



**BLUE GOLD:
Building New Hydropower With
Existing Infrastructure**



April 2015

Notice

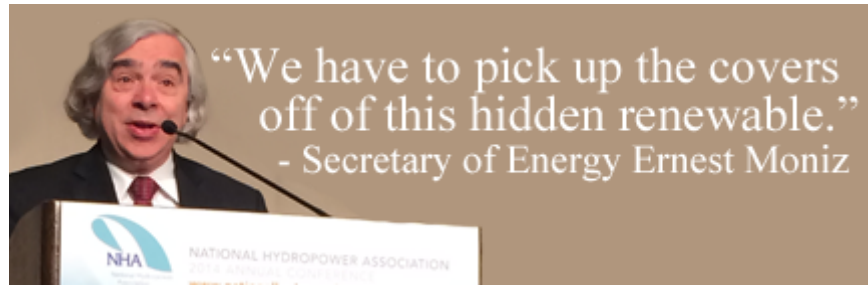
This document was prepared under contract to the Hydro Research Foundation by Kurt Johnson from Telluride Energy with input from a broad range of industry experts. Neither the Hydro Research Foundation nor any of its employees make any warranty or assumes any legal liability or responsibility for the accuracy of any information contained herein. Reference to any specific policy suggestion does not constitute endorsement by the Hydro Research Foundation. This report includes material previously prepared by the author for inclusion in related documents issued by the Colorado Small Hydro Association and others.

Acknowledgements

The author wishes to thank Deborah Linke and Brenna Vaughn from the Hydro Research Foundation for review of this document, as well as Jan Lee with the Northwest Hydropower Association, Linda Church Ciocci, Jeff Leahey and David Zayas with the National Hydropower Association and John Seebach with American Rivers. In addition, the Hydro Research Foundation wishes to thank the following for participation in a policy innovation brainstorming meeting held in Washington, DC in 2014: Alan Roth, Weir American Hydro; Chuck Sensiba; Van Ness Feldman; David Zayas, National Hydropower Association; Kevin Young, Young Energy Services; Mike Murphy, TRC Solutions; Dr. Michael Sale, Low Impact Hydro Institute; Norman Bishop, Knight Piésold Consulting; Peter Brown, Preti Flaherty; Sarah Hill-Nelson, Bowersock Mills Power Company; Carl Vansant, HCI Partners. Any errors are the responsibility of the author.

“Congress Finally Found an Energy Source Everyone Likes – Hydropower”

August 2, 2013, Headline in the *Washington Post* following unanimous Senate approval of the Hydropower Regulatory Efficiency Act and the Bureau of Reclamation Small Conduit Hydropower Development and Rural Jobs Act.



Executive Summary

Hydropower is the single largest source of renewable electricity in the United States. In 2014, it accounted for almost half of all renewable electricity generation and approximately 6.5 percent of total U.S. electricity generation.ⁱ

There is an enormous untapped opportunity to develop additional new hydropower without requiring construction of any new dams or diversions by building hydropower on existing infrastructure -- including existing dams, canals and pipelines.

The National Hydropower Association (NHA) estimates that only 3% of the nation's approximately 80,000 dams currently generate hydropower. In April 2012, the Department of Energy (DOE) issued an assessment of the nation's existing non-powered dams and estimated that more than 12,000 megawatts of new hydropower capacity was available to be developed.ⁱⁱ

Currently, however, the amount of new hydropower being installed each year in the U.S. is minimal. Since 2000, total U.S. hydropower generating capacity has been essentially flat, with less than 2% total increase over the past 15 years.ⁱⁱⁱ Total hydropower energy generation fluctuates annually depending on water supply, decreasing 3.7% during 2014 relative to 2013.^{iv}

There has not yet been a comprehensive national assessment of untapped hydropower potential utilizing existing water distribution systems -- including canals and pipelines -- although industry groups estimate that over 400 billion gallons of water flows through pipes every year in the U.S., representing an enormous opportunity for energy recovery.^v

Distributed hydropower has received broad, bi-partisan support. In August of 2013, President Obama signed into law two pieces of legislation aimed at making the hydropower regulatory process more efficient, both of which passed the Senate unanimously: H.R. 267, the Hydropower Regulatory Efficiency Act and H.R. 678, the Bureau of Reclamation Small Conduit Hydropower Development and Rural Jobs Act.

Notwithstanding the success of this recent legislation, there is much more which needs to be done to remove remaining regulatory barriers to new hydropower development.^{vi} The Hydro Research Foundation convened a meeting in 2014 to develop consensus policy recommendations for additional hydro policy reforms, which include the following:

Proposed Federal Executive Action

- Allocate a percentage of the DOE hydropower budget to distributed hydropower.
- Prepare a DOE distributed hydropower market status report.
- Prepare a distributed hydropower roadmap as part of the DOE hydropower vision report.
- Complete a nationwide resource assessment focused on distributed hydropower that could be developed using existing water distribution systems.
- Disseminate hydro policy best practice information.
- Streamline US Army Corps of Engineers permitting processes for hydro development so projects can complete federal approvals expeditiously.
- Increase federal procurement of hydropower by including distributed hydropower as an eligible resource type for federal agency procurement.
- Highlight distributed hydropower as an attractive compliance option under the EPA Clean Power Plan.
- Implement a FERC rulemaking to add existing dams to the type of projects under 5 MW eligible for the “regulatory off-ramp” created by the Hydropower Regulatory Efficiency Act of 2013 to include non-controversial distributed hydro projects which can meet criteria as determined by FERC staff for a National Environmental Policy Act (NEPA) Categorical Exclusion.

