. Ibid., p. 20. DOE efforts aim to standardize technologies with the intent of expediting regulatory approval.

TABLE I: AGENCY AUTHORIZATIONS REQUIRED FOR NEW HYDROPOWER CAPACITY

<table>
<tr><th rowspan="2"></th><th colspan="3">DAM</th><th colspan="2">CONDUIT</th><th rowspan="2">New Stream-Reach Development</th></tr>
<tr><th>Nonpowered Army Corps</th><th>Nonpowered Bureau of Reclamation</th><th>Nonfederal, Nonpowered</th><th>Bureau of Reclamation</th><th>Nonfederal</th></tr>
<tr><td><= 5 MW</td><td rowspan="4">FERC license and Sect. 408 permit from Army Corps</td><td rowspan="4">FERC license or Bureau of Reclamation LOPP</td><td rowspan="2">FERC exemption or license</td><td rowspan="4">Bureau of Reclamation LOPP</td><td>“Qualifying Conduct” Status Petition</td><td rowspan="2">FERC exemption or license</td></tr>
<tr><td><= 10 MW</td><td rowspan="2">FERC conduit exemption</td></tr>
<tr><td><= 40 MW</td><td rowspan="2">FERC license</td><td rowspan="2">FERC license</td></tr>
<tr><td>> 40 MW</td><td>FERC license</td></tr>
</table>

SOURCE: Derived from DOE[1]
NOTE: LOPP refers to “lease of power privilege.”

1. U.S. Department of Energy, 2014 Hydropower Market Report (2015), p. 17. https://www.energy.gov/sites/prod/files/2015/04/f22/2014%20Hydropower%20Market%20Report_20150424.pdf

top 100 sites.[39] For example, FERC may license additional generation to nonpowered federal dams, but construction waits for additional approvals from the federal owner (Army Corps or Bureau of Reclamation).[40]

LEGISLATIVE REFORMS

In light of such regulatory barriers, legislative prioritization should focus on those processes that deter the most investment opportunities. It should be guided by cost-benefit and risk analysis, with the goals of enhancing regulatory transparency, predictability and efficiency. In particular, emphasis should be placed on streamlining regulatory treatment for relicensure and modifying existing facilities, and on reducing or eliminating regulatory burdens for low-impact projects. This primarily concerns nonfederal facilities under FERC’s jurisdiction, but conduit exemptions, a *de minimis* standard for small conventional projects (e.g., under 1 MW) and streamlining processes for nonfederal uses at federal facilities all hold considerable promise.

For nonfederal facilities, legislative improvements may take the form of sweeping or incremental reforms to a variety of statutes, most notably the FPA, CWA, CZMA, NEPA, ESA and FAST-41 (Fixing America’s Surface Transportation Act). Congress may also consider regulatory transparency requirements by adjusting agency funding terms or performance requirements to expedite reviews.

Priority reforms for nonfederal facilities and uses include eliminating redundancies and imposing schedule discipline for all agencies that participate in the FERC licensure process, regardless of statute. FERC itself has noted that:

> [T]he most effective way to reduce the cost and time of obtaining a hydropower license would be for Congress to make legislative changes necessary to restore the Commission’s position as the sole federal decisional authority for licensing conditions and processes.[41]

Several recent bills have sought process coordination by proposing to establish FERC as the lead agency to coordinate federal authorizations and NEPA compliance for hydropower licensing, license amendments and exemptions. FERC officials have expressed concern that expansion of the commission’s responsibilities without the authority to enforce the schedule could have unintended consequences and increase the complexity and length of the licensure process.[42] To grant schedule-enforcement capabilities or impose statutory deadlines could expedite both licensing and capacity-adding amendments, but may not benefit other amendments and exemptions (because these are often simple, quick reviews).

