WRITTEN TESTIMONY OF RAMYA SWAMINATHAN

CEO, Rye Development

before the

U.S. HOUSE OF REPRESENTATIVES SUBCOMMITTEE ON ENERGY

regarding

"MODERNIZING ENERGY INFRASTRUCTURE: CHALLENGES AND OPPORTUNITIES TO EXPANDING HYDROPOWER GENERATION"

MARCH 15, 2017

EXECUTIVE SUMMARY

1. Hydroelectric power has proven grid reliability and stability characteristics, in addition to being a clean, emission-free, renewable form of electricity generation.
2. An increase in hydropower generating and storage capacity would be in the nation's best interest due to these characteristics.
3. There is significant potential for increases in hydroelectric generating capacity in a variety of forms, including capacity increases at existing hydro plants, new conventional hydropower, pumped hydro storage, marine and hydrokinetic generation and applications in conduits.
4. One of those forms, adding hydropower generating capability to existing non-powered dams has the potential to add as much as 12,000 MW of generating capacity.
5. The length, redundancy and opacity of the federal permitting processes that govern the timeline for new hydropower on existing dams is a significant barrier to additional capital being invested into this sector.
6. New hydropower development has faced challenges far beyond other energy technologies – both renewable and not – for this reason and others. Reducing the challenges and creating opportunities would speed the development of new hydropower throughout America.
7. Based on the success of the 2-year pilot licensing process, which this Subcommittee approved and was signed into law in 2013, as well as other licensing processes Rye Development has been through, we believe it is possible to adopt a 2-year licensing process for a significant number of projects that meet the criteria for low-impact, low-controversy projects.
8. Duplication and opacity in the overall federal process, both at FERC and USACE, must be minimized with regulatory risks throughout the overall federal permitting process being sequentially taken "off the table."

9. Non-federal hydropower development on federal dams brings quantifiable benefits to the federal government that should be valued through the extension of low cost financing to those projects and/or a federal standard offer power purchase agreement.
10. In conclusion, we see many opportunities, both legislative and regulatory, for the federal government to play an important role in overcoming impediments to increasing hydropower generating capacity, including permitting reforms, recognition for the value of Public-Private Partnerships, definitional changes that allow hydropower market access, and other economic incentives.

INTRODUCTION

Chairman Upton, Ranking Member Rush, Members of the Subcommittee, thank you for the opportunity to testify before you today on this important topic. My name is Ramya Swaminathan, and I am the CEO of Rye Development, a member of the National Hydropower Association (NHA).

I am pleased to discuss the importance of hydroelectric power, its benefits to the national electricity generation mix, and the potential for and impediments to the growth of hydropower.

NHA is a nonprofit national association dedicated to promoting clean, affordable, renewable, U.S. hydropower – including conventional hydropower, pumped hydro storage, marine and hydrokinetics, and conduit power projects. NHA represents more than 220 companies, from Fortune 500 corporations to family-owned small businesses. NHA's members include both public and investor-owned utilities, independent power producers, project developers, equipment manufacturers, other service providers and academic professionals.

Rye Development is a member of NHA and is the developer of the largest portfolio of new hydropower development projects in the United States. Our projects are located in eight states (Oregon, Pennsylvania, Ohio, West Virginia, Indiana, Kentucky, Mississippi, and Louisiana). All but one project are proposed to be located on existing dams owned by the state or the US Army Corps of Engineers. These make beneficial use of existing infrastructure by adding hydroelectric generating equipment to the existing dam. No new dams or impoundments will be constructed and the impacts of these projects on environmental and other resources are broadly agreed to be minimal and mitigable.

In addition to this portfolio of projects that will add hydropower generating capacity to existing dams, we have recently entered into a partnership with Grid America Holdings, an affiliate of the multi-national utility company, National Grid, to jointly acquire, develop, construct and operate a 393 MW pumped hydro storage project in the State of Oregon, near the California border.

THE BENEFITS OF HYDROPOWER

Hydroelectric generation is the oldest and most reliable form of renewable generation. The technology behind conventional hydroelectric generation has not changed significantly since the world's first hydroelectric power plant began operating in Appleton, Wisconsin in 1882. As our chief engineer likes to say, there's nothing very innovative about hydropower, and that's the beauty of it.

Hydropower accounts for approximately 7 percent of the nation's total electricity generation, generates power in every region of the country, and is, by far, the largest form of energy storage available and used in the United States and around the world. As this Committee stated in the report on H.R. 8, the inherent benefits of hydropower include: energy security, stability, and reliability, environmental protection and enhancement, and recreation.

The benefits that hydroelectric generation provides to the electric grid are unique and numerous. In addition to pure generating capacity, hydropower and pumped storage provide essential grid reliability and stability services, such as load following, firming for other more intermittent sources of power through energy storage, voltage and frequency support, and blackstart capability in times of outage.

The addition of significant amounts of <u>new</u> hydropower generating capacity to our nation's energy mix will provide all of these mentioned grid benefits as well as a meaningful amount of economic activity in the regions of development, additional emissions-free clean energy, and in the case of new hydro development on existing dams, much-needed private investment into our aging dam infrastructure and its ongoing maintenance.

POTENTIAL FOR NEW HYDROPOWER

There is significant potential for increasing hydropower generating capacity. The Department of Energy's "Hydropower Vision" report suggests that hydropower capacity can be increased by close to

50% by 2050, which would represent a cumulative economic investment of $148 billion and more than 195,000 related jobs. Increases in capacity could come from efficiency improvements and responsible expansion of existing hydropower projects, pumped hydro storage, marine and hydrokinetic generation, applications in conduits and new hydropower added to existing non-powered dams.

The headline number for the potential for new hydropower on existing dams is compelling: there are over 80,000 dams in the United States and only three percent (3%) of them have hydropower generating capacity. The supply of non-powered dams that can provide incremental generating capacity is essentially unbounded even if a significant fraction of the remaining of 77,600 are excluded from consideration.

The Department of Energy estimates that adding generating capacity to existing dams in this type of low-impact development could add as much as 12,000 MW to the nation's electricity stack.

The benefits of this form of hydropower development include:

1. Direct employment. The construction of hydropower projects on existing dams has the potential to create approximately 150 – 300 jobs per project during an average construction period of between 1½ and 3 years.
2. Direct purchase of goods and services. Many goods and services used in construction must be procured locally (e.g. concrete, fuel, riprap, gravel, etc.), which is a benefit to local and regional businesses.
3. Indirect Economic Impact. Additional benefits to local communities include the "multiplier effect" from the economic activity generated by direct employment and purchase of goods and services locally.
4. Private investment into aging dam infrastructure. The addition of newly constructed hydropower facilities on an existing dam provides a number of enhancements, both structural

and operational, to the dam itself. These inure to the benefit of the dam owner and, by enhancing the stability of the dam, contribute to the public benefit.

REGULATORY IMPEDIMENTS TO NEW HYDROPOWER DEVELOPMENT

The timeline for a new hydropower development project to reach commercial operation is between 10 and 13 years, which is almost unmatched in the power generation space. Most of this time is taken by permitting. Federal permitting can account for 8 to 10 years (FERC licensing for 5 – 6 years and USACE permitting for 2 – 4 years) of that time, with the average construction period being between 1.5 and 3 years. Other renewable energy resources, and indeed fossil fuel generation, can effectively progress from inception to operation in less than half that time. It is possible to advance solar, wind, and even combined cycle plants from concept to being operational within 2 or 3 years.

This disparity of timelines to commercial operation presents a formidable challenge to new hydropower development. Private investors in the power generation space find the length and complexity of hydropower's timeline difficult to manage. As a result, hydropower development becomes expensive due to the compounding of interest costs over long periods coupled with the unclear risk profile. When faced with these factors, many investors to choose to invest in other forms of generation with far shorter timelines and clearer risk assessments.

Only nuclear and geothermal generation have regulatory processes that are comparable in length and complexity to what new hydropower on existing USACE dams must undergo. However, the impacts of building new hydropower on existing dams are not comparable to the risks of building a new nuclear or geothermal plant. These dams already exist, and the projects are proposed on already disturbed ground. Hydraulic impacts are typically limited to the stretch of the river a few thousand feet upstream and downstream of the existing dam; terrestrial impacts are typically limited to the area of ground

disturbance, which is usually small as there is no dam being built, only a relatively small powerhouse and appurtenances, including transmission lines, and construction access.

The federal permitting regime for new hydropower on existing USACE dams has two major parts: the FERC license and the USACE processes.