Proposed Federal Legislation

- Exclude small (under 5 MW) conduit hydropower projects from having to apply to FERC for projects which entail no changes in water diversion from an existing natural waterway.
- Reauthorize the Energy Policy Act of 2005 Sections 242 and 243 hydro incentive payments program and provide ongoing appropriations.

Proposed State Action

- Treat distributed hydropower the same as other distributed renewable energy technologies in state renewable energy incentive programs.
- Include distributed hydropower as a compliance option in development of state Clean Power Plans.
- Coordinate Federal and State environmental and permitting processes for hydropower.
- Add hydropower as an eligible project type to existing state loan and grant programs for water infrastructure.

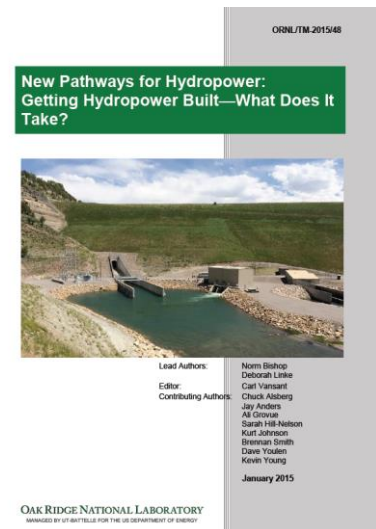
About the Hydro Research Foundation and this Report

The Hydro Research Foundation was established in 1994 and became an independent 501(c)(3) non-profit corporation in 1996. The Foundation has two principal objectives: to facilitate research and to promote educational opportunities related to hydropower.

This report is part of the New Hydropower Innovation Collaborative, a partnership between the Hydro Research Foundation and Oak Ridge National Laboratory, with support from the U.S. Department of Energy (DOE).

Policy innovation is the subject of this report. Technological innovations are addressed in a separate report, “New Pathways for Hydro: Getting Hydro Built – What Does it Take,” (shown at right) released in February 2015, which also includes some policy-related recommendations. Since this report is part of the same series, related policy recommendations from the New Pathways report have not been repeated here.

The New Hydropower Innovation Collaborative also includes development of a web-based technology catalog containing project-specific and vendor and technology information which is available for industry use on the Foundation’s website.



There are also related forthcoming reports currently being developed by DOE: “Opportunities for Energy Development in Water Conduits: A Report Prepared in Response to Section 7 of the Hydropower Regulatory Efficiency Act of 2013,” as well as a technical appendix. These reports contain background information related to this report, including discussion regarding barriers to hydro development.

Currently there is no widely agreed-upon definition of the term “small hydropower.” The term typically refers to installations that are less than 10 megawatts in size, primarily utilizing interconnection at a distribution voltage. The terms “small hydropower” and “distributed hydropower” are used interchangeably in this report to mean hydropower built with existing infrastructure.

This report focuses on hydropower development at existing infrastructure since this type of hydropower development is most likely to occur in the near term. Some of the recommendations, however, such as coordinated federal and state regulatory review processes, have broader applicability to all hydropower development.

This report will be available on the Hydro Research Foundation’s website.

Introduction

Large Untapped Potential for New Hydro on Existing Facilities

The nation's existing infrastructure for storing and transporting water contains an enormous, largely-untapped opportunity for development of new, small hydropower. Recently completed federal and state resource assessments have highlighted the magnitude of this opportunity using infrastructure including existing dams, pipelines and irrigation canals.



The National Hydropower Association (NHA) estimates that only about 3 percent of the nation's approximately 80,000 existing dams currently include hydropower. DOE issued an assessment of the nation's non-powered dams and estimated that an additional 12,000 MW of capacity were available (shown above). The top ten sites identified have the potential to provide approximately 3,000 MW, with the top 100 sites able to provide up to 8,000 MW. Of the top 100 sites, 81 are located on U.S. Army Corps of Engineers dams. The U.S. Army Corps of Engineers also completed their own assessment of potential hydropower development at unpowered dams, with similar results.^{vii}

There has not yet been a comprehensive national assessment of untapped hydropower potential utilizing existing conduits, although industry groups estimate that over 400 billion gallons of water flows through pipes every year in the United States, serving the power, agricultural, drinking and industrial water sectors. Recapturing the excess energy available in the existing water distribution system could help lower energy costs for water operators, who are among the nation's leading consumers of electricity in the U.S., accounting for about 4% of nationwide electricity consumption.^{viii} The Department of Energy has been tasked to prepare that assessment in response to the Hydropower Regulatory Efficiency Act of 2013.

Recent Federal Hydro Reform Legislation

Federal permitting requirements for small hydropower have recently been simplified through permitting reform legislation.

In August 2013, President Obama signed into law two pieces of legislation aimed at making the regulatory process more efficient for small hydro: H.R. 267, the Hydropower Regulatory Efficiency Act (HREA), and H.R. 678, the Bureau of Reclamation Small Conduit Hydropower Development and Rural Jobs Act.

HREA created a "regulatory off-ramp" from Federal Energy Regulatory Commission (FERC) permitting requirements for non-controversial hydro projects on existing conduits that are less than 5 MW in capacity, provided that there are no public objections to the project during a 45-day public notice period administered by FERC. The bill also increased the FERC conduit exemption to 40 MW, directed FERC to explore a two-year licensing process for hydropower development at existing non-powered dams and closed-loop pumped storage projects, increased the FERC small hydro exemption from 5 MW to 10 MW, authorized FERC to grant developers two-year preliminary permit extensions; and directed DOE to prepare reports regarding pumped storage and conduit project opportunities.