Moreover, eliminating redundant statutory requirements would provide considerable benefit, especially for water-quality and CZMA reviews. Under the FPA, FERC water-quality reviews are duplicative of state reviews under the CWA, and the stringency of water-quality permitting varies by state. For example, hydro-heavy Washington, California and New York have especially stringent standards. Congress could eliminate redundancy via revisions to either the FPA or CWA. Limiting statutory permitting processes for nonfederal uses at federal facilities to one agency also would eliminate duplication. Success may depend on the process quality of the lead agency—for example, industry tends to prefer FERC’s definitive review process, which the Army

39. “Written Testimony of Ramya Swaminathan, CEO, Rye Development before the U.S. House of Representatives Committee on Energy and Commerce Subcommittee on Energy,” Hearing on Modernization Energy Infrastructure: Challenges and Opportunities to Expanding Hydropower Generation, March 15, 2017, 8. http://docs.house.gov/meetings/IF/IF03/20170315/105702/HHRG-115-IF03-Wstate-SwaminathanR-20170315-U1.pdf.

40. Ibid., 13.

41. Federal Energy Regulatory Commission, *Report on Hydroelectric Licensing Policies, Procedures, and Regulations* (2001), p. 6. https://www.ferc.gov/legal/maj-ord-reg/land-docs/ortc_final.pdf.

42. “Testimony of John Katz” (2017), 15. http://docs.house.gov/meetings/IF/IF03/20170503/105916/HHRG-115-IF03-Wstate-KatzJ-20170503.pdf.

Corps lacks. An alternative would be to require other federal agencies to adopt FERC's NEPA analysis if it covers the same project within a particular time period.[43]

Congress may also inquire on the progress of FERC and the Council on Environmental Quality (CEQ) to persuade state water-quality-certification and fish-and-wildlife agencies to cooperate in preparing the NEPA review. For example, the New York Department of Environmental Conservation worked successfully with FERC to relicense the St. Lawrence-FDR and Niagara Projects, both of which included comprehensive settlement agreements approved by FERC. Improved NEPA coordination would require cooperating agencies to waive their right to intervene, which would eliminate the possibility of legal challenges to associated FERC orders.[44]

Statutory reform may enable the regulatory process to better account for the heterogeneity of environmental impacts from various hydropower projects. A "one-size-fits-all" intensive review process is inappropriate for small-impact projects, including continued operations (relicensing) and some modifications to existing facilities. Uniform licensure processes impose disproportionate transaction costs for small hydropower projects, which sometimes carry a much lower environmental risk profile. Owners of small projects report that the associated costs may ultimately render projects economically infeasible.[45] One possible avenue for congressional action is to differentiate the regulatory treatment for powering nonpowered dams, new stream-reach development and relicensing to be commensurate with the environmental profile of each project type.

Two congressional reforms in 2013 targeted small hydropower development:

1. The Hydropower Regulatory Efficiency Act of 2013 granted small hydropower projects (10 megawatts or less) an exemption from FERC licensing requirements;[46] raised the FERC exemption for conduit projects to 40 megawatts (MW); and required FERC to examine a two-year licensing process for nonpowered dams and closed-loop pumped storage projects.[47] Some hydropower developers considered FERC's two-year pilot process successful, highlighting the benefits of imposing strict and published timelines for all parties.[48] Other developers indicate limited interest in emulating the process.[49]
2. The Bureau of Reclamation Small Conduit Hydropower Development and Rural Jobs Act authorized nonfederal conduit (less than 5 megawatts) hydropower development at all Bureau of Reclamation projects and partially streamlined the regulatory process. The law reduced redundancy by authorizing the Bureau of Reclamation (not FERC) as the lead agency, while also allowing categorical exclusions under NEPA for select projects. This encourages small conduit development at bureau-owned pipelines, aqueducts, canals and other waterways.