FERC Licensing

In our experience, the FERC licensing process takes 5 – 6 years from preliminary permit to license order. The Hydropower Regulatory Efficiency Act of 2013 (HREA, H.R. 267, 113th Congress; P.L. 113-23) made multiple references to increasing the efficiency of the FERC licensing process and directed the FERC to investigate the feasibility of a two-year licensing process for hydropower development and non-powered dams.

In May of 2014, FFP Project 92, LLC, a project company for which Rye Development is the agent, requested approval to use the two-year licensing process for a proposed project on Kentucky River Lock & Dam 11. In August of 2014, FERC granted that request, and our project became the only project nationwide selected to advance through the two-year licensing process. In May of 2016, the FERC granted a license order to FFP Project 92, LLC for its proposed project, marking the successful completion of the two-year licensing process.

Based on our successful experience with the two-year licensing process and our experience filing 22 other final license applications with the FERC and receiving 11 license orders, we believe that it is possible to shorten the FERC licensing process to two years for a narrowly defined yet nationally significant set of projects. All would be low-controversy projects that have impacts that are widely understood to be minimal and mitigable. This does not mean they would all be small projects; with hydropower, size and impact are not directly correlated.

In our view, there are two critical requirements for the successful adoption of the two-year process:

1. Limiting projects that qualify for that expedited treatment to those that meet an objective, predetermined set of criteria that is applicable to a larger number of projects than the pilot project solicitation.
2. Imposing strict and published timelines for all parties involved, including the applicant and FERC staff. This was very successfully implemented by FERC during the two-year pilot process.

USACE Regulatory Process

The USACE is the owner of many of the non-powered dams best suited for hydropower development in the country. Developers who propose projects on USACE dams must go through more federal permitting at the USACE, typically after FERC license, which can add another 2 to 4 years to the 5 – 6 years spent in FERC licensing. Before infrastructure construction can begin, Section 404 permits (required by Section 404 of the Clean Water Act) for "dredge and fill" activities must be granted (usually at all projects, not just at those on USACE dams) and Section 408 permissions to modify the USACE dam itself must also be granted.

There have been a number of recent legislative and administrative developments that are positive steps toward the rationalizing the USACE permitting regime and its interaction with FERC licensing. The Water Resources Reform and Development Act of 2014 (P.L. 113-121) mandated that the USACE prioritize the development of non-federal hydropower at federal dams. The USACE has also entered into an MOU with the FERC to prioritize coordination between these agencies.

However, from a developer's perspective, these steps have not yet resulted in a "right-sized" federal permitting process: the overall timeline is still too long and the combined permitting process does not sequentially take risks "off the table" for the investor. Important project parameters are left unresolved until very late (i.e. the 7th or even 8th year of a combined federal permitting cycle).

There are still redundancies between the FERC licensing process and the USACE permitting regime, for example, the duplicative application of NEPA, first by the FERC at the licensing phase and then subsequently by the USACE, triggered by the Section 404 permit. In particular, the parameter that is most at stake for a hydropower developer is the water quality standard, which determines the amount of water ultimately that will be available for passage through the turbines and therefore, determine the amount of generation (revenue) at any given project. From a planning perspective, understanding the volume of water allowed to be used is necessary for designing the project. From a commercial perspective, this is an absolutely critical parameter that would best be known as early as possible and is a risk that needs to be taken "off the table" at the earliest point in the process regulators have the ability to do so.

Pursuant to the Clean Water Act, the state in which the project discharges water must either grant or waive a Section 401 permit, without which the FERC license order cannot be granted. For our project that borders Mr. McKinley's district and Mr. Johnson's, we require permits from both West Virginia and Ohio. The FERC license order incorporates the terms and conditions of the State-issued Section 401 permit as mandatory conditions.

Subsequent to all the work, studies, and analysis performed by the applicant, FERC staff and contractors, and the State, and subsequent to the issuance of the FERC license at the 10 - 20% design point, the UASCE may undertake separate analysis, for which the developer may be required to perform new and different studies (beginning in the 6th or 7th year of a federal permitting process), and may prescribe different water quality standards from the FERC and the State after the 60% design point. At that point, the developer will have likely spent several million dollars on the development of a license and studies supporting it as well as final design engineering to the 60% point based on a set of economic criteria that may or may not be achieved under new design parameters to support the changed water quality criteria In addition to the sunk costs at that point, the developer will likely have to spend hundreds of thousands

of dollars more to determine whether the changed design parameters will lead to an economically feasible project.

There are a number of different potential solutions to the opacity and the redundancy of this combined federal process, including:

- Requiring any federal agency to adopt the NEPA analysis of another federal agency if it has analyzed the same project within a certain period of time, or
- Requiring that USACE adopt the prevailing State standards for water quality parameters applicable to the project.

FACILITATING THE DEVELOPMENT OF HYDROPOWER PUBLIC-PRIVATE PARTNERSHIPS

Non-federal hydropower development at federal dams is an avenue for the federal government to attract private capital to invest in its dam infrastructure and an example of a Public-Private Partnership.

The privately-funded construction of hydropower on an existing dam provides a number of benefits to the federal owner:

a. New construction of a powerhouse and other appurtenances at an existing dam reinforces the dam at the powerhouse and at the tie-in to the dam structure.
b. Erosion and sedimentation control on the side of the dam with the new construction will typically become the responsibility of the private developer.
c. The private developer will typically take maintenance obligations of at least the portion of the dam occupied by the powerhouse and other project elements.
d. In some projects, hydropower project elements benefit the dam, the dam owner and the ongoing operations in support of the original purpose of the dam. For example, lining of existing conduits enhances the strength and long-term serviceability of the conduits.

e. New hydropower projects typically provide recreational enhancements to existing facilities, including fishing platforms and portages.

f. Federal facilities typically require that the private developer provide electricity or pay the electric bill for the dam on which the project is located.

Taken in this context, non-federal hydropower development offers a quantifiable benefit to the federal government. The federal government could recognize the value that private capital brings in one of a few different ways:

- Providing a 20- or 30-year standard offer for the purchase of power, pursuant to published rates, for hydroelectric power sold by non-federal projects located on federal dams, or
- Making non-federal hydropower projects on federal dams eligible for low-cost financing from programs such as the Rural Utility Service (RUS) Electric Programs. Since this would take the form of a loan, the project entity would be required to pay interest to the RUS, benefiting the United States taxpayer.

Both of these actions would effectively lower the cost of the electricity produced by the relevant hydroelectric projects, providing further benefit to the local communities in which the projects are located.

ADDITIONAL OPPORTUNITIES TO EXPAND HYDROPOWER GENERATION

In addition to the regulatory impediments we face and the potential Public-Private Partnerships that we propose, there are other opportunities for the federal government to expand hydropower generation:

- Definition of "renewable energy": The current definition of "renewable energy" for Federal purchase requirements (42 US Code § 15852) includes electric energy generated from hydroelectric generation capacity achieved from increased efficiency or additions of new capacity at an existing hydroelectric project. Allowing hydropower added to non-powered dams

and pumped-storage projects would allow these types of projects to support the federal government's goals and benefit project developers.

- Section 242: The Hydropower Production Incentives Act was added to the Energy Policy Act of 2005 by this Committee. It creates an incentive for private developers to add hydropower to existing dams and conduits. We thank Congressmen McKinley and Johnson for their leadership to reauthorize the program and for their and Congressman Doyle's annual efforts to fund it.
- Tax Incentives: While not within this Committee's jurisdiction, changes to the tax code, including reestablishing parity among generation sources, would greatly improve the ability of hydropower developers to access capital.

CONCLUSION

Rye Development, as a member of NHA, thanks you for inviting our testimony on this vitally important subject and are ready to work further with you to resolve the challenges and create opportunities to expand hydropower generation. This Subcommittee worked last Congress to produce legislation that addressed the challenges hydropower developers face. We are grateful for all your efforts. We encourage you to continue working to help expand the development of low-impact, low-cost, zero-emission power. Hydropower helps to promote our national energy security by diversifying local energy portfolios, provides a tried-and-true mechanism for integrating all renewables into the grid, and with pumped storage, like our Swan Lake North project, is essential for energy storage and grid reliability.

SUPPLEMENTAL WRITTEN TESTIMONY OF RAMYA SWAMINATHAN

CEO, Rye Development (on behalf of NHA)

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"MODERNIZING ENERGY INFRASTRUCTURE: CHALLENGES AND OPPORTUNITIES TO EXPANDING HYDROPOWER GENERATION"

MARCH 15, 2017

Supplemental Written Testimony of Ramya Swaminathan, CEO, Rye Development on behalf of NHA

Executive Summary

1. In the last several years, hydropower has provided approximately 6 percent of all U.S. electricity generation and nearly half of renewable generation. By 2030, approximately 400 projects representing 18,000 MW of capacity of the existing system will be up for relicensing.