The Bureau of Reclamation Small Conduit Hydropower Development and Rural Jobs Act authorized small (under 5 MW) conduit power projects on Reclamation-owned infrastructure, while providing irrigation districts and water user associations the first right to develop hydropower projects. The bill also directed the Bureau of Reclamation to use its NEPA categorical exclusion process for small conduit applications.

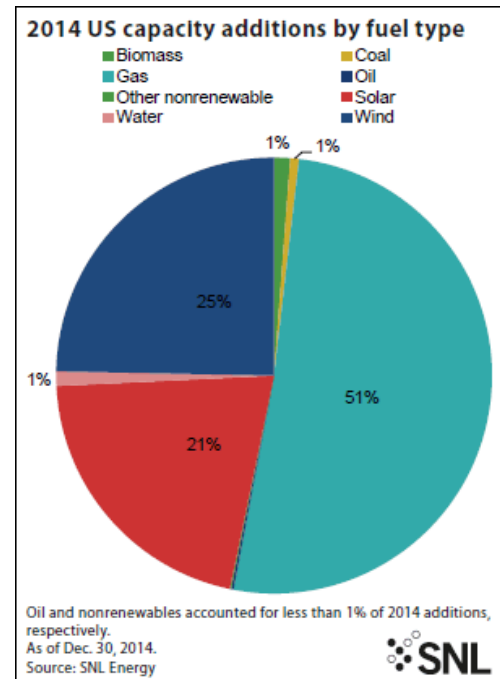
In addition, the June 2014 Water Resource Reform and Development Act (WRRDA) included language in Section 1008 stating that it is the policy of the United States that the development of non-Federal hydroelectric power at Corps of Engineers civil works projects, including locks and dams, shall be given priority, and that Corps approval shall be completed in a timely and consistent manner. The bill also required regular reporting to Congress.

Very Little Hydro Development

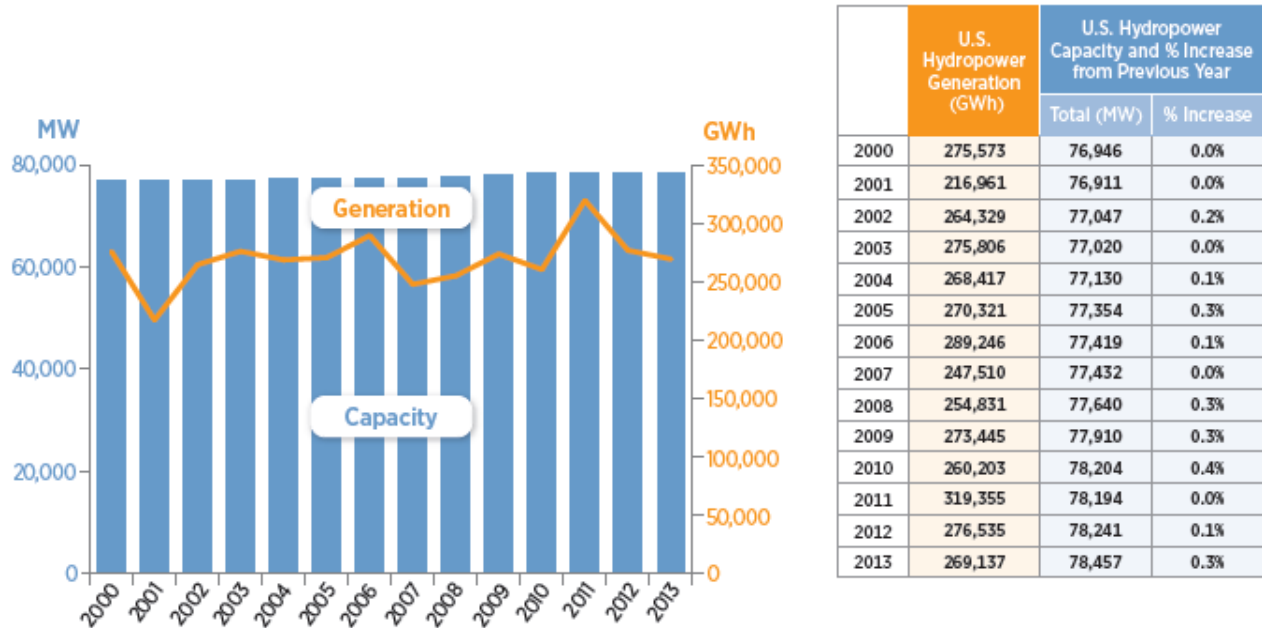
Notwithstanding recent legislation, the amount of new hydropower being installed each year is minimal.^{ix} During 2014, hydropower represented only about 1% of the 15,450 MW of new generation added nationwide.^x

2014 data is consistent with historical data, which shows that hydropower capacity has been essentially flat since 2000, with less than a 2% total increase during that time. Energy generation has fluctuated depending on water supply, but remains flat overall as is shown in the chart below.

According to Energy Information Administration data, total conventional hydropower generation during 2014 decreased by 3.7% relative to total 2013 generation.^{xi}



Annual Changes in U.S. Hydropower Capacity and Generation



Source: NREL 2013 Renewable Energy Data Book^{xii}

Economic Development Opportunity

Construction of new distributed hydropower presents an opportunity for economic development. Combining the DOE estimate that 12,000 MW could be built using existing non-powered dams with the NHA estimate that each megawatt of new conventional hydropower construction creates approximately 5.3 jobs^{xiii} yields a job creation estimate of over 60,000 new jobs, not including any job creation benefits associated with construction of new hydro projects on existing conduits.

