Testimony of Malcolm Woolf
President and CEO of the National Hydropower Association

Senate Energy and Natural Resources Committee
Hearing on Hydropower

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Hydropower is America's first renewable energy resource, providing enough reliable, zero-carbon electricity to power over thirty million Americans homes and playing an essential part of any climate solution. The International Energy Agency recently described hydropower as "the forgotten giant of clean electricity," [1] providing more carbon-free electricity globally than any other generating source. I hope today's important Senate hearing will help raise the visibility of hydropower's critical role in creating a reliable, affordable, and zero-carbon electricity grid, and the challenges and opportunities facing the U.S. hydropower industry.

I am Malcolm Woolf, President and CEO of the National Hydropower Association. NHA is the national non-profit trade association dedicated to advancing the interests of the U.S. hydropower industry, including conventional, pumped storage, and new marine energy technologies. NHA's membership consists of more than 250 organizations, including consumer-owned utilities, investor-owned utilities, independent power producers, equipment manufacturers, and environmental, engineering, and other service providers. Our vision is for waterpower, in all its forms, to be valued as America's premier carbon-free, renewable energy resource, be a growing source of green-energy jobs, and help achieve a sustainable, clean, and secure electricity system in North America.

As discussed in more detail in my testimony, I offer six key take-aways for the Senate's consideration:

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[1] International Energy Association, "*Forgotten giant" of low-carbon electricity needs a sweeping policy and investment push to put it in line with net zero goals and to support a faster expansion of solar and wind, IEA special report shows,* June 30, 2021, available at www.iea.org/news/hydropower-has-a-crucial-role-in-accelerating-clean-energy-transitions-to-achieve-countries-climate-ambitions-securely

1) **Hydropower is an essential part of a clean, reliable, and affordable 21st Century grid** – The existing hydropower fleet provides enough emission-free electricity to power over thirty million American homes. Traditional hydropower and pumped storage provide over 100 GW of dispatchable, carbon-free, baseload resources, providing roughly 7% of all electricity generated in the U.S.,[2] 38% of U.S. renewable energy,[3] 94% of current U.S. electricity storage capacity,[4] and 68,000 well-paying jobs.[5] As a flexible renewable resource, hydropower is a force multiplier by balancing the grid when the wind isn't blowing and the sun isn't shining. It also plays an essential yet often-overlooked role in enhancing grid reliability by, for example, providing nearly half (40%) of the nation's "black start" capability, which is vital in re-starting the grid in the event of a blackout.[6]

2) **The baseload renewable electricity provided by the existing U.S. hydropower fleet is at risk –** Roughly 30% of FERC hydropower licenses expire by 2030. The uncertainties surrounding the length and cost of the relicensing process threaten the availability of the renewable energy provided by the existing hydropower fleet. Relicensing takes, on average, 7.6 years to complete,[7] with re-licensing for many facilities lasting over a decade. At the same time, the paperwork costs associated with relicensing typically exceeds $10 million for a project over 10 MW,[8] with facility upgrades requiring many millions more. Not

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[2] U.S. Department of Energy, *U.S. Hydropower Market Report,* Jan. 2021, at p. iv, available at www.energy.gov/eere/water/hydropower-market-reports

[3] *U.S. Hydropower Market Report,* Jan. 2021, at p. iv.

[4] *NHA's 2021 Pumped Storage Report*, Sept. 22, 2021, at p. 4, available at www.hydro.org/news/nha-unveils-new-2021-u-s-pumped-storage-hydropower-report

[5] *2021 U.S. Energy Employment Report*, p. 83, available at www.energy.gov/us-energy-employment-jobs-report-useer

[6] *US Hydropower Market Report,* Jan. 2021," at p.19.

[7] U.S. DOE National Renewable Energy Laboratory (NREL), *An Examination of the Hydropower Licensing and Federal Authorization Process*, at p. xiii, available at www.nrel.gov/docs/fy22osti/79242.pdf

[8] Id. at 66.

surprisingly, a recent industry survey found that over one-third (36.4%) of hydropower industry asset owners were "actively considering" decommissioning a facility.[9]

3) **Stanford's "Uncommon Dialogue" process has created a historic new opportunity for bipartisanship** – Shared concern about climate change prompted an unprecedented collaboration, launched in 2008, between the hydropower industry and a broad array of river conservation, environmental, and dam safety advocates. Through Stanford University's "Uncommon Dialogue" process, these longstanding opponents agreed in October 2020 to a Joint Statement of Collaboration[10] to accelerate the rehabilitation, retrofit, and removal (the "3Rs") of our nation's more than 90,000 dams (of which fewer than 3% are powered). Working together, these groups have since developed joint legislative proposals to implement the 3Rs and set the stage for bipartisan solutions.