The costs and risks associated with hydropower licensure are often not commensurate with the environmental impacts. Cost-benefit analysis (CBA) forms the basis of efficient regulatory decisions, but does not drive the balancing—that is, equal consideration of all relevant factors in the public interest—under prevailing statutes for hydropower regulation. In the case of hydropower, federal agencies with mandatory conditioning authority and Section 401 and CZMA authority are not required to perform a CBA on their conditions. Nevertheless, FERC must include these conditions in the license, along with the associated costs.

Some agencies and environmental stakeholders have resisted the idea that environmental agencies should have to justify their conditions and demonstrate benefits. Even when FERC determines the benefits of reduced air emissions and fossil fuel displacement, the commission's focus, as well as that of other stakeholders, remains on the riverine impacts and benefits. Thus, no robust consideration of environmental trade-offs has occurred, which may result in net negative environmental impacts from stunted hydropower retention or growth. Travis Kavulla, a commissioner at the Montana Public Service Commission, has referred to hydropower licensing processes as the "*reductio ad absurdum* of a stakeholder-controlled process where everyone gets a slice of the action, but which loses focus on more important items."[50]

43. "Testimony of Ramya Swaminathan" (2017), 11. http://docs.house.gov/meetings/IF/IF03/20170315/105702/HHRG-115-IF03-Wstate-SwaminathanR-20170315-U1.pdf

44. Congress may need to consider an exception under the Administrative Procedures Act.

45. "Written Testimony of Jeffrey Leahey, Deputy Executive Director On behalf of The National Hydropower Association Before the U.S. House of Representatives Energy and Commerce Committee Subcommittee on Energy," Hearing on Legislation Addressing Pipeline and Hydropower Infrastructure Modernization, May 2017, 19. http://docs.house.gov/meetings/IF/IF03/20170503/105916/HHRG-115-IF03-Wstate-LeaheyJ-20170503.pdf.

46. This does not mean exempt from FERC requirements, but rather exempt from Part I of the FPA. This means FERC cannot use its balancing authority under FPA sections 10 and 4(e) but other agencies have total mandatory conditioning authority.

47. Bracmort, et al. (2015), p. 22. https://fas.org/sgp/crs/misc/R42579.pdf. It also enabled a 60-day FERC process for non-federal conduits under 5 MW.

48. "Testimony of Ramya Swaminathan" (2017), 2, 9. http://docs.house.gov/meetings/IF/IF03/20170315/105702/HHRG-115-IF03-Wstate-SwaminathanR-20170315-U1.pdf.

49. Success in the pilot case resulted from Kentucky's issuance of a conditional water-quality permit, which most states would not entertain.

50. Travis Kavulla, "There is No Free Market for Electricity: Can There Ever Be?", *American Affairs* 1:2 (2017). https://americanaffairsjournal.org/2017/05/no-free-market-electricity-can-ever/.

Expanded use of CBA in hydropower regulation may alter decisions significantly, as some hydropower environmental compliance costs are quite large. In some cases, compliance costs escalate dramatically. For example, the Bonneville Power Administration estimated that costs for fish-and-wildlife mitigation, including ESA, exceeded $800 million, or roughly 30 percent of BPA's charges to ratepayers in 2010.[51] A more typical example is Exelon's 574 MW Conowingo Project on the Susquehanna River, which is undergoing relicensing. Fish-and-wildlife agencies may require additional measures, since American Shad runs are down significantly, despite a $12 million fish lift built 22 years ago to pass fish upstream. Revisions to the FPA, CWA and ESA may result in better accounting for the costs and benefits of relicensing, modifications or new hydropower projects. Further, as such methodology has had pronounced shortcomings in the past, these types of actions would benefit from improved environmental-valuation techniques.

On a cost-benefit basis, small-impact hydro projects warrant reduced default regulatory treatment, while those with *de minimis* impact should be exempt. Developing criteria for low-controversy projects that have minimal and mitigatable impacts would set the stage to expand the two-year process. Relicensing 30-to-50-year-old smaller projects built prior to the passage of NEPA, CWA and other key statutes may not be economically viable after environmental-mitigation and dam-safety measures. Larger projects, especially those with peaking capacity, are better able to absorb such costs.[52]
One such *de minimis* exemption would include conduit projects, which by their nature are either man-made structures or water-supply pipelines used for municipal or irrigation purposes. Their limited environmental footprints warrant exclusion from FERC regulation and categorical exemptions at federal dams for the purposes of NEPA.