According to research commissioned by NHA, the U.S. hydropower industry currently employs up to 300,000 workers, including professionals in project development, manufacturing, and operations and maintenance.^{xiv} These include jobs in a variety of fields including project development, manufacturing, operations and maintenance, research and the sciences, regulatory and legal specialties, engineering and land management, as well as finance, marketing and management. In addition, project construction creates jobs for concrete workers, plumbers, carpenters, welders and electricians. Following project construction, a new hydropower plant can create an ongoing revenue stream for project owners, providing ongoing revenue which can be used to maintain and improve aging water infrastructure.

Environmental Opportunity

Electricity generation is a significant source of industrial air pollution.^{xv} Hydropower provides electricity which is emission-free. NHA estimates that development of 12,000 MW of new hydropower on existing non-powered dams could provide clean, emissions-free electricity for approximately 4 million American homes,^{xvi} capturing energy that is currently being wasted.



Energy currently being wasted at Button Rock Dam in Colorado was recently featured on PBS Newshour.

Proposed Federal Executive Action

Federal hydropower activities should be reconfigured to more aggressively support development of hydropower utilizing existing infrastructure, which does not require major new construction or changes in diversions to existing natural waterways. Notwithstanding the 2014 WRRDA bill, hydro development at USACE facilities continues to be hindered by process delays as well as redundancy in federal review requirements.

Proposed Federal Legislation

The 2013 hydro reform legislation was a great step in the right direction, but the vast majority of potential development using existing water infrastructure will not take place without additional federal legislative reform. A review of the conduit exemption applications received to date by FERC pursuant to the Hydropower Regulatory Efficiency Act indicates that, so far, slightly over 50 projects have applied to FERC seeking the qualified conduit exemption under the new law, suggesting that the new FERC process is perhaps still not perceived as simple.^{xvii} Permitting barriers remain particularly acute for small hydro projects on existing dams. The smallest hydropower projects often are subject to the highest project permitting costs relative to total project costs.^{xviii}

Proposed State Government Action

Various states have pioneered small hydro policy reforms – including coordination and streamlining of state environmental reviews, support for hydro resource assessments, and provision of low-interest financing for hydro development – policies which have had a measurable impact on new hydro development. These policies should be replicated in additional states.



On May 31, 2014, Colorado Governor John Hickenlooper signed into law HB14-1030, small hydro streamlining legislation which coordinates federal and state environmental review, building upon recently enacted federal permitting reform legislation for small hydro.

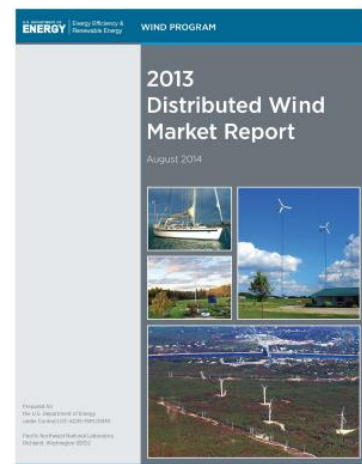
Proposed Federal Executive Action

Allocate a percentage of the DOE hydropower budget to distributed hydropower.

DOE currently supports other renewable, distributed generation technologies as part of its technology programs – a policy precedent which should be applied to distributed hydropower. Because of substantial remaining permitting challenges, unlike other renewable energy technologies, distributed hydropower – not utility/transmission scale hydropower -- is the most likely type of new hydropower to be developed.

Prepare a DOE distributed hydropower market status report.

DOE is currently preparing a hydropower market status report. As part of that effort, DOE should develop a distributed hydro market update, just like it currently provides for other distributed generation technologies, such as distributed wind (shown at right).



Prepare a distributed hydropower roadmap as part of the DOE hydropower vision report.

DOE is currently completing a hydropower vision document to map out a future for U.S. hydropower development. DOE should highlight distributed hydropower as a featured element of that report. Distributed hydropower has unique barriers and needs that are distinct from utility-scale hydropower. Some states have started their hydropower programs with a “roadmap” document to inform program development (see boxes below regarding Oregon and Colorado).

Complete a nationwide resource assessment focused on distributed hydropower which could be developed using existing water distribution systems.

Various states have completed small hydro resource assessments -- including Oregon, California, Colorado, Nebraska, and Maine. These could serve as models for national efforts focused on existing water distribution systems. With the exception of analysis completed by the Bureau of Reclamation related to hydro development on existing Reclamation canals,^{xix} to date there has not yet been a federally-supported estimate for conduit hydropower.

A related policy precedent is a new hydro effort being developed in Europe: RESTOR Hydro^{xx} is a European project aimed at increasing small and micro hydropower production by assessing opportunities for hydropower in Europe. The project is developing a publicly available database that identifies the location and outlines the characteristics of up to 50,000 small hydropower project sites. RESTOR Hydro also contributes to a broader effort called the Hydro Data Initiative, an effort that compiles detailed energy, market, and policy data in a central database.

Some industry estimates indicate that over 400 billion gallons of water flows through pipes every year in the United States,^{xxi} serving the power, agricultural, drinking and industrial water sectors. There are hundreds of thousands of potential project sites available. Water operators are among the leading consumers of electricity in the U.S. accounting for 4% of nationwide electricity consumption.^{xxii} Optimization of this energy usage is a crucial consideration as aging water distribution infrastructure is upgraded, providing energy recovery and a new revenue source from electricity sales for water system operators.