4) **Building upon the recent Bipartisan Infrastructure package, Congress should advance the 3Rs by enacting S.2306, the *Maintaining and Enhancing Hydropower and River Restoration Act* and S.2356, *the 21st Century Dam* bill –** The Uncommon Dialogue collaboration led to a joint legislative proposal by the hydropower industry, environmental groups, and dam safety advocates to advance the clean energy and electricity storage benefits of hydropower and the environmental, safety, and economic benefits of healthy rivers. For Senate jurisdictional reasons, the package was split into two bills: *the Maintaining and Enhancing Hydropower and River Restoration Act*, S.2306, championed by Senators Cantwell (D-WA) and Murkowski (R-AK), and *the 21st Century Dam Act*, S.2356, sponsored by Sen. Feinstein (D-CA).

A critical down-payment towards the 3R's goals was included in the recent Bipartisan Infrastructure Act, thanks to the leadership of Chairman Manchin and Senator Portman. Further thanks go to Senators Wyden and Cantwell for including a critical "environmental

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[9] Hydropower Foundation, Ontario Waterpower Association, and Kleinschmidt, *Ear to the Water industry survey,* Oct. 2021 (final report expected in Jan. 2022).

[10] Stanford University Uncommon Dialogue, *Joint Statement of Collaboration - U.S. Hydropower: Climate Solution and Conservation Challenge,* Oct. 13, 2020, available at https://woods.stanford.edu/research/hydropower

improvements" tax credit for existing hydropower in the pending Build Back Better package. The industry looks forward to working with the Senate to further clarify this tax provision to include dam safety, grid resilience, and dam removal. We also urge Congress to enact important tax incentives for new pumped storage and an extension (and increase to full value) of the now-expired tax credits for hydropower capacity additions and efficiency improvements at current powered dams, as well as for adding generation at existing non-powered dams, and marine energy.

5) **Congress needs to address the lack of certainty involved in the hydropower license and relicensing process -** The time, cost, and uncertainty involved in relicensing an existing hydropower facility is diametrically at odds with the urgency of addressing climate change and the upcoming wave of hydropower relicensing proceedings. Through Stanford's Uncommon Dialogue process, NHA has been working to develop a set of recommended reforms to the Federal Power Act in collaboration with numerous environmental, river advocacy, and native American tribal organizations. We aim to provide the Committee in February with a legislative proposal that can win bipartisan support, with a goal of enacting such a reform package before the end of this Congress.

6) **Congress Should Promote New Renewable Generation at Existing Nonpowered Dams, and Support DOE's Water Power Technology Office (WPTO), as well as Investments to Maintain and Expand the Existing Federal Hydropower Fleet** – DOE found in 2012 that the top 100 non-powered dams (81% of which are Army Corps of Engineer facilities) could contribute approximately 8 GW of clean, reliable hydropower.[11] Yet a decade later, only a handful have been developed. To encourage greater use of this untapped carbon-free resource, Congress should establish a two-year, start-to-finish licensing process for adding generation to non-powered dams, and require the Army Corps of Engineers to develop a coordinated, consistent, and nationwide strategy to expedite the development of non-powered

[11] U.S. DOE, Oak Ridge National Labs, *An Assessment of Energy Potential at Non-Powered Dams in the United States*, April 2012, at viii, available at www.osti.gov/biblio/1039957-assessment-energy-potential-non-powered-dams-united-states

dams. In addition, Congress supports full funding of DOE's WPTO, as well as investments to maintain and expand the existing federal hydropower fleet.

Detailed Statement

I. Hydropower is an Essential Part of a Clean, Reliable, and Affordable Energy Grid, Providing 38% of America's Renewable Electricity and 94% of our Electricity Storage Capacity

Since the Appleton Edison Light Company began operating in Wisconsin in 1882, hydropower has been providing emission-free electricity and helping to power America's economic prosperity. Through a continued commitment to robust environmental and technological advancements, hydropower is uniquely positioned to provide dispatchable renewable electricity and energy storage capacity, offer essential grid reliability services, and further enable the integration of variable wind and solar to accelerate the transition to a twenty-first century clean energy grid.