For federally owned facilities, Congress could pursue alternative project financing mechanisms or privatize federally owned dams (powered and nonpowered), both without increasing public expenditures. Alternative financing includes using private performance contracts that could avoid annual appropriations requirements.[53] Privatizing public infrastructure works well when the private sector can manage assets or services more efficiently than the government and when competitive forces drive down costs over time.[54] These conditions apply to public hydropower, as federal management has come under scrutiny.

While there is considerable potential to expand capacity at existing facilities, many federal facilities currently sell power below market rates. Privatization would therefore increase rates for certain constituencies. Since applicable laws depend on federal and nonfederal ownership status, privatizing dams would remove some legal barriers to hydropower development. It would also eliminate reliance on congressional approval for project funding and reduce the deficit. While it is true that privatization would require greater legislative commitment than some incremental reforms, Congress could move the discussion along if it follows the advice of the American Society of Civil Engineers to at least study such an option for select federally owned dams.[55]

Congress and the U.S. Environmental Protection Agency (EPA) should also re-examine how delegation of Section 401 authority to the states is working for the hydropower and natural gas programs. Specifically, Congress or the EPA should make continued delegation of the CWA and CZMA conditional on regulatory performance and the timely review and issuance of permits. Congress or the EPA could, for example, request that states report their performance and explore incentives for improved performance. Given state agency resource constraints, Congress may consider mechanisms to reimburse water-quality agencies for the cost of hydropower reviews and for issuing timely water-quality certificates—a mechanism that already exists for federal and state fish-and-wildlife and federal land-management agencies.

Congress can also seek input from FERC and the EPA on whether Section 401 permits apply at all hydro projects. While few would argue that CWA permits apply to greenfield hydro projects or those that propose new construction, Congress and the EPA should determine whether projects that are being relicensed with no new construction are required to obtain a water-quality certificate. If no certificate is required, FERC would rely on the recommendations of all federal and state agencies to determine the appropriate level of protection, mitigation and enhancement for a project.

Despite the slow pace of hydropower licensure, many industry proponents and stakeholders have used the dispute-res-

51. "Statement of R. Scott Corwin, Executive Director, Public Power Council, to the U.S. House of Representatives Committee on Natural Resources," Hearing on H.R. 1719, Endangered Species Compliance and Transparency Act of 2011, September 2011, 29-30. https://www.scribd.com/document/326625103/HOUSE-HEARING-112TH-CONGRESS-H-R-1719-ENDANGERED-SPECIES-COMPLIANCE-AND-TRANSPARENCY-ACT-OF-2011-AND-H-R-2915-AMERICAN-TAXPAYER-AND-WESTE.

52. Larger projects may face other financial constraints like the limited peak production that results from required environmental conditions.

53. Bracmort, et al. (2015), p. 19. https://fas.org/sgp/crs/misc/R42579.pdf.

54. "The Art of the Deal: the promise and pitfalls of privatizing public assets," *The Economist*, June 22, 2017. https://www.economist.com/news/united-states/21723870-privatisation-can-increase-efficiency-and-spur-investment-it-can-also-go-wrong-promise.

55. "Testimony of The American Society of Civil Engineers to the U.S. House of Representatives Committee on Energy and Commerce Subcommittee on Energy," Hearing on Modernizing Energy Infrastructure: Challenges and Opportunities to Expanding Hydropower Generation, March 2017, 10, 14. http://docs.house.gov/meetings/IF/IF03/20170315/105702/HHRG-115-IF03-Wstate-HookhamC-20170315.pdf.

olution process to resolve complicated issues at 37 hydropower projects. While FERC is the lead agency on hydro projects, it has not done enough proactively to encourage stakeholders to resolve disputes, aside from limited use of specially designated staff.[56] This often results in multiyear licensing delays. Accordingly, in order to counteract stakeholder inertia, Congress may authorize FERC to require expedited dispute resolution on complex projects or where chronic delays exist.