Ideally, this new distributed hydro resource assessment could be integrated with additional data necessary to efficiently assess the extent to which a given potential hydro project site makes not only technical sense, but also economic sense, given local utility tariffs, net metering policies and local policy and electricity market structure.

Disseminate distributed hydro policy best practice information.

DOE previously played a pivotal role in supporting efforts to disseminate best practice information for distributed renewable technologies through the Database of State Incentives for Renewable Energy (DSIRE) database as well as the Interstate Renewable Energy Council.^{xxiii} Similar DOE efforts with a new focus on distributed hydro could play an equally pivotal role in development of the U.S. hydro industry.

State Small Hydro Policy Innovation: Oregon

The Energy Trust of Oregon completed a report on small hydropower development, “Small Hydropower Technology and Market Assessment.” The purposes of the report were to develop an understanding of the technologies, project types, configurations, and associated costs appropriate for hydropower development in Oregon, and to develop an understanding of the current conditions, barriers, and opportunities related to development of small hydropower in Oregon. The report recommended actions needed to move the Oregon small hydro market forward, including the following: increasing outreach; creating a roadmap of all permitting requirements; creating long-term certainty in available incentives; using existing diversions and infrastructure; and leveraging planned construction, such as adding hydro when new and replacement pipes are already being constructed.

Oregon implemented small hydro policy innovations including the following:

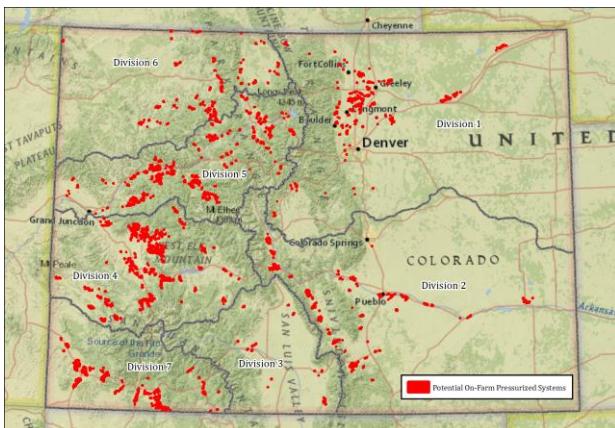
- A state initiative approved by the voters set up a Small Scale Energy Loan Program so that developers can finance projects using state bonding authority.
- The Oregon Department of Energy, as the result of state legislation in 2005, implemented a tax credit program for renewable energy projects. If an entity is public (such as an irrigation district), the tax credits can be sold to a taxable entity with a major share of the credit provided to the district. The program started out with a 50% tax credit for several years and in 2010 was reduced to a capped amount per project on a competitive basis.
- Oregon’s Renewable Portfolio Standard, adopted in 2007, includes many types of hydropower.
- Holders of existing water rights for other purposes (irrigation, municipal, industrial, etc.) have an expedited process (90 days or less) to reuse that same right for energy production.
- Small conduit projects are exempt from fish passage requirements at the head of the conduit; instead they pay a small fee which will go toward prioritized fish passage projects determined by the state.
- The Energy Trust of Oregon was set up by the state legislature to fund renewable energy development from ratepayer funds provided by investor owned utilities. The Energy Trust provides money for feasibility studies and has developed workbooks for hydropower development (including instructions for filing hydro applications with FERC)
- The Oregon Department of Energy has funds available for feasibility studies for small hydro projects.

State Small Hydro Policy Innovation: Colorado

Recent Colorado small hydro policy innovations include the following:

- Colorado was the first state to sign a Memorandum of Understanding FERC to expedite small hydro approval.
- Colorado was the first state to prepare a small hydropower handbook.
- Colorado modified existing water infrastructure loan programs through the Colorado Water Conservation Board to make 2% interest loan financing available for small hydro construction, which has proven to be a key driver of new hydro installations in Colorado.
- The Colorado Water Resources and Power Development Authority provides cost-shared feasibility grant funds for small hydro in amounts up to \$15K.
- In 2014, Colorado passed state-specific hydro reform legislation, modeled upon the 2013 federal hydro streamlining legislation, which coordinates hydro project review by federal and state agencies.

The Colorado Department of Agriculture is implementing a new program to accelerate development of agricultural hydropower, following up on findings from a statewide hydro resource assessment and vision document, “Recommendations for Developing Agricultural Hydropower in Colorado.” The report identified substantial small hydro development opportunities focused on small systems capturing energy available in pressurized irrigation. The analysis indicated that Colorado has potential for installation of approximately 30 MW of new small hydropower utilizing pressurized irrigation (at sites shown in the map below). In 2015, Colorado’s agricultural hydropower program was awarded a \$1.8M program implementation grant from the U.S. Department of Agriculture.



Streamline US Army Corps of Engineers permitting processes for hydro development so projects can complete federal approvals expeditiously.

Hydro development at U.S. Army Corps of Engineers (USACE) facilities has been hindered by overlapping federal review requirements, requiring approval by both FERC and the Corps. There is also inconsistency in how different USACE district offices are approaching non-federal hydropower development, resulting in differing priority given to hydro development depending upon the district office processing the hydro development request.

Congress recently addressed these issues with inclusion of relevant language in the Water Resource Reform and Development Act (WRRDA) bill which was signed into law in June 2014. Section 1008 of the WRRDA bill states that it is the policy of the United States that:

1. The development of non-Federal hydroelectric power at Corps of Engineers civil works projects, including locks and dams, shall be given priority and;
2. Corps of Engineers approval of non-Federal hydroelectric power at Corps of Engineers civil works projects, including permitting required under section 14 of the Act of March 3, 1899 (33 U.S.C. 408), shall be completed by the Corps of Engineers in a timely and consistent manner.