2. Hydropower has significant untapped growth potential, particularly at existing infrastructure and with low impact projects, such as capacity additions at current hydropower facilities, adding generation to non-powered dams, and closed-loop pumped storage, among others. The Department of Energy's recent Hydropower Vision Report estimates that close to 50 GW of new capacity is available by 2050, with the right conditions and policy support in place.

3. New hydropower project development, as well as the relicensing of existing projects, faces a variety of obstacles. These include: a regulatory process that can be modernized to increase coordination and reduce unnecessary duplication, delays and costs; a lack of valuation of grid security and reliability services; and inequitable treatment and recognition under renewable energy tax incentives and other renewable/clean energy programs, including federal R&D funding to support new technologies. Combined, these issues are impacting hydropower competitiveness and creating unnecessary challenges that hold back growth.

4. NHA supports policies to address regulatory inefficiencies and to improve coordination in the overall hydropower project approval process and calls on Congress and the Administration to address this and other energy and market policy issues that limit investment in hydropower infrastructure. And, we believe this can all be done in ways that promote the hydropower resource while protecting environmental values.

5. Hydropower has a critical role to play in meeting our nation's energy, environment, and economic objectives. The benefits from this resource are many – low-cost, reliable, base load renewable electricity, along with additional ancillary grid services (load following, frequency response, energy storage, etc.) – services that will allow our country to add significantly to our national portfolio of renewable, clean energy resources.

6. Finally, as the Congress works to address our energy and infrastructure needs, whether that be on a new national infrastructure program or further work on an energy bill, policies that support the preservation of the existing hydropower system and promote the deployment of new projects (for all categories of water power technologies) must be included. A greater recognition that our hydropower infrastructure is incredibly valuable is needed, and continued investment and re-investment in the system is critical to our energy future and national security.

Introduction

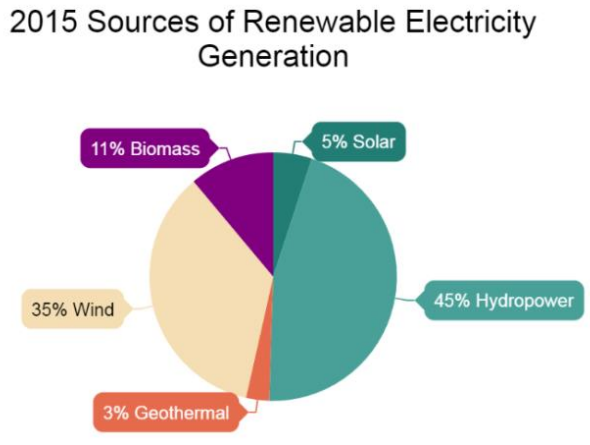
The following information supplements the written testimony of Ramya Swaminathan on behalf of the National Hydropower Association (NHA) and provides additional information and details on the state of the U.S. hydropower industry today, the importance of hydropower to the U.S. electric system, the untapped growth potential across the various sectors of the industry, and the policy issues that need to be addressed to fully realize that growth.

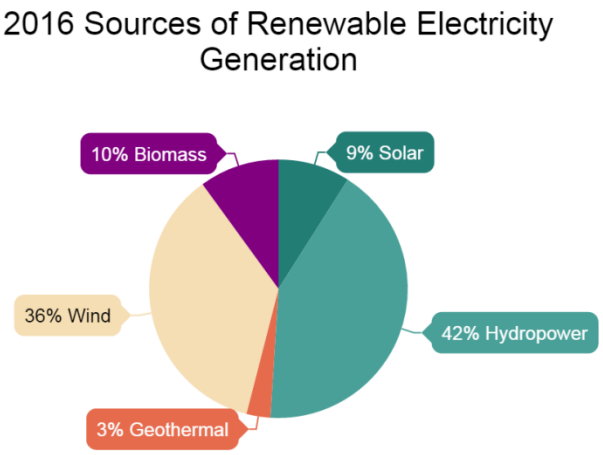
NHA is a nonprofit national association dedicated to promoting clean, affordable, renewable U.S. hydropower – from conventional hydropower to pumped storage to marine energy to conduit power projects. NHA represents more than 220 companies, from Fortune 500 corporations to family-owned small businesses. Our members include both public and investor-owned utilities, independent power producers, developers, equipment manufacturers and other service providers, and academic professionals.

U.S. Hydropower Statistics

Currently, the U.S. conventional hydropower fleet is made up of almost **2200 individual plants** with a total capacity around **80 GW**. In the last two years, these plants provided approximately **6 percent** of all U.S. electricity generation and **almost half** of all renewable electricity generation – making hydropower the single largest provider of renewable electric power in our country. Looking over the long term, hydropower has supplied a cumulative 10 percent of U.S. electricity generation over the past 65 years (1950-2015), and 85 percent of cumulative renewable power generation over the same time period.

In addition to the conventional hydropower system there are an additional **42 hydropower pumped storage plants** with approximately **22 GW** of capacity – projects that make-up almost all, **97 percent**, of energy storage in the U.S. today.[1]

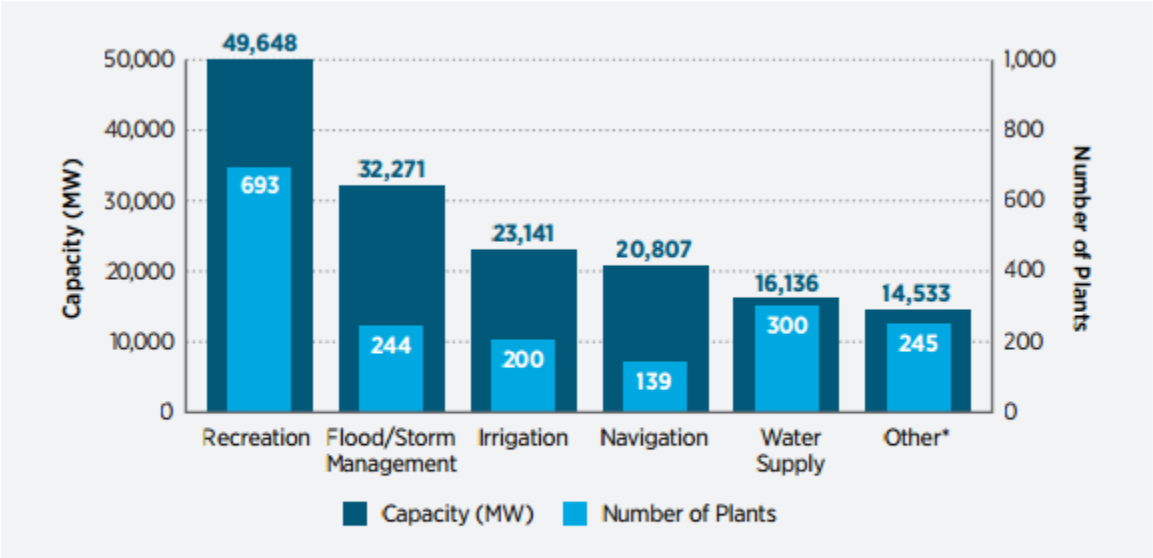




[1] 2016 Hydropower Vision Report, Department of Energy, Office of Energy Efficiency and Renewable Energy, Wind and Water Power Technologies Office, Executive Summary P. 9. https://energy.gov/sites/prod/files/2016/10/f33/Hydropower-Vision-Executive-Summary-10212016.pdf

Hydropower generation is a clean air resource and avoids millions of metric tons of carbon emissions each year. In fact, regions that rely on hydropower as a primary energy source (like the Northwest) reap the benefits of significantly cleaner air with some of the lowest carbon intensity rates in the country.