FEDERAL IMPLEMENTATION IMPROVEMENTS

In addition to the proposed legislative reforms, executive implementation improvements may substantially increase licensing predictability and reduce regulatory timeframes. Such goals could be achieved through process-efficiency improvements, increased stakeholder access to information and improved resources for greater collaboration.[57]

First, license applications often contain incorrect or incomplete information, which reflects applicants' limited understanding of complex application requirements and review processes. This suggests that improved access to information would clarify the regulatory process and improve the quality of applications. This also could expedite review timeframes and improve licensing predictability. In 2014, the DOE developed a toolkit to document and provide easily accessible information on federal and state hydropower permitting processes and approvals.[58] Soliciting and incorporating industry feedback on DOE's tool and the FAST 41 dashboard[59] could reduce information deficiencies. Similarly, improved assessments and disseminating information on innovations that affect environmental impact or mitigation also might achieve outcomes more quickly and predictably without reducing environmental protection.[60]

Process-efficiency improvements

By their nature, potential process-efficiency improvements must be achieved within and between various agencies. Federal agencies have made progress through several initiatives to improve interagency regulatory processes and water-resource planning. For example, FERC and the Army Corps forged an agreement (memorandum of understanding, or MOU) in 2011, facilitated by the DOE's Hydropower Program, to synchronize approval processes for nonpowered dams.[61] Along with stakeholder input, the agreement has identified coordinated process improvements, which include simultaneous FERC and Army Corps reviews, and a single water-quality certification application and NEPA documentation to avoid redundancy.

Effective MOU implementation would provide both training on FERC processes and ongoing advice to Corps districts that deal with hydropower applicants who are interested in siting hydropower projects at their facilities (the National Hydropower Association and FERC can help to identify these).[62] The DOE's hydropower office would be ideal to lead this effort, since they have knowledge of both the FERC process and the Corps districts that were involved in the MOU's negotiation.

Additionally, FERC could improve process performance and provide more certainty to stakeholders and investors by issuing "conditioned" licenses for all projects, not just hydrokinetic ones, as it did in 2007.[63] While this appears to be discretionary, FERC should notify Congress if it believes there is some statutory ambiguity.

A revision of FERC's performance goals offers another path to improve process efficiency. FERC currently must issue hydropower orders within 24 months of when it receives a completed application.[64] The existing goal does not distinguish between large and small projects, let alone identify projects that merely add generating capacity at existing projects or at nonpowered dams. This metric also seems inappropriate for a project that has undergone extensive dispute resolution. A 12-month performance goal would be more appropriate for these projects, especially if FERC issues a conditioned license.

Further, improving terms for relicensure within FERC's control would provide additional benefits. For example, FERC should increase the license term to 50 years if the hydro project adds generation capacity, undertakes dam-safety measures and implements new environmental measures. In the past, projects that developed a comprehensive settlement received either a 40- or 50-year license. FERC recently

56. Federal Energy Regulatory Commission, "Alternative Dispute Resolution," U.S. Department of Energy, April 12, 2017. https://www.ferc.gov/legal/adr.asp.

57. U.S. Department of Energy, Hydropower Vision (2016), p. 30. https://energy.gov/sites/prod/files/2016/10/f33/Hydropower-Vision-10262016_0.pdf.

58. See rapidtoolkit.org

59. See https://www.permits.performance.gov/projects.

60. U.S. Department of Energy, *Hydropower Vision* (2016), p. 30. https://energy.gov/sites/prod/files/2016/10/f33/Hydropower-Vision-10262016_0.pdf.