Today, traditional hydropower provides over 80 GW of electricity capacity in the United States, roughly 7% of installed electricity generation.[12] Pumped storage hydropower provides another 22 GW of dispatchable, long-duration energy storage, representing 94% of all energy storage currently in the U.S.[13] According to a 2021 National Renewable Energy Lab study, marine energy resources could add enough clean energy to the U.S. grid to power an additional twenty-two million homes.[14] Today the water power industry already provides 68,000 high value jobs and generates reliable renewable energy throughout the country.[15]

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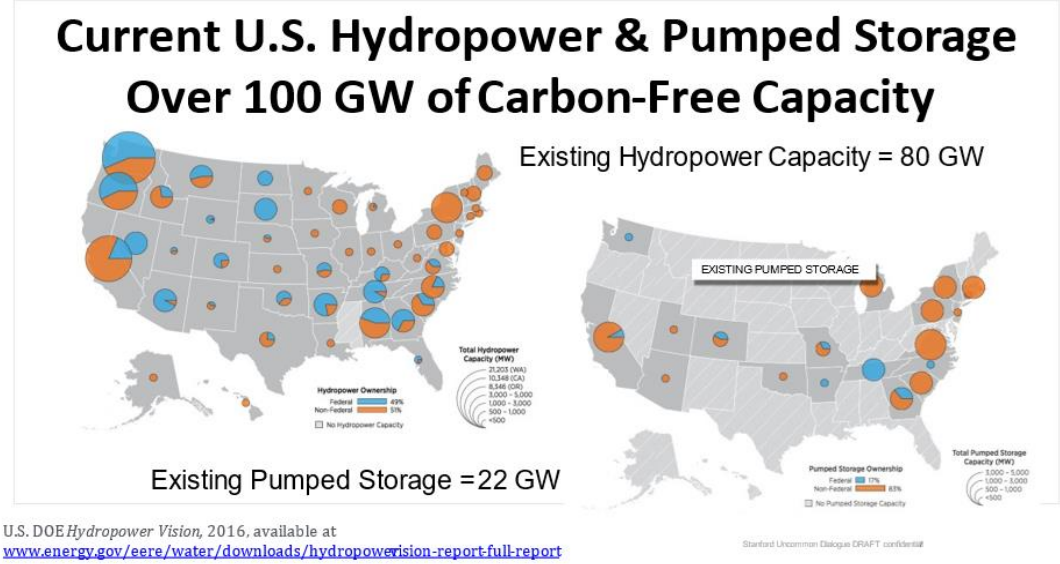
[12] U.S. Department of Energy, *U.S. Hydropower Market Report,* Jan. 2021, at p. iv, available at www.energy.gov/eere/water/hydropower-market-reports

[13] *NHA's 2021 Pumped Storage Report*, Sept. 22, 2021, at p. 4, available at www.hydro.org/news/nha-unveils-new-2021-u-s-pumped-storage-hydropower-report

[14] National Renewable Energy Laboratory, *Marine Energy in the United States: An Overview of Opportunities*, Feb. 2021, at vi, available at www.nrel.gov/docs/fy21osti/78773.pdf

[15] *2021 U.S. Energy Employment Report*, p. 83, available at www.energy.gov/us-energy-employment-jobs-report-useer



U.S. DOE *Hydropower Vision*, 2016, available at www.energy.gov/eere/water/downloads/hydropowervision-report-full-report

Hydropower also plays a critical role as the flexible renewable resource that enables more wind, solar, and other variable renewables on the grid. When the sun goes down or the wind isn't blowing, hydropower and pumped storage rush in to fill the gaps and balance the grid in seconds. For example, in the Spring of 2020, when a nuclear unit tripped offline in New England, the lights in Boston didn't flicker due to the ability of the Northfield Mountain and Bear Swamp pumped storage stations to provide 1700 MWs of immediate backup. Hydropower's flexibility allows it to serve as a force multiplier, enabling greater amounts of variable wind and solar on the grid.

Significantly, hydropower also plays an often-overlooked role in enhancing grid reliability. For example, although hydropower provides 7% of overall U.S. electricity generation, it provides nearly half (40%) of the nation's "black start" capability, which is vital in enabling the grid to re-start (such as the 2003 Northeast blackout).[16] Additionally, hydropower is roughly 15% of installed capacity in California but can provide up to 60% of spinning reserves, a service that was crucial during the August 2020 blackouts.[17] The chart below from a recent Brattle Group

[16] U.S. Department of Energy, *U.S. Hydropower Market Report,* Jan. 2021, at p. 19, available at www.energy.gov/eere/water/hydropower-market-reports

[17] U.S. Hydropower Value Study: Current Status and Future Opportunities, January 2021 at 19, available at https://www.energy.gov/sites/default/files/2021/01/f82/hydropower-value-study-v2.pdf

report highlights hydropower's unique ability to provide frequency control, spinning reserves, and other essential grid reliability services.[18]