In addition to this clean and renewable energy, hydropower infrastructure provides other important benefits, including managing river flow for aquatic species and habitat protection, flood control and drought management, water supply, irrigation and more, as the chart below illustrates.[2]

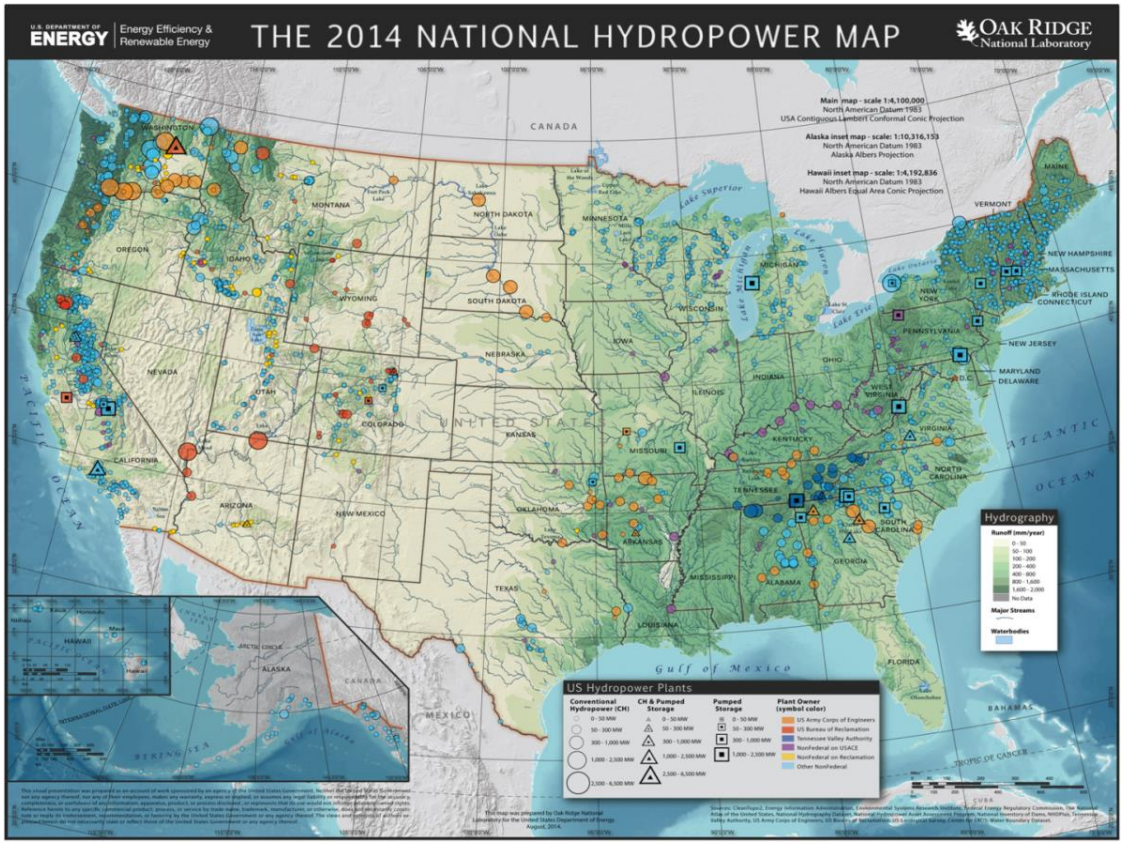


Note: The use categories are not mutually exclusive; a given dam can be included in more than one category. The data include only powered dams.
Source: Uría-Martínez et al. 2015 [2]

Figure 2-11. Total capacity and number of plants for six separate uses (illustrated by the blue bars) of existing hydropower dams and reservoirs

The next map below was developed by the Department of Energy (DOE) through Oak Ridge National Laboratory (ORNL) and provides a visual representation of the size and location of projects for both the federal and non-federal hydropower systems. Existing hydropower assets are located in all but two states (Delaware and Mississippi), though every state receives the benefit of the clean renewable generation that these projects provide.

[2] Hydropower Vision Report, Chapter 2, Page 83.



The contributions of the existing hydropower fleet to the electric grid are many (base load power, peaking generation, load-following, energy storage, reliability and more). With the need for more of these benefits and services, as the nation strives to become more energy independent, NHA has seen the hydropower industry grow and expand in recent years.

In fact, the United States experienced a net capacity increase of **1.4 GW**[3] from 2005 to 2013, enough to power over half a million homes[4]. FERC has reported an additional 260 MW of capacity being placed in service since then, with even more projects in licensing or in the construction phase today. And this number could significantly increase with a modernized regulatory approval process that currently takes years longer than that of other renewable resources – in some cases licensing can take 10 years or longer.

In addition, hydropower projects bring multiple economic benefits to the communities in which they are located and those that they serve. To start, the industry itself currently employs a sizable workforce. 143,000 jobs are created just from the continued operation and maintenance, as well

[3] 2014 Hydropower Market Report, Executive Summary P. VI.
[4] An Assessment of Energy Potential at Non-Powered Dams in the United States, Department of Energy, Office of Energy Efficiency and Renewable Energy, Wind and Water Power Technologies Office and Oak Ridge National Laboratory, April 2012, Executive Summary P.VII, Footnote 1.
http://nhaap.ornl.gov/sites/default/files/NHAAP_NPD_FY11_Final_Report.pdf

as upgrades, of the existing system, with additional employment opportunities gained in the pursuit of new project development and deployment.[5]
On top of this, the access to low-cost, reliable clean power is attracting many companies to regions with hydropower. For example, major high-tech companies like Google, Facebook, and Yahoo require large, energy-intensive data centers to drive their businesses. Specifically, in September 2010, Yahoo opened a new facility in Lockport, New York to utilize hydropower provided by the New York Power Authority. And again, in 2013, New York officials cited the importance of low-cost hydropower in Yahoo's decision to expand the Lockport facility.[6]

Growth Potential

One of the largest misconceptions of the hydropower industry is that any growth potential is "tapped out". In its new report issued in 2016 titled, Hydropower Vision: A New Chapter for America's 1st Renewable Electricity Resource, the Department of Energy smashes that myth. The Vision analysis finds that U.S. hydropower could grow to nearly **150 GW by 2050**. This would represent close to a **50 percent** increase in capacity.

The report identifies opportunities for **13 GW** of new hydropower capacity by adding generating facilities to existing non-powered dams and canals, upgrades to existing hydropower facilities, and limited development of new stream reaches. It also finds the potential to add up to **36 GW** of new pumped storage capacity.

Looking to the benefits of this potential, the report finds $148 billion in cumulative economic investment. $58 billion in savings in avoided mortality, morbidity and economic damages from air pollution. Cumulative 30 trillion gallons of water withdrawals avoided for the electric power sector. 5,600,000,000 metric tons of CO_2 emissions reductions with $209 billion in avoided global damages. And over 195,000 hydropower-related gross jobs spread across the nation in 2050.[7] Those are quite substantial benefits for our country.

Adding Generation to Non-powered Dams

One of the prime areas of growth in the hydropower industry is on existing infrastructure, such as non-powered dams and conduits. Of the approximately 80,000 dams in the U.S. today only **3 percent** have electric generating facilities. Put another way, **97 percent** of our dams do not produce power and were built for other purposes such as water supply, irrigation, navigation and recreation.

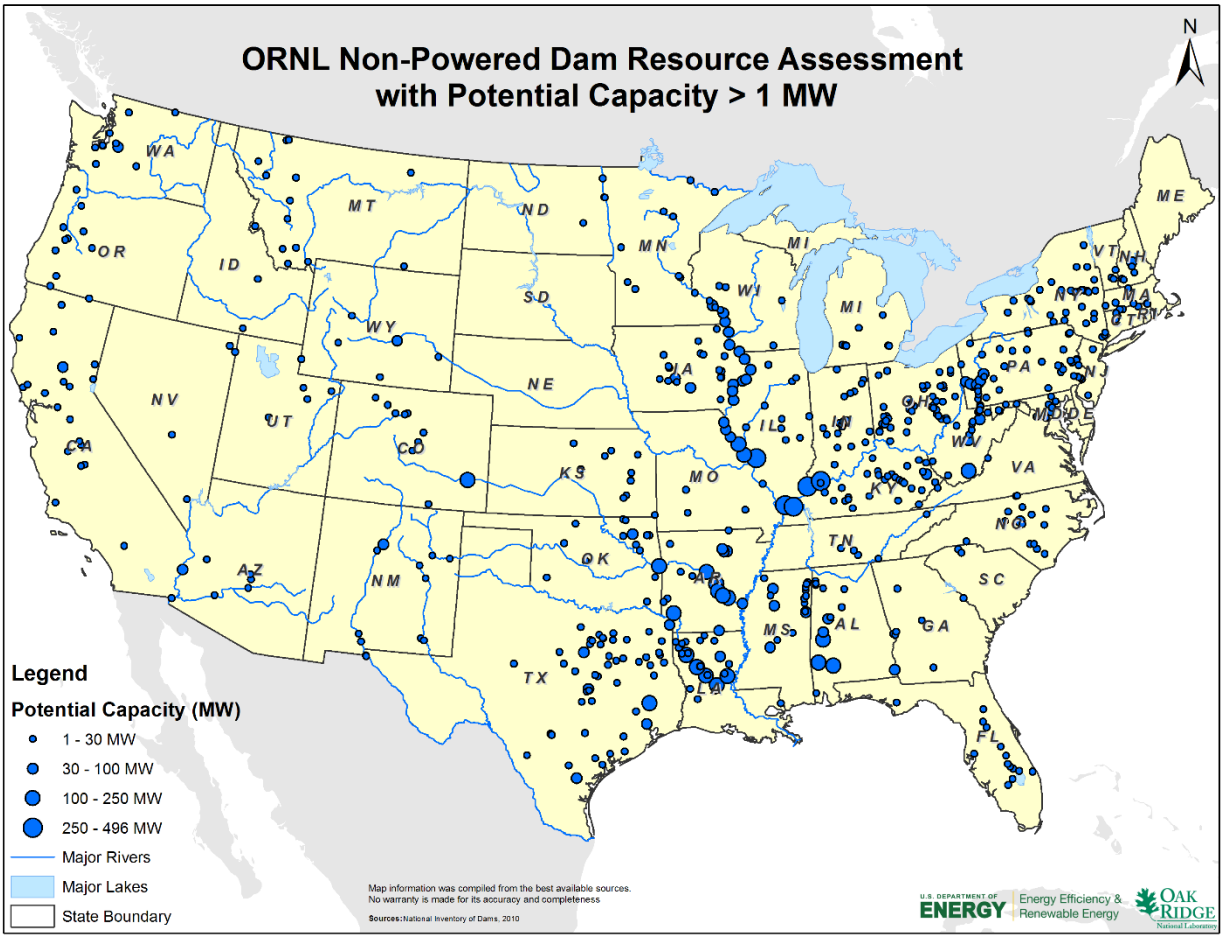
NHA recognizes that not every existing dam may be a suitable candidate to add power generating equipment, as many factors come into play in development decisions: project development costs and revenue opportunities; energy generation potential; natural resource