61. U.S. Army Corps of Engineers and the Federal Energy Regulatory Commission, "Memorandum of Understanding between United States Army Corps of Engineers and the Federal Energy Regulatory Commission on Non-federal Hydropower Projects," 2011, 5. https://www.ferc.gov/legal/mou/2016/07-21-16.pdf.

62. Tom Russo, "The Trump Effect on U.S. Hydropower" *Russo on Energy*, Jan. 3, 2017. http://www.russoonenergy.com/content/trump-effect-us-hydropower.

63. Federal Energy Regulatory Commission, "Policy Statement on Conditioned Licenses for Hydrokinetic Projects," 121 ¶ 61,221, Nov. 15, 2016, 1. https://www.ferc.gov/EventCalendar/Files/20071130153255-PL08-1-000.pdf.

64. Federal Energy Regulatory Commission, Fiscal Year 2018 Congressional Performance Budget Request, *Fiscal Year 2016 Annual Performance Report, U.S. Department of Energy*, 2017, p. 29. https://www.eenews.net/assets/2017/05/23/document_gw_17.pdf.

issued a notice of inquiry to obtain public input on license terms, which should provide a record to initiate reform.

Improved collaboration

Improved dispute-resolution mechanisms also have considerable potential to improve licensing predictability and timeframes. In particular, collaboration reduces litigation risk, especially for high-impact and contentious projects. Ideally, dispute-resolution mechanisms would drive expeditious settlements, which are the surest sign of successful collaboration. FERC has approved 37 hydropower settlements and has 56 years of experience with mitigating the environmental impact from hydropower.65 In 2006, FERC sent a strong message that it prefers settlements when the commission issued its Policy Statement on Hydropower Licensing Settlements.66 Nevertheless, there has not been a coordinated effort by industry, NGOs or FERC to advance dispute resolution, encourage settlements or develop a comprehensive list of best practices for stakeholders. In fact, FERC may have sent a different message to stakeholders by failing to prioritize and expedite settlement processes.

Currently, FERC has three licensing process options with different approaches to dispute resolution. FERC developed the integrated licensing process (ILP) and alternative licensing process (ALP) as alternatives to the traditional licensing process (TLP) in order to provide a more efficient and effective method. The ILP now serves as the default process, and applicants seeking to use the TLP or ALP are required to obtain FERC approval.

The TLP and ILP have limitations in their ability to spur collaborative outcomes. Both designs allow FERC to make a knowledgeable decision with respect to licensure using NEPA, which would include the analysis of mandatory conditions by federal agencies, Section 401 and CZMA. The ILP provides for dispute resolution of studies, but not mitigation measures. It arranges for stakeholders to respond to notices and comments, but it does not center on issue resolution. Instead, FERC conducts decisionmaking after it weighs stakeholder recommendations and determines appropriate mitigation measures, which often remain heavily disputed among stakeholders.

The ILP emphasizes deadlines to move the licensure process forward, which makes it the preferred approach in many cases. However, while the ILP does not discourage dispute resolution, many agency staff complain that they are under enormous pressure to respond to studies and comments but lack the time to negotiate with applicants.[67] The U.S. Fish and Wildlife Service (USFWS) has indicated that the ILP's challenging timeframes and milestones serve as disincentives to collaborative engagement.[68]

The ALP, on the other hand, leverages stakeholder negotiations to determine mitigation measures. It shifts decisionmaking to the applicant and stakeholders in the vicinity of the project, and FERC's role shifts from judge (ILP) to technical and regulatory adviser (ALP). The main goal is to design the best project and/or mitigation through a formal settlement agreement that the NEPA document can assess and FERC can approve. This sometimes motivates the timely issuance of Section 401 water-quality certificates by states, since stakeholders have bought into the settlement and the license includes the certificate conditions.[69]