FIGURE 3: RESOURCE CAPABILITIES TO PROVIDE VARIOUS GRID SERVICES

Product	Nuclear	Run-of-River Hydro	Pondage Hydro	Pumped Storage	Coal	Combined Cycle	Combustion Turbine	Wind	Solar	Battery Storage	Demand Response	Energy Efficiency
Day-Ahead Energy	✓	✓	✓	✓	✓	✓	O	✓	✓	O	O	O
Real-Time Energy	O	✓	✓	✓	✓	✓	O	✓	✓	O	O	O
Clean Energy	✓	✓	✓	O	X	O	O	✓	✓	O	O	✓
Regulation	X	O	✓	✓	✓	✓	O	O	O	✓	O	X
Spinning Reserves	X	O	✓	✓	✓	✓	✓	X	X	✓	O	X
Non-Spinning Reserves	X	X	✓	✓	X	✓	✓	X	X	✓	O	X
Load-following	O	O	✓	✓	O	✓	✓	O	O	✓	O	X
Reactive Power	✓	✓	✓	✓	✓	✓	✓	O	O	✓	X	X
Black Start	X	✓	✓	✓	O	✓	✓	X	X	O	X	X
Resource Adequacy	✓	✓	✓	✓	✓	✓	✓	O	O	O	✓	✓

Technical Capability to Provide Product
✓ Well-Suited
O Neutral
X Poorly-Suited

II. The Renewable, Baseload Electricity Provided by Existing Hydropower is at Risk with 30% of the Non-Federal Fleet Up for Relicensing by 2030

Two hundred and eighty-one facilities, representing 13.8 GWs of hydropower and pumped storage facilities, are set to have their licenses expire by 2030.[19] This represents a "doubling of FERC relicensing activity" over the eight years.[20] Together, these 281 facilities represent about 30% of the roughly 1,000 active FERC hydropower licenses.[21]

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[18] The Brattle Group, *Leveraging Flexible Hydropower in Wholesale Markets, Principles for Maximizing Hydro's Value*, April 2021, available at www.hydro.org/wp-content/uploads/2021/04/Leveraging-Flexible-Hydro-in-Wholesale-Markets.pdf

[19] U.S. Department of Energy, *U.S. Hydropower Market Report,* Jan. 2021," at p.39, available at www.energy.gov/eere/water/hydropower-market-reports

[20] Id. at p. v.

[21] U.S. Federal Energy Regulatory Commission (FERC), *Hydropower Primer: A Handbook of Hydropower Basics*, available at www.ferc.gov/sites/default/files/2020-05/hydropower-primer.pdf

The uncertainties surrounding the cost, duration, and outcome of the relicensing process threaten the existing hydropower fleet. According to a U.S. DOE study, relicensing takes, on average, 7.6 years to complete,[22] with re-licensing for many facilities lasting over a decade. Surprisingly, relicensing an existing hydropower facility takes longer than relicensing a nuclear power plant.[23]

The process paperwork associated with relicensing is also expensive, with projects of greater than 10 MW reporting licensing costs exceeding $1 million, and projects more than 100 MW reporting costs around $10 million or more.[24] In addition to the process work, relicensing typically requires physical construction measures to be implemented, including modernization of recreational facilities and/or environmental improvements, such as the installation of new fish passage passed or around a dam, or the replacement of expensive equipment to improve environmental performance.[25]

As a result of these costs, over one-third (36.4%) of hydropower industry asset owners said that they were "actively considering" decommissioning a facility in a recent industry survey, while only 13.6% of these owners had previously considered decommissioning.[26]

For reference, forty-one facilities submitted license surrender applications to FERC between 2010-2019.[27] This trend cannot continue if the U.S. is to achieve its clean energy objectives.

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[22] U.S. DOE National Renewable Energy Laboratory (NREL), *An Examination of the Hydropower Licensing and Federal Authorization Process*, at p. xiii, available at www.nrel.gov/docs/fy22osti/79242.pdf

[23] Id. at p. xiii compared to U.S. Nuclear Regulatory Commission, Backgrounder on Reactor License Renewal, aiming to complete license renewal decisions within 18 month from receipt of application, available at www.nrc.gov/reading-rm/doc-collections/fact-sheets/fs-reactor-license-renewal.html

[24] Id. at p. 66.

[25] U.S. Department of Energy, *U.S. Hydropower Market Report,* Jan. 2021, at p. 6.

[26] Hydropower Foundation, Ontario Waterpower Association, and Kleinschmidt, *Ear to the Water industry survey,* Oct. 2021 (final report expected in Jan. 2022).

[27] U.S. Department of Energy, U.S. *Hydropower Market Report,* Jan. 2021, at p. 5.