[5] Vision Chapter 2, Page 203-204. https://energy.gov/sites/prod/files/2016/10/f33/Hydropower-Vision-Chapter-2-10212016.pdf
[6] http://www.nypa.gov/Press/2013/130322.pdf
[7] Hydropower Vision, Executive Summary P. 7 and 23.

considerations; transmission needs; dam safety; etc. However, what this statistic shows is the large untapped universe of potential opportunities that exist – and that are not being developed in significant part because of the concerns about the uncertain, duplicative and lengthy regulatory process.

Those dams that are candidates for hydropower development are infrastructure that will continue to exist, operate and release flows to meet water supply, irrigation, flood control, and other purposes for which they were originally constructed – regardless of whether hydropower facilities are installed. It is good public policy to take advantage of these existing releases to capture the energy currently untapped at these sites to add to our portfolio of renewable, carbon-free resources.

The U.S. Department of Energy recognized this opportunity and in 2012, through the Oak Ridge National Laboratory, released an assessment of potential capacity at non-powered dams for projects greater than 1MW. The map below on the following page depicts the size and location of the top projects of that survey with capacity greater than 1 MW.[8]



8 http://www.energy.gov/eere/water/hydropower-resource-assessment-and-characterization

The results of the study show that over **12 GW** of potential exist across the existing system with **8 GW** of potential available at the top 100 sites.[9] Also of interest, **81 of the top 100** sites were located on federal facilities, in particular, Army Corps of Engineers dams.[10]

These types of projects are some of the lowest impact new developments in the energy sector. No new dams need to be built and the projects aim to utilize existing flows through the projects. This water is already moving through the system, what better way to maximize the benefits of this infrastructure by also generating clean, renewable power with them.

Capacity Additions/Efficiency Improvements at Existing Hydropower Infrastructure

The potential for new conventional hydropower generation is not only about adding new capacity at non-powered dams. Existing hydropower facilities are also expanding through upgrades and efficiency improvements.

In fact, since EPAct of 2005 and the inclusion of hydropower as an eligible technology in the production tax credit (PTC), over **150 projects** have received certification. These projects have seen, on average, about a **9 percent** gain in generation.[11] These projects represent a small fraction of the hydropower fleet, so there are even further gains to be had if more projects undertake these kinds of upgrades. And in many instances, the project realizes not only an increase in capacity or generation, but also an increase in environmental performance.

NHA also notes from an infrastructure perspective that there is tremendous opportunity for re-investment in the federal hydropower system. Almost half of the U.S. hydropower generation comes from the federal system, with the bulk owned and operated by the U.S. Army Corps of Engineers, the Bureau of Reclamation and the Tennessee Valley Authority. The median age for federal hydropower projects is 50 years.[12] Turbine and other equipment refurbishments (including repairs, replacements and upgrades) are available and can improve the performance of these projects both from an energy and environmental perspective.

Hydropower Pumped Storage

Pumped storage is a modified use of conventional hydropower technology to store and manage electricity. As shown below, pumped storage projects store potential electricity by circulating water between an upper and lower reservoir.[13]

Electric energy is converted to potential energy and stored in the form of water at an upper elevation. Pumping the water uphill for temporary storage "recharges the water battery" and,

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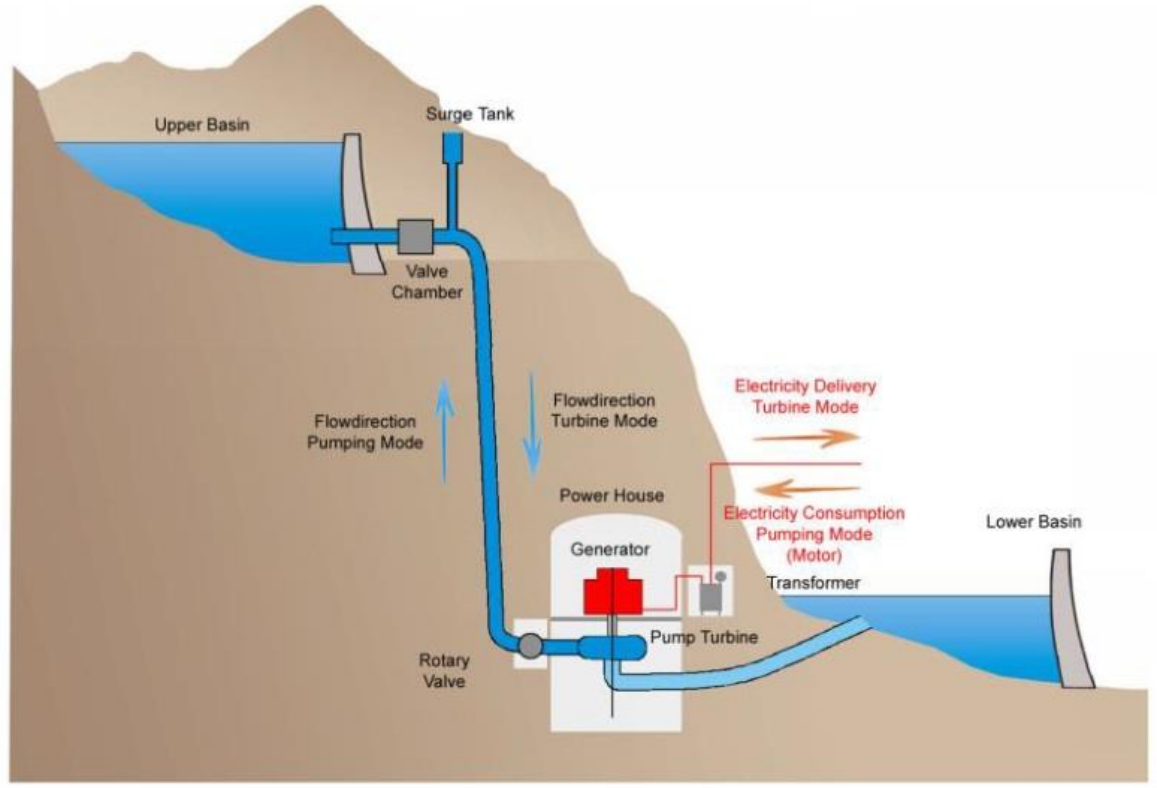
[9] 2012 Non-Powered Dams Report, Executive Summary P.VII and VIII.
[10] 2012 Non-Powered Dams Report, Executive Summary P.VIII.
[11] Federal Energy Regulatory Commission data.
[12] Hydropower Vision, Chapter 2, Page 147.
[13] Illustration provided by GE Renewable Energy.