The administration needs to move aggressively to implement these provisions. Notwithstanding the 2014 WRRDA bill, hydro development at Corps facilities continues to be hindered by process delays, including an inability by developers to complete very basic engineering feasibility because of the inability to get needed technical information from the Corps--a necessary step to starting an analysis of the potential of hydro development on a Corps dam.

Corps engineering approval processes typically take place subsequently to, rather than simultaneously with, FERC approval processes. The 408 District Letter of Permission will only be issued after 100% plans and specifications have been reviewed by the District. Since the FERC license is typically approved on 30% plans and specifications, these two processes will rarely end at the same time. Additionally, both USACE and FERC complete dam safety reviews. Although both agencies are required to review the project from different perspectives, and both reviews will continue to be required, there is room for better integration and coordination.

Following passage of the WRRDA bill in 2014, DOE initiated an effort to identify challenges and recommend solutions for improving the efficiency of the licensing and permitting processes associated with adding hydro generating facilities at non-powered Corps dams. The recommendations developed as a result of those efforts should be implemented expeditiously. Without substantial streamlining of Corps and FERC processes, the enormous, untapped hydropower potential at existing non-powered Corps dams may never be developed.

Include distributed hydropower as an eligible resource type for federal agency procurement.

Federal agencies have been purchasing renewable energy dating back to 1999, starting with Executive Order 13123 which called upon federal agencies to purchase renewable energy.

Unfortunately federal agency renewable energy procurement activities tend to exclude hydropower. In recent years, federal initiatives related to renewable energy development on public lands and federal renewable energy development procurement requests have largely excluded hydropower as an eligible renewable technology.



The U.S. military academy at West Point, New York is seeking to develop small hydro utilizing an existing dam.

For example, a Bureau of Land Management Final Rule – Segregation of Lands – Renewable Energy (April 30, 2013), included the following:

“In Section 211 of the Energy Policy Act of 2005, Congress declared that before 2015, the Secretary of the Interior should seek to have approved *non-hydropower renewable energy projects on public lands* (emphasis added) with a capacity of at least 10,000 megawatts (MW) of electricity.”

In early 2012 the Department of the Army, through the Corps, issued a \$7 billion request for proposals (RFP) for renewable energy contracts. Eligible technologies included solar, wind, biomass and geothermal. Hydropower was not included.

Shortly after the Army RFP, a new MOU between Interior and the Department of Defense (DOD) was signed on July 20, 2012 - *Renewable Energy and Renewable Energy Partnership Plan*. The purpose of the MOU was to “help DOD develop renewable energy in the interests of greater installation energy security and reduced installation energy costs...” Eligible technologies discussed in the MOU included wind, solar, geothermal and biomass, but once again excluded hydropower.

In March of 2015, the President signed a new executive order committing to reduce greenhouse gas (GHG) emissions from the federal government, including by the procurement and use of more clean and renewable energy.

The new executive order sets a schedule for agencies to cut their GHG emissions by 40 percent from 2008 levels. It requires the government to draw 25 percent of its electricity and thermal energy from clean energy sources, including renewable sources, by 2025,

while also specifically setting a level of 30 percent for the total amount of building electricity consumed from renewable resources by 2025.

Unfortunately, once again, the eligibility of hydropower as a renewable resource was limited. While ocean energy is included (tidal, wave, current, and thermal), the only hydropower resources that qualify under the executive order are new hydroelectric generation capacity achieved from increased efficiency or additions of new capacity at an existing hydroelectric project.

In order to alleviate the systematic exclusion of hydropower from federal procurement, new executive guidance should be issued to make new distributed hydropower an eligible resource type for federal renewable energy procurement, consistent with the President's Climate Action Plan, which specifically mentioned that adding new hydropower on existing infrastructure was highly encouraged.

Highlight distributed hydropower as an attractive compliance option in development of State Clean Power Plans.

The EPA should include new hydropower development utilizing existing infrastructure as a recommended form of compliance under EPA's Clean Power Plan. States should be encouraged to examine the extent to which hydropower development could help states to meet compliance targets, based upon recently-developed federal and state hydro resource assessments. These opportunities were highlighted in comments filed with the EPA by NHA.

Implement a FERC rulemaking to expand upon the type of projects eligible for the "regulatory off-ramp" created by the Hydropower Regulatory Efficiency Act of 2013 to include additional types of non-controversial hydro projects, including projects on existing dams, which can meet criteria as determined by FERC staff for a National Environmental Policy Act (NEPA) Categorical Exclusion.

Many of the nation's 80,000 existing dams are low-head and do not have other environmental concerns. The hydropower permitting burden on these facilities should be commensurate with their potential impact on a waterway. Projects with minimal or no impact should have simpler permitting requirements.

In 2014, Reclamation published a NEPA Categorical Exclusion checklist for use by Reclamation staff in determining whether a proposed project is eligible for a Categorical Exclusion.^{xxiv}

The expedited decision-making made possible by Reclamation processes could be replicated by FERC for FERC-jurisdictional hydro projects.

Proposed Federal Legislation

Exclude small (under 5 MW) conduit hydropower projects from having to file with FERC for projects which entail no changes in water diversion from an existing natural waterway.

Thanks to the Hydropower Regulatory Efficiency Act of 2013, it is now possible to receive FERC approval for conduit projects as quickly as 60 days, a substantial improvement over previous requirements.