III. The United States Can Add Almost 50 GW of Renewable Hydropower by Optimizing the Existing Fleet, Adding Generation to Existing Non-Powered Dams, and Building Closed-Loop Pumped Storage

Great potential remains to grow carbon-free hydropower resources in the United States by upgrading the existing fleet, powering existing non-powered dams, and constructing off-river and closed-loop pumped storage. While the era of major new on-river dams ended generations ago, a 2016 comprehensive analysis by U.S. DOE found that the U.S. had the potential to increase it's hydropower generating and storage capacity from 101 GW to over 150 GW, a 50% increase by 2050.[28]

Table ES-3. Summary of Modeling Results for the *Business-as-Usual* and *Advanced Technology, Low Cost Finance, Combined Environmental Considerations* Scenarios in 2030 and 2050

Resource Category	*Business-as-Usual* Scenario (GW)		*Advanced Technology, Low Cost Finance, Combined Environmental Considerations* Scenario (GW)	
	2030	2050	2030	2050
Total New Hydropower Generation Capacity	4.5	5.2	9.4	12.8
Upgrades and Optimization of Existing Hydropower Plants	4.5	5.2	5.6	6.3
Powering of Non-Powered Dams	0.04	0.04	3.6	4.8
New Stream-Reach Development	0	0	0.2	1.7
New Pumped Storage Hydropower Capacity	0.2	0.5	16.2	35.5
Total New Hydropower Capacity	4.7	5.7	25.6	48.3

Optimizing Existing Hydropower - **DOE estimates that upgrades and optimization of the existing hydropower fleet has the potential to add 6.3 GW of carbon-free generation to the grid by 2050.**[29] Innovations in the areas of more accurate streamflow forecasting for optimized safety and revenue,[30] development of fish-friendly turbines,[31] and novel hybridizations between

[28] U.S. Department of Energy, Waterpower Technology Office, *Hydropower Vision: A New Chapter for America's First Renewable Electricity Resource,"* Oct. 21, 2016, at p.1, available at www.energy.gov/eere/water/downloads/hydropower-vision-report-full-report

[29] Id. at p 18.

[30] www.usbr.gov/research/challenges/streamflowrodeo.html

hydropower and energy storage[32] are just a few examples of the technology directives that have been enabled through federal support and partnership with the hydropower private sector. Realizing the sector's potential by 2050 will necessitate continued public-private partnerships such as can be realized through ongoing support to the U.S. DOE and it's national labs.

Non-Powered Dams - **DOE estimates that adding generation to existing non-powered dams could add 4.8 GW to the grid by 2050.[33]** Almost all of the nation's 90,000 dams were built for flood control, water storage, irrigation, navigation, and/or recreation. Less than 3% of these multi-purpose dams (roughly 2,200) are also used to generate emissions-free electricity. Better utilization of the nation's existing non-powered dam infrastructure can accelerate the transition to a clean electricity grid, while simultaneously improving environmental outcomes.

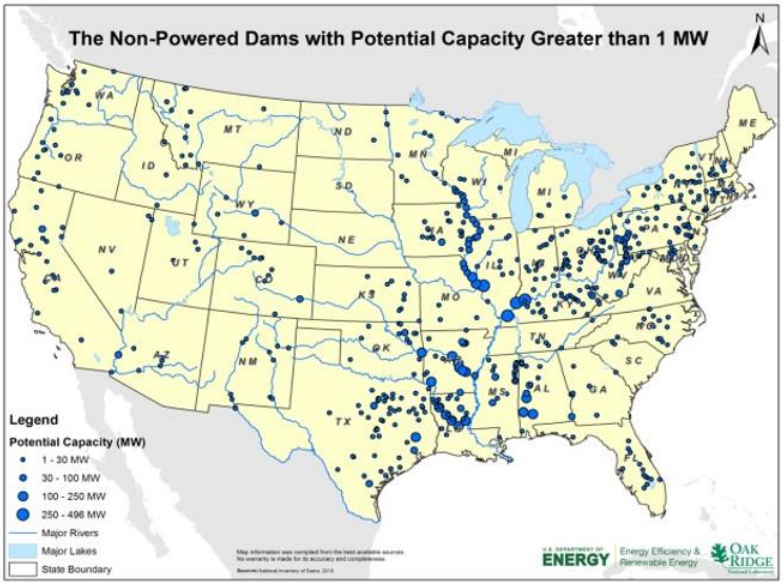

Figure ES-1: Locations of the top non-powered dams with potential hydropower capacities greater than 1 MW

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[31] https://www.forbes.com/sites/jenniferhicks/2020/11/23/this-new-fish-friendly-technology-was-designed-with-fish-in-mind/?sh=63688f4679ad

[32] https://inl.gov/waterpower/hydrostorage-powering-the-grid-during-emergencies/

[33] Id. A different DOE study reached a higher estimate, concluding that the untapped generation potential from non-powered dams to be 12 GWs. U.S. DOE, Oak Ridge National Labs, *An Assessment of Energy Potential at Non-Powered Dams in the United States*, April 2012, at viii, available at www.osti.gov/biblio/1039957-assessment-energy-potential-non-powered-dams-united-states