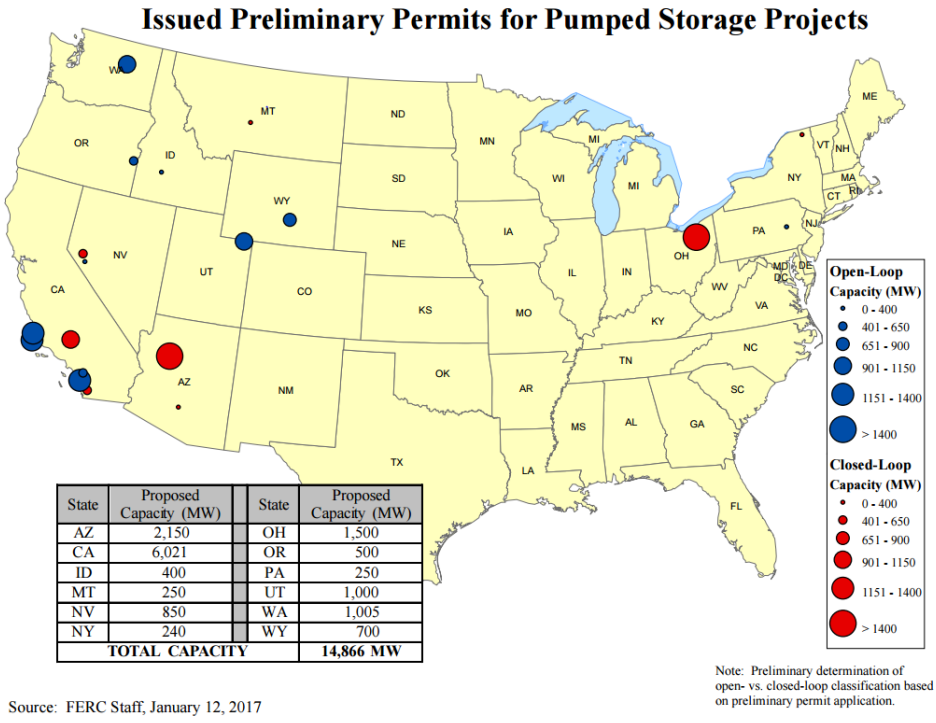
during periods of high electricity demand, the stored water is released back through the turbines and converted back to electricity like a conventional hydropower station. See illustration below.



Pumped storage projects able to rapidly shift, store, and reuse energy generated until there is the corresponding system demand and for variable energy integration. This energy shifting can alleviate transmission congestion, which helps more efficiently manage the electric grid, and can reduce the need for costly new transmission projects, as well as to avoid potential interruptions to energy supply.

As more intermittent generation is added to the grid, particularly in the West, the need for the services that pumped storage provides is increasing. As a result, we are seeing a significant renewed interest in these projects, including closed-loop project proposals.[14] As the map below shows, there are currently close to **15,000 MW** of proposed new pumped storage projects before FERC with preliminary permits right now.

[14] Closed loop pumped storage projects are physically separated from existing river systems. They present minimal to no impact to existing river systems because after the initial filling of the reservoirs, the only additional water requirement is minimal operational make-up water required to offset evaporation or seepage losses.



State	Proposed Capacity (MW)	State	Proposed Capacity (MW)
AZ	2,150	OH	1,500
CA	6,021	OR	500
ID	400	PA	250
MT	250	UT	1,000
NV	850	WA	1,005
NY	240	WY	700
TOTAL CAPACITY			**14,866 MW**

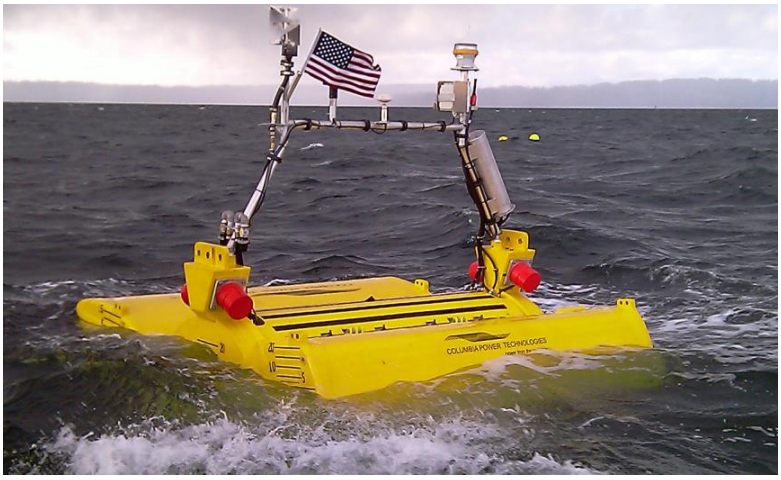
Source: FERC Staff, January 12, 2017

Again, NHA recognizes that not all of these projects may be developed, however, they clearly rebut the proposition that hydropower is a "tapped out" resource.

Marine Energy and Hydrokinetics

With more than 50 percent of the U.S. population living within 50 miles of coastlines, there is vast potential to provide clean, renewable electricity to communities and cities across the United States using marine and hydrokinetic (MHK) technologies. MHK technologies extract energy from waves, tides, ocean currents, rivers, streams, and ocean thermal gradients. Though still in its early stages of development as a whole, the MHK industry continues to move forward with new technological innovations, test site developments, and demonstration projects.[15] DOE assessments have estimated that the total marine resource potential represents up to 25 percent of projected U.S. electricity generation requirements by 2050.[16]

[15] Photo below of technology demonstration of Columbia Power Technologies of Charlottesville, Virginia
[16] https://energy.gov/eere/water/marine-and-hydrokinetic-resource-assessment-and-characterization



Conduits

Conduit projects utilize existing tunnels, canals, pipelines, aqueducts and other manmade structures that move water. These are fitted with electric generating equipment and are often small projects that are able to extract power from the water without the need for additional infrastructure or a reservoir.

One of the prime opportunities in this sector is at Bureau of Reclamation infrastructure. In a recent study, Reclamation identified 373 potential sites with a capacity of 103 MW, enough to power 33,000 homes.[17]

In addition, as a result of the expedited review of non-federal conduit projects under the Hydropower Regulatory Efficiency Act of 2013, the Federal Energy Regulatory Commission (FERC) has approved dozens of small conduit projects across the country.[18][19]

[17] Site Inventory and Hydropower Energy Assessment of Reclamation Owned Conduits (Final Report - March 2012). https://www.usbr.gov/power/CanalReport/

[18] https://www.ferc.gov/industries/hydropower/indus-act/efficiency-act/qua-conduit.asp

[19] Picture of Natel Energy, Monroe Hydro Project, a 250 kw hydroelectric plant located in an irrigation canal, in partnership with Apple.

Also, in 2013, legislation was passed focused on similar small conduit development at Bureau of Reclamation infrastructure and Reclamation has made changes to its lease of power privilege (LOPP) program. Reclamation continues to see increased interest in these project opportunities as well.[20]

New Stream-Reach Development

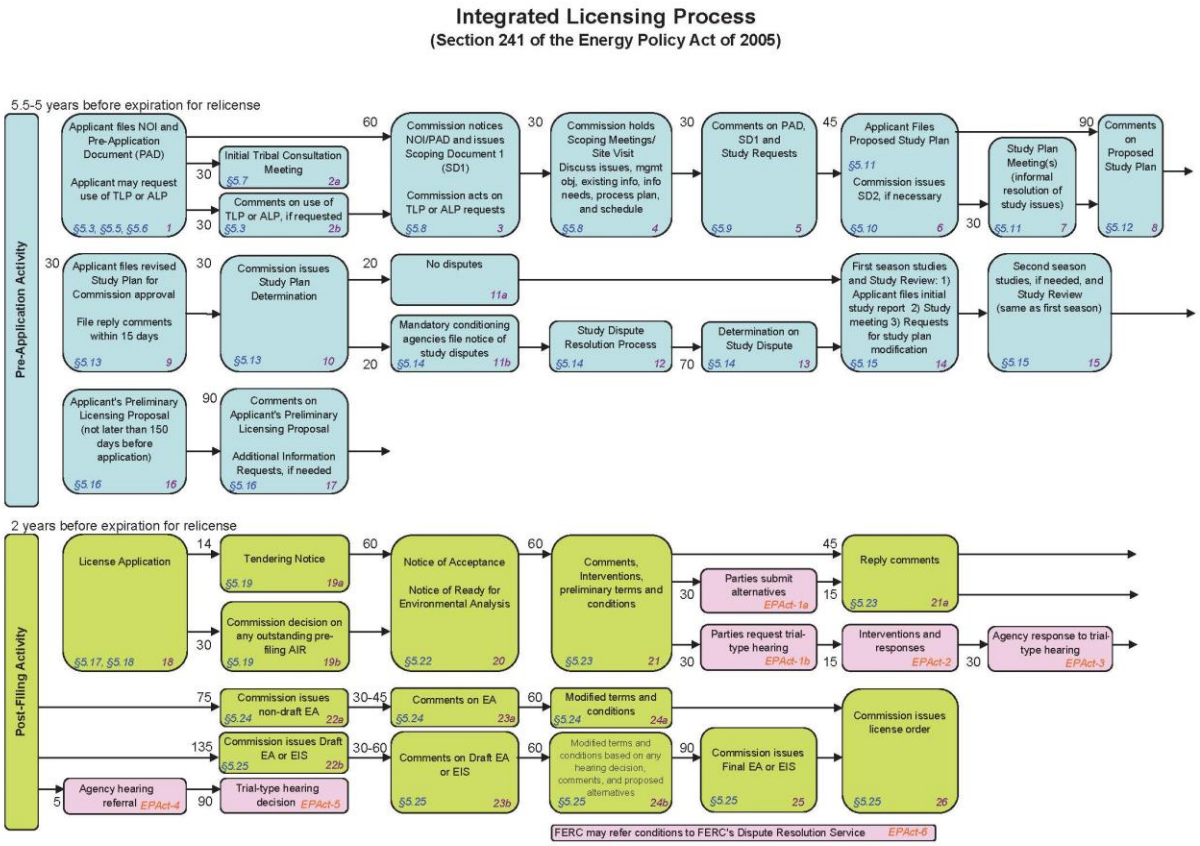
Lastly, the DOE has also recently conducted a study of potential new greenfield projects. The assessment concluded that the technical resource potential is 85 GW of capacity. When federally protected lands—national parks, national wild and scenic rivers, and wilderness areas—are excluded, the potential is about 65 GW of capacity.[21] Not all of these new hydropower opportunities are likely to move forward once site-specific considerations are taken into account. Site selection will be an important factor. Additionally, the industry and the DOE are investigating innovative new technologies and operational regimes to see where some of this potential can be realized, while also minimizing potential impact.