While successful use of the ALP depends on stakeholders' willingness to resolve disputes, it equally depends on FERC's willingness to prioritize approval of such projects. FERC staff must actively advise stakeholders about settlements and what FERC considers appropriate. This is particularly valuable to develop mitigation measures at large-impact projects and to optimize the use of water resources for multi-use projects that are consistent with local stakeholder interests. Although it often requires more time upfront, the ALP may achieve stakeholder consensus (including multiple regulatory bodies) that avoids sequential, segmented and sometimes adversarial regulatory proceedings, which can result in prolonged litigation. Once approved by FERC, settled projects have lower litigation risk, which boosts investor confidence and lowers financing costs.

Despite its many potential benefits, the increased upfront time, effort and expense required in the ALP process has had mixed results. Some hydropower applicants have not encountered extended delays and continue to use the ALP, but in other cases, those that oppose projects or hold extreme positions have been able to prolong the process. This may reflect area-specific stakeholder differences, and delineates the imperative of improved schedule discipline in the ALP process. However, ALP delays, which appear improvable, have led to an industry preference for the ILP, which provides more certainty on FERC-approved studies. This is the case even for contentious projects, where the consensus-driving advantages of the ALP should prove advantageous. This suggests a disconnect between ALP principles and practice, but it is one that can certainly be improved.

65. Hydropower Reform Coalition, "Appendix C – Hydropower License Settlement," 2017. http://www.hydroreform.org/appendix-c-hydropower-license-settlements.

66. Federal Energy Regulatory Commission, "Policy Statement on Hydropower Licensing Settlements," U.S. Department of Energy, September 21, 2006, 1. https://www.ferc.gov/whats-new/comm-meet/092106/H-1.pdf.

67. Based on personal conversations with state water-quality agency staff.

68. Doug Young, "USFWS Perspectives on Hydro ESA Consultation," U.S. Fish and Wildlife Service. http://www.nwhydro.org/wp-content/uploads/events_committees/Docs/2013_Annual_Conference_Presentations/Tuesday/2%20USFWS%20Perspectives%20on%20ESA%20Consultation.ppt.

69. In other cases, such as the issuance of some relicenses in California, delays have exceeded 10 years despite a comprehensive settlement.

FERC could take several steps to improve collaboration by enhancing and republishing its 2006 Policy on Settlements and requesting that applicants, federal and state agencies, tribes and NGOs consider using the ALP and settlements to resolve project issues. To make the ALP timelier and more appealing to industry, FERC should initiate a public review of the process itself, the means to improve schedule discipline among stakeholders and the time it takes FERC to process applications filed under the ALP. FERC could also advocate use of dispute-resolution mechanisms at industry conferences and in meetings with agencies and NGOs. Irrespective of the process, FERC should suggest timely dispute resolution and settlements on complex projects with numerous stakeholders.

CONCLUSION

Arcane hydropower regulatory processes have century-old roots that reflect an accumulated bureaucratic legacy through a variety of expansive environmental statutory reforms. These processes embody the ills of the modern regulatory state—one marked by duplicative reviews and one-size-fits-all remedies that are poorly suited for a heterogeneous resource class. Some recent legislative and executive actions have reduced certain regulatory burdens, yet additional actions could greatly mitigate artificial barriers to continued and expanded hydropower development.

Hydropower reviews deserve no more regulatory scrutiny than the commensurate maximum potential environmental impact, which varies immensely by the type, size and status of a project. Regulatory recognition of the limited incremental environmental effect of maintaining or modifying existing facilities—the backbone of any hydropower expansion—is particularly important. This implies that there is value in differentiating the default regulatory treatment for classifications of resources based on their environmental impact profiles.