However, certain projects could -- without environmental or engineering risk -- be exempted from federal approval processes. Currently, even the smallest hydro systems such as pressure reduction valve projects and agricultural hydropower projects must still file with FERC, a process entailing online registration for FERC e-filing as well as development of an exemption application, a process which typically requires the services of an attorney or consultant familiar with FERC processes.

Some types of small hydro projects are so non-controversial that they should not be subject to federal jurisdiction by having to file with FERC requesting an exemption pursuant the Hydropower Regulatory Efficiency Act. The Federal Power Act, a foundational federal law underlying hydropower regulation, contemplates tradeoffs which need to be balanced to protect the public interest. These types of distributed hydropower projects, however, do not require considering tradeoffs because typically there are no discernible environment impacts.

The nation's existing water distribution infrastructure includes hundreds of thousands of pressure reduction valve vaults, typically located in underground concrete vaults. There is also substantial potential for development of hydropower using irrigation supply pipelines. Comparably-sized distributed solar and wind installations are not subject to any federal approval requirements.

Eliminating current federal approval requirements for these types of hydro projects will make it possible for them to eventually become commonplace for use in pressurized irrigation systems and water distribution systems where it makes technical and economic sense.

Examples of Small Hydro Projects Which Should Not Require Federal Review

Hydropower Using Pressure Reduction Valve Vaults and Pipelines

The nation's water transmission and distribution system includes a vast network of pipelines transporting untreated and treated water. In order to keep water pressures at sufficiently low levels to protect pipelines, plumbing and appliances, pressure reduction valves (PRV) are used, typically located in underground concrete vaults. Industry estimates suggest that the nation's existing water distribution infrastructure includes hundreds of thousands of PRV vaults. If there is sufficient space available within a vault and if there is proximity to utility interconnection, it is possible to install a small hydropower turbine in parallel to an existing PRV, using a turbine rather than a PRV to consume excess water pressure. Turbines are available which are appropriate for both untreated as well as treated drinking water.



Hydropower Using Agricultural Irrigation Water

The nation's agricultural industry includes a vast network of canals, ditches and pipelines transporting water for irrigation after it has already been diverted from a natural waterway.



Reauthorize the Energy Policy Act of 2005 Section 242 hydro incentive payments and provide ongoing appropriations.

Hydropower has not historically received equal treatment in federal incentive programs for renewable energy such as the Production Tax Credit. In addition, many hydro developers are public entities and thus are unable to benefit from tax credits unless they create a financial structure in partnership with a private sector entity.

Fortunately, Congress previously created an effective incentive program to support development of small hydropower: the “Section 242 Program” authorized by the Energy Policy Act of 2005. The Section 242 program received appropriations for the first time in fiscal year 2014 when Congress provided \$3.6M in appropriations; the program was again funded in fiscal year 2015 at \$3.9 million. The program’s incentive for new hydroelectric generation on existing facilities is currently equal to about 2.3 cents/kWh, an amount sufficient to be effective in incentivizing development of new hydropower if the program can be relied upon into the future.

The authorization in Section 242 of the Energy Policy Act of 2005 expires in 2015. Congressional reauthorization is needed and funds need to be appropriated for the program on an ongoing basis into the future.

Proposed State Government Action

Treat distributed hydropower the same as other renewable energy technologies in state renewable energy incentive programs.

Most states have developed policies and programs designed to support development of renewable energy.^{xxv} Distributed hydropower should be treated equally to other distributed renewable energy options in state incentive programs, including net metering and renewable portfolio standards.

Highlight distributed hydropower as a compliance option in development of state Clean Power Plans.

In response to directives pursuant to EPA’s Clean Power Plan, states are tasked with creating compliance plans. In developing these plans, states should examine the extent to which distributed hydropower could help states to meet their compliance targets, by referencing existing federal and state hydro resource assessments as well as developing new resource assessments in order to counter the false perception that there is no future hydropower growth potential.

Coordinate Federal and State environmental and permitting processes for hydropower

Hydropower is subject to both federal and state environmental and permitting requirements. It is possible to coordinate federal and state permitting requirements for hydropower, which some states have started to implement. Under FERC requirements pursuant to the Hydropower Regulatory Efficiency Act (HREA), there is no requirement for receipt of state agency comments in order to receive a FERC determination that a given project is not FERC jurisdictional. The HREA does nothing to change any state law, so it is conceivable that a small hydro project could receive a determination of exemption from FERC jurisdiction and then later still have to contend with state agency review processes covering issues including historical preservation, water quality and related issues.

States are starting to address this issue with efforts to coordinate federal and state requirements, with a goal of making it possible to simultaneously comply with both federal and state environmental requirements.

In California in 2013, a Memorandum of Understanding (MOU) was signed between FERC and the California State Water Resources Control Board to coordinate pre-application activities for non-federal hydropower proposals in California. The purpose of the MOU was to coordinate the procedures and schedules prior to FERC's review of hydropower license applications and the State Water Board's review of water quality certification applications in order to lead to issuance of environmental documents that satisfy the legal requirements of both the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA).

In 2014, Colorado enacted legislation to synchronize federal and state agency review of hydropower project applications. Like the 2013 federal small hydro reform bills, the Colorado bill was approved on a wide bi-partisan basis with support from both industry and the environmental community. The bill does not diminish the existing legal authority of any state agency; rather, it simply creates a new state process to ensure that if any state agencies do have project concerns, they are noted and recorded in a timely way that matches the FERC public comment period. The bill creates a new combined federal and state review process to enable a project developer to be able to simultaneously secure federal and state approval within 45 days. Upon successful completion of the FERC and coterminous state process, a project developer can be confident that the only remaining regulatory requirements would be related to local government requirements (for example, for compliance with any local government building codes).