Challenges for Hydropower and Policy Needs

To begin, hydropower has the longest, most complex development timeline (for project relicensing or new project approvals) of any of the renewable energy technologies, with some projects taking **10 years or longer** from the start of the licensing process through construction to being placed-in-service.

This process requires a considerable up-front financial commitment from the developer or asset owner to undertake the engineering and environmental studies required for various federal and state approvals. The chart below outlines the integrated licensing process or ILP, the default process, of several, for authorizing hydropower projects.

[20] https://www.usbr.gov/power/LOPP/index.html
[21] http://www.energy.gov/eere/water/downloads/new-stream-reach-hydropower-development-fact-sheet



*Section 241 of the Energy Policy Act of 2005 in pink.

A multitude of federal and state agencies, as well as the public and other stakeholders, play a major and important role in the process. And in the chart above, additional authorizations such as those required by federal dam owners if building on their infrastructure, are not included. These decisions and authorizations have tended to come at the end of the timeline after the FERC issuance of the license.

Water is a public resource and NHA and the industry recognize the necessity for and value of thorough review of project applications. However, redundancies and sequential reviews contained in the overall process are key reasons for delays. For example, for projects adding generating facilities to non-powered federal dams, FERC may issue a license, yet that project cannot commence construction until it has received additional approvals from the federal owner of the dam (Corps of Engineers or Bureau of Reclamation). If there are unanticipated delays for those additional needed approvals, no work can commence. It is a similar case for state issuances of Clean Water Act Section 401 water quality certifications. A license cannot be issued, nor work commenced, until the certificate is approved.

NHA believes the time, cost and risks associated with licensing hydropower projects are not commensurate with the impacts, particularly when compared with other forms of generation – conventional or renewable. As former NHA President John Suloway testified before Congress in

2015[22], because of this, when faced with the choice of what type of generation to install, there is less risk in choosing a simple cycle turbine or a combined cycle plant that burns natural gas or low-sulfur oil, than building a hydropower plant.

While there is some variability with regard to size and location, the regulatory approval processes for simple cycle turbine or combined cycle plants are generally 1-2 years – even in urban areas like New York City. The FERC licensing process for hydro plants is generally 8 years or more, including both licensing and pre-filing activities. With regard to licensing costs, a combined cycle plant is approximately $1 to $2 million; whereas, some studies alone can cost multiples of that figure for a hydropower project. It is not uncommon for a hydropower license applicant to spend $10 million or more on just the licensing process.

And this is not just an issue for new project deployment, but also for existing projects that are undergoing relicensing. In fact, by 2030, **approximately 400 projects**, representing **18,000 MW** of capacity, will be in or have gone through relicensing. NHA has already begun to hear from owners of smaller projects, particularly in the Northeast, but across the country, that the process costs for licensing may render projects uneconomic and result in the surrender of licenses. As states continue to press for more clean and renewable energy resources, it would be unfortunate to lose the many benefits these existing hydropower projects provide.

NHA believes that Congress and the Administration should seek to reduce uncertainties in the hydropower licensing and relicensing processes, eliminate unnecessary and/or duplicative studies or other requirements, create discipline in the schedule, and reduce the time for obtaining federal and state approvals. In doing so, policymakers would be recognizing the value of hydropower as a critical component in the nation's energy supply portfolio. In addition, NHA believes process improvements can maintain the substantive ability of federal and state regulators to appropriately protect, mitigate and enhance natural resources.

Another issue that holds back hydropower is its limited recognition, or the complete lack thereof, as a renewable and/or clean energy resource under federal or state programs/environmental markets. State renewable portfolio standards provide one good example, and often contain restrictions on the amount of hydropower that is eligible. These include: project capacity limitations (30 MWs or less); placed-in-service restrictions (no eligibility for existing generation); resource and technology limitations (i.e. existing infrastructure; no new dams; capacity uprates or efficiency improvements only); explicit operational or impact criteria (run-of-river; low-impact certified), among others.

On the federal side, there are many recent examples of initiatives related to renewable energy development on public lands, federal renewable energy procurement policies, and government-wide sustainability goals that either excluded hydropower as an eligible renewable technology, or qualified hydropower in a way that significantly reduces (or effectively eliminates) its ability to participate.

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[22] https://energycommerce.house.gov/hearings-and-votes/hearings/discussion-drafts-addressing-hydropower-regulatory-modernization-and

For example, in 2015, Executive Order No. 13,693 utilized a definition of "renewable electric energy" that includes only new hydroelectric generation capacity achieved from increased efficiency or additions of new capacity at an existing hydroelectric project and yet excludes generation added to non-powered dams and others.[23] Another example is the 2012 U.S. Army Corps of Engineers proposal for "Large Scale Renewable Energy Production for Federal Installations", which completely excluded hydropower as an eligible resource. And also, the EPA's Green Power Partnership Program significantly limits the definition of qualifying hydropower. When hydropower is not included and recognized as a renewable resource on par with other resources like wind and solar, it creates a distinct economic and market disadvantage for the industry participants (existing asset owners and developers alike).

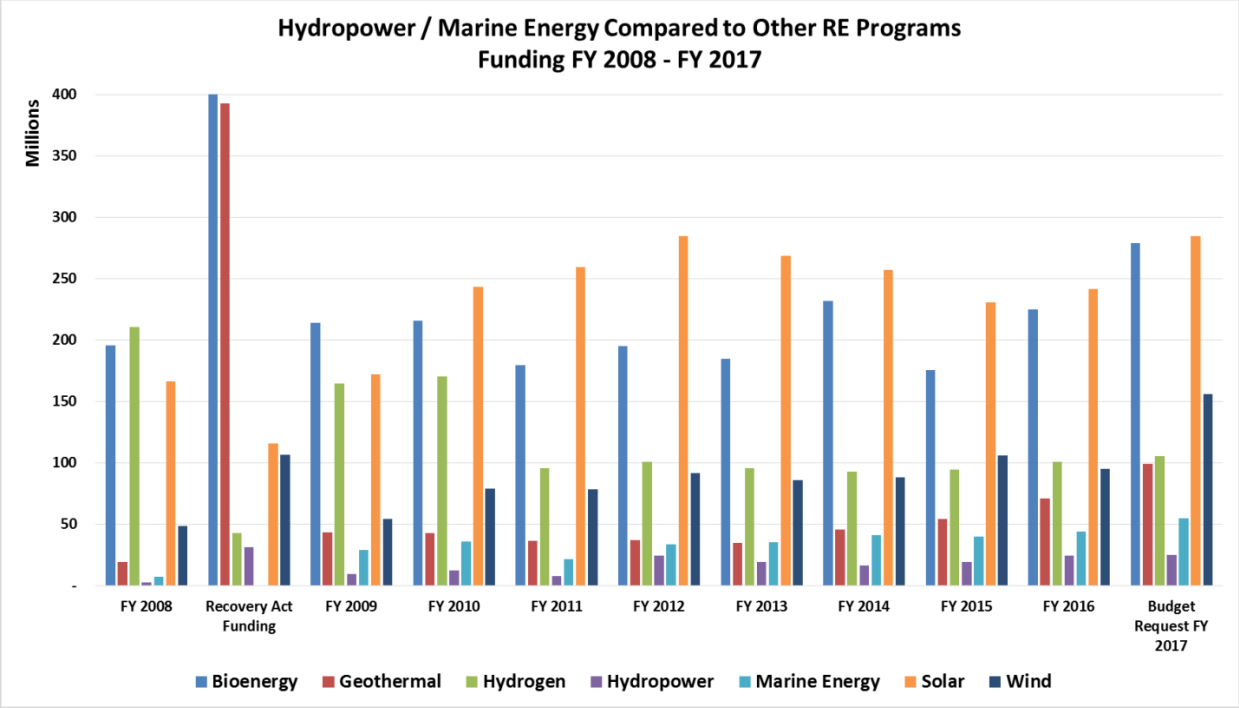
This disadvantage is no more clearly illustrated than in the context of the extension of the renewable energy tax incentives (Section 45 production tax credit (PTC) and Section 48 investment tax credit (ITC)). The PATH Act of 2015 created a competitive imbalance between incentives for wind and solar and other renewables, including hydropower. While the PTC and ITC for hydropower, MHK, and other technologies was extended through the end of 2016 (now lapsed), the credits for electricity produced from wind and solar facilities was extended for years longer. This on top of the fact that the hydropower industry, only receives, and has only ever received, half-credit under the PTC since becoming eligible years after the program was created for the wind industry.