For example, in 2021, Missouri River Energy Systems successfully added over 55 MWs of capacity at the previously non-powered Red Rocks dam owned by the Army Corps of Engineers on the Des Moines River in Iowa.[34] In additional, several companies announced plans in 2021 to add generation at existing non-powered dams in Kentucky, Louisiana, Mississippi, Ohio, Pennsylvania, and West Virginia.[35] Innovations, including new turbine designs, ,

Closed-Loop Pumped Storage – The greatest potential for new hydropower generation and storage capacity comes from off-river and closed-loop pumped storage. Today, the United States has 43 existing pumped storage projects, with over 22.8 GW of storage capacity, representing 94% of all installed capacity of energy storage.[36] **DOE estimates that new pumped storage could add 35.5 GW of much-needed energy storage capacity to the grid by 2050.**[37]

Pumped storage facilities essentially serve as a "water battery" to help address the tandem challenge of integrating a growing amount of variable wind and solar resources into the grid (which can charge the "water battery") while maintaining grid stability and reliability. It generates power the same way a traditional hydropower plant does, by using a turbine and generator to transform the kinetic energy of falling water into electricity, but with an added feature. A pumped storage facility pumps water to the upper reservoir and stores it for later use. That gives pumped storage the flexibility to inject power into the grid or to absorb it when needed. Both functions are becoming increasingly important for grid stability and reliability. At the same time, these closed loop and off-river projects are typically environmentally benign since they do not create fisheries or aquatic impacts.

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[34] Power Magazine, *Red Rock Hydropower Project Successfully Generation New Power from a Pre-Existing Dam,* Sept. 1 2021, available at https://www.powermag.com/red-rock-hydroelectric-project-successfully-generating-new-power-from-a-pre-existing-dam

[35] For example, see www.climateadaptiveinfra.com/post/climate-adaptive-infrastructure-funds-hydroelectric-projects-at-22-existing-non-powered-dams and https://www.natelenergy.com/2021/09/28/natel-energy-expands-its-development-portfolio-adding-80-mw-of-renewable-power-to-louisianas-red-river

[36] *NHA's 2021 Pumped Storage Report*, Sept. 22, 2021, at p. 4, available at www.hydro.org/news/nha-unveils-new-2021-u-s-pumped-storage-hydropower-report

[37] *Hydropower Vision Report,* at p 19.

Today, there are over 75 pumped storage projects in some stage of development across 21 states, representing over 50 GW of new, long-duration storage, including 11 projects in the Northwest, 27 projects in the Southwest, 15 projects in the Northeast, and 8 projects in the Southeast.[38] Three pumped storage projects have been fully licensed by FERC, specifically Eagle Mountain in Southern California (1,300 MW), Gordon Butte in Montana (400 MW), and Swan Lake in Oregon (393 MW), which makes these prime candidates to become the first U.S. large-scale pumped storage projects constructed in over twenty years.

Benefits of Preserving and Growing Hydropower and Pumped Storage - Maintaining and expanding the existing hydropower and pumped storage fleet provides significant carbon avoidance, well-paying jobs, and social and economic benefits. The table below from DOE's 2016 Hydropower Vision Report summarizes these benefits:[39]

Benefits—Existing and New Capacity, 2017–2050[a,b,c]

	Economic Investment	Greenhouse Gases	Air Pollution	Water	Jobs
Existing Fleet and New Capacity Additions Combined (149.5 GW)	$148 billion in cumulative economic investment[d] $110 billion for hydropower generation and $38 billion for PSH	Cumulative GHG emissions reduced by 5,600,000,000 metric tons CO_2-equivalent, saving $209 billion in avoided global damages	$58 billion savings in avoided mortality, morbidity, and economic damages from cumulative reduction in emissions of SO_2, NO_x, and $PM_{2.5}$ 6,700–16,200 premature deaths avoided	Cumulative 30 trillion gallons of water withdrawals avoided for the electric power sector	Over 195,000 hydropower-related gross jobs spread across the nation in 2050

Figure ES-12. Selected benefits and impacts from the existing hydropower fleet and from new deployment, 2017–2050

a. Cumulative benefits are reported on a Net Present Value basis ($2015) for the period of 2017 through 2050.

b. Estimates reported reflect central values within a range of estimates as compared to the *baseline scenario* with no new hydropower.

c. Existing fleet includes new projects and plant retirements announced as of the end of 2015; new development reflects the modeled scenario titled *Advanced Technology, Low Cost Finance, and Combined Environmental Considerations.*

d. Capital investment and annual operating expenses, 2017–2050.

IV. Stanford's "Uncommon Dialogue" Process Has Created an Historic New Opportunity For Bipartisanship

Shared concern about climate change prompted an unprecedented collaboration between the hydropower industry and a broad array of river, environmental, and dam safety advocates.

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[38] *NHA's 2021 Pumped Storage Report,* at 5.