Statutory reform may enable the regulatory process to better account for differing levels of environmental impact associated with the size and types of hydropower projects, without sacrificing environmental integrity. Excluding *de minimis* projects (e.g., conduits and small conventional projects) from licensure and exemption requirements altogether and "right-sizing" the default regulatory treatment of low-incremental-impact projects (e.g., expanding FERC's two-year licensing pilot effort) would require only small statutory adjustments. More ambitious reforms could include eliminating duplicative interagency processes, requiring increased agency cooperation and using a single NEPA analysis for federally owned projects, and single water-quality analysis for nonfederal FERC projects.

Further, Congress and the administration should prioritize the reduction of uncertainties and delays in hydropower licensure, which largely stem from redundant processes, poor dispute resolution and lack of schedule discipline, especially from Section 401 and ESA agencies. Congress should also make FERC the sole federal decisionmaking authority—to include schedule enforcement—for licensing conditions and processes. In addition, Congress could consider regulatory transparency requirements and adjusting agency funding terms or performance requirements to expedite reviews, especially by linking performance with delegated state Section 401 authority. Expanding FERC's use of conditioned licenses[70] to all hydropower projects may also encourage agencies to conduct timely reviews. For federally owned facilities, Congress may pursue alternative project-financing mechanisms or privatize federally owned dams.

The lowest-hanging fruits, however, require no statutory change. Improving regulatory process efficiency and providing stakeholders with better access to information, along with increased collaboration, may substantially increase licensing predictability and reduce implementation timeframes. In particular, FERC should pursue ALP improvements and encourage other expeditious dispute-resolution mechanisms to resolve complex projects. It should also consider the expansion of conditioned hydropower licenses, review hydropower performance goals, improve relicensing terms and implement the 2011 FERC-Corps MOU by providing training and ongoing advice to targeted Army Corps districts. The DOE also has a valuable role to facilitate discussions among agencies to implement regulatory reform. However, while changes in FERC regulations and policies may reduce the cost of licensure, they are not an adequate substitute for legislative reform.[71]

Incremental legislative reforms may be hydropower-specific, but statutory problems often affect a broad array of resources. Hydropower serves as a case-in-point for a broader discussion on deeper statutory reform. For example, Kavulla notes that NEPA reform "should include mandatory deadlines for agencies and reducing extraneous interagency review that enmeshes good projects in a bureaucratic morass."[72] An American Action Forum study suggests that reducing the statute of limitations for judicial review could reduce legal vulnerabilities without a major statutory overhaul.[73]

70. Federal Energy Regulatory Commission, "Policy Statement on Conditioned Licenses for Hydrokinetic Projects," 121 ¶ 61,221, November 15, 2016. https://www.ferc.gov/EventCalendar/Files/20071130153255-PL08-1-000.pdf

71. Federal Energy Regulatory Commission, *Report on Hydroelectric Licensing Policies, Procedures, and Regulations* (2001), p.6. https://www.ferc.gov/legal/maj-ord-reg/land-docs/ortc_final.pdf.

72. Kavulla (2017), 1. https://americanaffairsjournal.org/2017/05/no-free-market-electricity-can-ever/.

73. Philip Rossetti, "Addressing Delays Associated with NEPA Compliance," American Action Forum, March 20, 2017. https://www.americanactionforum.org/research/addressing-delays-associated-nepa-compliance/

The current statutes affecting hydropower regulation embody the "precautionary principle," where innovators seek the blessing of public officials before developing and deploying new technologies. This reflects old forms of thinking that miss how incentive-based policies unleash innovation, which in turn drives environmental improvements far more efficiently than command-and-control regulations. Reforms that move toward "permissionless innovation" would encourage technological progress, with benefits both to the economy and the environment.[74]

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The authors also would like to thank several external reviewers for their input, including Kelly Schaeffer, principal at Kleinschmidt Associates. The views in this paper are the authors' own and do not necessarily reflect those of the reviewers.

74. For a thorough discussion of this concept, see Adam Thierer, *Permissionless Innovation* (Arlington, Virginia: Mercatus Center), 2016. https://www.mercatus.org/publication/permissionless-innovation-continuing-case-comprehensive-technological-freedom.