As hydropower projects continue to compete for investment dollars, the policies adopted at the end of 2015 tipped the scales against investment in hydropower, putting the industry at a distinct disadvantage – a disadvantage that is magnified when you include the RPS policy treatment other renewable resources have as described above. NHA is working to fix this inequity to allow hydropower resources to better compete in the marketplace without the thumb on the scale tipped in favor of other renewable resources in the tax arena.

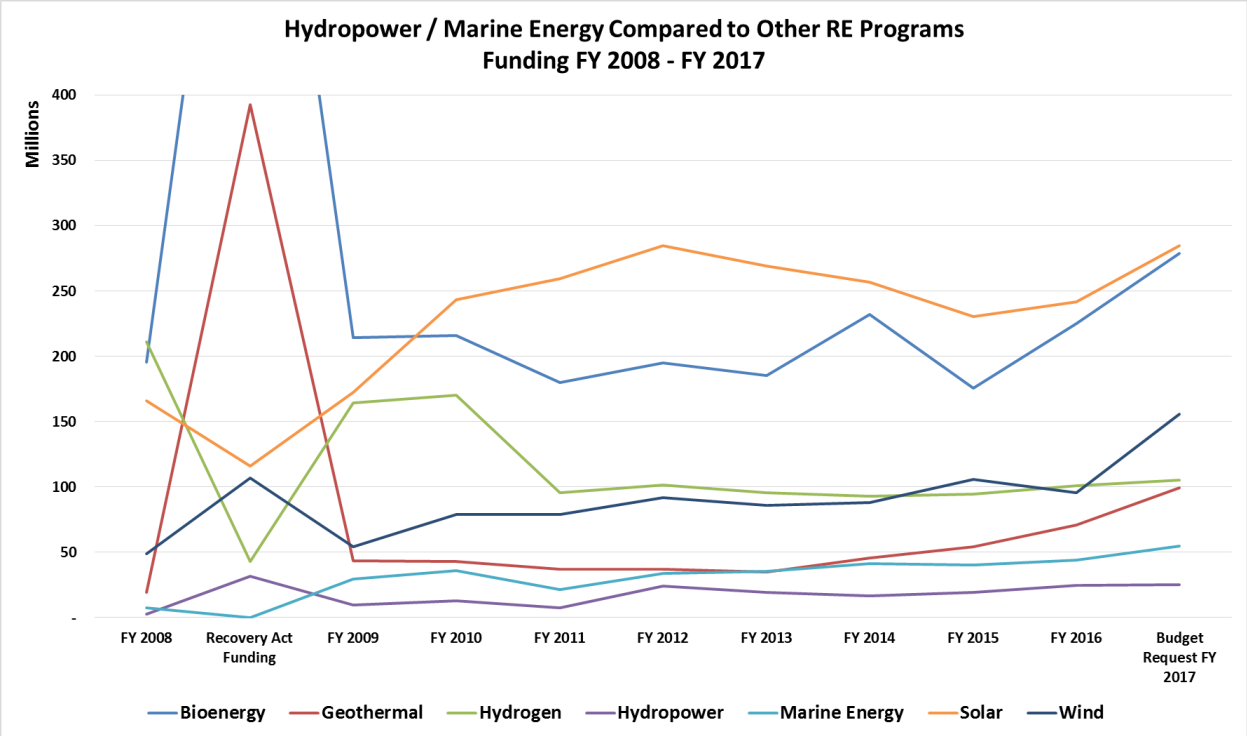
Lastly, on the federal policy front, NHA highlights investment in R&D for technology innovation. The DOE Water Power program, which represents the single largest source of renewable electricity in the United States today, still remains one of the smallest of the Office of Energy Efficiency and Renewable Energy (EERE), particularly when compared to the funding levels for other EERE programs.

The graph that follows charts the funding levels for the EERE programs from FY 2008 through the Administration's FY 2017 funding request, including American Recovery and Reinvestment Act of 2009 (ARRA).

[23] Fixing America's Surface Transportation Act (Pub. L. No. 114-94) Executive Order No. 13,693, Planning for Federal Sustainability in the Next Decade (2015)



The next graph below presents the same information, but more clearly shows the trend lines through time for each individual renewable energy technology program.



NHA appreciates and is encouraged by the growing investments by Congress in the DOE's Water Power program activities in recent years. However, as these charts clearly indicate, the

level is still substantially below that afforded other EERE programs, with the hydropower program receiving the least funding, followed by the MHK program receiving the next lowest level of funding. One of the factors for the tremendous growth in other renewables over the last several years is the sustained investment shown by the federal government in technology R&D and market acceleration initiatives in these sectors.

One final policy area that NHA would like to raise is that of regional electricity/power markets. Similar to what was discussed above on the state and federal energy policy front, oftentimes the various grid benefits both hydropower and pumped storage projects provide are not valued or compensated in our existing electricity markets. NHA, in 2015, filed comments with FERC on this issue that we believe are useful in this discussion and highlight the need to re-examine policies in order to promote hydropower deployment.[24]

In its filing, NHA notes:

> "While energy storage projects are eligible to participate in some markets, there are several attributes of energy storage and specifically pumped storage units that are not currently addressed by these tariffs. Pumped-storage plants can offer significantly more benefits to the electric system than those commonly recognized by ISOs and included in the comments previously received by the ISO commenters. Specifically pumped storage plants can offer real time system inertia [see FERC 755 reference to flywheel effect], generator droop setting that can respond to system conditions instantaneously, and Automatic Voltage Regulation Control (AVR) that can adjust rotor field strength in real time. All three of these services can be provided by traditional hydropower generators as well and pumped storage plants. These three services are critical services that allow instantaneous response to grid conditions that keep the voltage and frequency stable as other services like AGC respond in the ultrafast 1-4 second time frame. Markets are not currently available to compensate for these services.
>
> Additionally, energy storage devices are able to provide grid services that offset the need for new transmission and or distribution infrastructure. Under the current regulatory environment, energy storage plants are classified as a generation resource and are not currently eligible for to get a transmission rate of return for these services."

Conclusion

Both the existing system and new hydropower projects have a critical role to play in meeting our nation's energy, environment, and economic development objectives and much is at stake for hydropower and the families, businesses and communities that rely on its low-cost, reliable, renewable generation.

[24] See: Electric Storage Participation in Regions with Organized Wholesale Electric Markets, FERC Docket No. AD16-20-000

NHA and the hydropower industry stand ready to help meet our common clean energy goals and we look forward to working further with Congress and the Administration to find pathways to address the important policy issues – federal, regional and state – to fully maximize and unlock the potential of the hydropower resource.

As the Congress works to address our energy and infrastructure needs, whether that be on a new national infrastructure program or further work on an energy bill, policies that support the preservation of the existing hydropower system and promote the deployment of new projects (for all categories of water power technologies) must be included. A greater recognition that our hydropower infrastructure is incredibly valuable is needed, and continued investment and re-investment in the system is critical to our energy future and national security.