Similar memorandums of understandings and hydro permitting synchronization legislation could be developed and passed in additional states nationwide.

Add hydropower as an eligible project type to existing state loan and grant programs for water infrastructure.

Many states have existing water infrastructure loan and grant programs that could be modified to apply to hydropower development using existing water infrastructure.

For example, the Colorado Water Conservation Board modified its existing water infrastructure financing program to create a hydropower loan program that can finance the construction of hydro projects with loan terms of 30 years at an interest rate of 2%.

Similarly, the Colorado Water Resources and Power Development Authority (CWRPDA) created a small hydro feasibility grant program which can provide up to \$15,000 in 50% cost-shared funds to support hydro feasibility studies, permitting, final design and other costs associated with small hydro development. CWRPDA also has a small hydropower loan program that can lend up to \$2 million at a rate of 2% for project construction with a maximum term of 20 years.

The 2% loan funding available for hydropower construction in Colorado has fueled a flurry of new development, including almost 30 MW of new hydro construction recently constructed or currently underway in Colorado – a significant number considering the minimal amount of new hydro capacity currently being installed each year nationwide.^{xxvi}

Conclusion

With implementation of the policy and program reforms suggested in this report, federal and state policymakers can unleash new hydropower development – providing substantial economic and environmental benefits -- without building a single new dam or changing any existing diversions from natural waterways.

In order for these distributed hydro project opportunities to be realized, Congress needs to eliminate federal involvement in small projects and dramatically simplify development on existing non-powered dams. The executive branch needs to apply to small hydro the same policy and program tools it has previously applied to other distributed generation



The 8 MW hydro project at Ridgway Dam in Colorado, completed in June 2014, was made possible by \$15M in 2% loan funding provided by the Colorado Water Resources and Power Development Authority and the Colorado Water Conservation Board.

technologies. State governments need to replicate successes from states that have pioneered small hydro policy innovation.

Notwithstanding the important federal legislative reforms of 2013, installing hydropower on existing infrastructure is a process that remains time-consuming, costly and rare. With some additional non-controversial regulatory changes as described here, it could become inexpensive, quick and commonplace.

Endnotes

ⁱ Personal communication, Jeff Leahey, National Hydropower Association

ⁱⁱ See "An Assessment of Energy Potential at Non-powered Dams in the United States" at http://www1.eere.energy.gov/water/pdfs/npd_report.pdf

ⁱⁱⁱ See <http://www.nrel.gov/news/press/2015/15450.html>

^{iv} See U.S. Energy Information Administration, Electric Power Monthly with Data for December 2014, published February 2015

^v Personal communication, Frank Zammataro, Rentricity

^{vi} Barriers to hydropower development are discussed in detail in the following forthcoming DOE reports: Department of Energy Report to Congress, "Pumped Storage and Potential Hydropower from Conduits" Oak Ridge National Laboratory, "Opportunities for Energy Development in Water Conduits: A Report Prepared in Response to Section 7 of the Hydropower Regulatory Efficiency Act of 2013"

^{vii} See Hydropower Resource Assessment at Non-Powered USACE sites (July 2013), available at: <http://www.hydro.org/wp-content/uploads/2014/01/Army-Corps-NPD-Assessment.pdf>

^{viii} Personal communication, Frank Zammataro, Rentricity

^{ix} See 2014 U.S. power plant installation data from SNL Energy available at <https://www.snl.com/InteractiveX/Article.aspx?cid=A-30383350-12597>

^x Ibid.

^{xi} See U.S. Energy Information Administration, Electric Power Monthly with Data for December 2014, published February 2015

^{xii} See <http://www.nrel.gov/news/press/2015/15450.html>

^{xiii} Job Creation Opportunities in Hydropower, Navigant Consulting, 2009.

^{xiv} Ibid.

^{xv} See <http://www.epa.gov/cleanenergy/energy-and-you/affect/air-emissions.html>

^{xvi} Source: National Hydropower Association

^{xvii} FERC posts regularly-updated data regarding HR 267 exemption applications at <http://www.ferc.gov/industries/hydropower/indus-act/efficiency-act/qua-conduit.asp>

^{xviii} This problem has been noted in various federal reports including a FERC Report to Congress, "Hydroelectric Licensing Policies, Procedures, and Regulations Comprehensive Review and Recommendations," May 8, 2001. That FERC study showed that licensing costs (based on year 2000 dollars) are around \$900/kW for projects < 1 MW, \$200/kW for those 1-5 MW, and \$100/kW for 5-25 MW projects, and the average licensing process takes many years, which means large carrying costs on capital raised for project development.

^{xix} See <http://www.usbr.gov/power/>

^{xx} See <http://www.restor-hydro.eu/en/tools/mills-map/>

^{xxi} Personal communication, Frank Zammataro, Rentricity

^{xxii} Ibid.

^{xxiii} See <http://www.irecusa.org/> and <http://www.dsireusa.org/>

^{xxiv} Available at the Reclamation LOPP website at <http://www.usbr.gov/power/LOPP/>

^{xxv} State incentives are explained in detail at <http://www.dsireusa.org/>

^{xxvi} For additional details, see the forthcoming 2015 version of the Colorado Small Hydro Handbook which will be available from the Colorado Energy Office at <http://www.colorado.gov/energy/>