[39] *Hydropower Vision Report,* at p 23.

Launched in 2018 as part of Stanford's "Uncommon Dialogue" process, under former DOE Assistant Secretary Dan Reicher, these longstanding opponents agreed in October 2020 to sign a Joint Statement of Collaboration[40] to accelerate the rehabilitation, retrofit, and removal (the "3Rs") of our nation's more than 90,000 dams (of which less than 3% are powered).[41]

The parties to the Joint Statement agreed that:

> To rapidly and substantially decarbonize the nation's electricity system, the parties recognize the role that U.S. hydropower plays as an important renewable energy resource and for integrating variable solar and wind power into the U.S. electric grid. At the same time, our nation's waterways, and the biodiversity and ecosystem services they sustain, are vulnerable to the compounding factors of a changing climate, habitat loss, and alteration of river processes. Our shared task is to chart hydropower's role in a clean energy future in a way that also supports healthy rivers.

Many of these companies and organizations have since worked together to develop and support joint legislative and funding proposals, as discussed below. Together, this new spirit of collaboration sets the stage for bipartisan solutions.

V. Recommendations for Congressional Action

The hydropower industry is tremendously appreciative of Chairman Manchin and the Senate Energy Committee for championing hydropower and healthy rivers in the recent Bipartisan Infrastructure Act. The bill provided an important down payment towards rehabilitating, retrofitting, and/or removing (the "3Rs") the nation's more than 90,000 dams. In particular, the U.S. DOE received over $900 million to promote the waterpower industry, including grants to preserve and enhance hydropower and to fund national marine energy research centers.[42]

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[40] Stanford University Uncommon Dialogue, *Joint Statement of Collaboration - U.S. Hydropower: Climate Solution and Conservation Challenge,* Oct. 13, 2020, available at https://woods.stanford.edu/research/hydropower

[41] *"Environmentalists and Dam Operators, at War for Years, Start Making Peace,"* New York Times, Oct. 13, 2020, available at www.nytimes.com/2020/10/13/climate/environmentalists-hydropower-dams.html

[42] The Bipartisan Infrastructure bill also provided $800 million for non-powered dam removal and $800 million for state dam safety efforts, resulting in over $2.5 billion for the 3Rs.

Yet additional legislative action is needed. Given the critical role played by hydropower on a clean energy grid, and the significant challenges currently faced by the industry, Congressional action is needed in at least three areas:

1) Advance the 3Rs by enacting S.2306, the *Maintaining and Enhancing Hydropower and River Restoration Act* and S.2356, *the 21st Century Dam* bill;

2) Modernize the expensive and uncertain timing of the hydropower licensing, relicensing, and license surrender process, and

3) Expand support of U.S. DOE's WPTO and the existing federal hydropower fleet.

Congress should advance the 3Rs by enacting S.2306, *the Maintaining and Enhancing Hydropower and River Restoration Act* and S.2356, *the 21st Century Dam* bill –

An historic collaboration of environmental and river conservation groups, dam safety advocates, and the hydropower industry have come together through Stanford University's Uncommon Dialogue process to jointly develop a legislative package to advance the clean energy and electricity storage benefits of hydropower and the environmental, safety, and economic benefits of healthy rivers. The resulting package includes *the Maintaining and Enhancing Hydropower and River Restoration Act*, S.2306, championed by Senators Cantwell (D-WA) and Murkowski (R-AK), and *the 21st Century Dam Act*, S.2356, sponsored by Sen. Feinstein (D-CA). Both bills are combined in the House companion bill, *the 21st Century Dam Act*, H.R. 4375, sponsored by Representatives Kuster (D-NH) and Young (R-AK).

NHA applauds Senator Cantwell along with Senators Wyden, Hassen and other legislative supporters for including a portion of this bill in the pending Build Back Better proposal. The latest public version of the Senate package includes a 30% investment tax credit to encourage "environmental improvements" at existing hydropower facilities. The industry looks forward to working with the Senate to further clarify this tax provision to include dam safety, grid resilience, and dam removal.

The House package also included important tax incentives for new pumped storage and an extension (and increase to full value) of the now-expired tax credits for hydropower capacity additions and efficiency improvements, as well as for non-powered dams and marine energy.

Without the certainty that comes with a long-term extension of the existing production and investment tax credits, securing the financing for expanded hydropower investments will be a significant challenge. We therefore urge Congress to take action to preserve and enhance this critical resource.

Reform of the Hydropower Licensing and Relicensing Process is Long Overdue – The time, cost, and uncertainty involved in licensing and relicensing an existing hydropower facility is diametrically at odds with the urgency of addressing climate change and the upcoming wave of hydropower relicensing proceedings. Though Stanford's Uncommon Dialogue process, NHA has been developing a set of recommended reforms to the Federal Power Act, working with numerous environmental, river advocacy and native American tribal groups. Key goals for NHA in this historic effort include addressing climate change, expediting the licensing of certain closed-loop pumped storage projects and powering of non-powered dams, protecting Native American tribal treaty rights and expanding authority for Native American tribes to protect their reservations, improving collaboration among FERC, tribes, and federal/state natural resource conditioning agencies, tying environmental mitigation requirements to project effects, and promoting a culture of "show your work" in hydropower licensing.

We hope to be able to provide the Committee a legislative proposal in February that can win bipartisan support, with a goal of enacting such a reform package before the end of this Congress.

Congress Should Enact Improvements to Promote New Renewable Generation at Existing Nonpowered Dams –

A 2012 Study by the Oak Ridge National Labs found the top 100 non-powered dams could contribute approximately 8 GW of clean, reliable hydropower. Of these top 100, eighty-one are Army Corps of Engineer facilities, many of which are on the Ohio River, Mississippi River, Alabama River, and Arkansas River.[43] Yet ten years later, only a handful have been developed,

[43] U.S. DOE, Oak Ridge National Labs, *An Assessment of Energy Potential at Non-Powered Dams in the United States*, April 2012, at viii, available at www.osti.gov/biblio/1039957-assessment-energy-potential-non-powered-dams-united-states

notwithstanding congressional action declaring, in the WRDA 2014 Act, that "the development of non-Federal hydroelectric power at Army Corps of Engineers civil works projects, including locks and dams, shall be given priority."[44]

As such, NHA encourages Congress to adopt two new measures to encourage greater use of this untapped carbon-free resource. First, a two-year, start-to-finish licensing process for adding generation to existing non-powered dams should be created. Such a process is appropriate since adding power generation to existing infrastructure and civil works is typically environmentally benign and does not create fisheries or aquatic impacts.

Second, the Army Corps of Engineers should be required to develop a coordinated, consistent, and nationwide strategy to prioritize and expedite the development of hydropower at non-powered dams. As part of this strategy, adequate funding shall be provided, particularly to allow the Corps to hire appropriate staff to review applications and to develop a more consistent approach to hydropower development at non-powered dams across the Corps' various districts.

NHA Supports Full Funding of DOE's Water Power Technologies Office, as well as Investments to Maintain and Expand the Existing Federal Hydropower Fleet

NHA greatly appreciates and commends Congress for its increased support of the U.S. Department of Energy's (DOE) Water Power Technologies Office (WPTO) in recent years, culminating with a record FY 2021 funding level of $150 million to support efforts related to hydropower, pumped storage, and marine energy. One recent example of WPTO's value is a series of recent tests performed the Pacific Northwest National Laboratories, in partnership with Natel Energy and Kleinschmidt Associates, confirming the ability of Natel's new "Restoration Hydro Turbine" to safely pass fish, including species of concern such as American eel, with up to 100% survival rates.[45]

[44] WRDA 2014 section 1008(a).

[45] www.natelenergy.com/fish-passage

However, WPTO's budget remains well below that historically afforded other DOE power generation research, development, and demonstration (RD&D) programs and much more remain to be done. For example, in April 2021, NHA released a "Commercialization Strategy for Marine Energy" which calls for domestic deployment targets of at least 50 MW by 2025, 500 MW by 2030, and 1 GW by 2035. To achieve these targets, federal policymakers need to increase RD&D support, reduce market barriers, and create financial incentives for marine energy technology deployment. Substantial new investments in DOE's WPTO, for example, would accelerate the pace of technology demonstration, reduce costs, and increase adoption.

As with wind or solar technologies, support from the U.S. Federal Government for critical early-stage innovation and technology deployment efforts are key to igniting commercialization of the marine energy sector. Thanks to the efforts of this Committee, Congress reaffirmed the importance of additional investments in marine energy by adopting the bipartisan Water Power Research and Development Act of 2020 as part of the Consolidated Appropriations Act of 2021. The legislation provided increased annual authorization levels for the WPTO for FY 2021-2025. NHA calls for the Biden Administration to support, at a minimum, the fully authorized level of $137 million for the marine energy program in its upcoming Fiscal Year 2023 budget submission to Congress. However, the marine energy sector truly requires a solar program level of funding to hasten domestic commercialization efforts in the near term.

In addition, while WPTO's mission has grown significantly over the years thanks to additional funding from Congress, its staffing level remains limited to that of a much smaller organization. Congress should allow DOE to use existing funds to hire the full-time staff needed to effectively perform its mission.

Finally, the federal government is the largest hydropower operator in the nation. As such, NHA also support robust funding for the operations and maintenance (O&M) programs of the U.S. Army Corps of Engineers and Bureau of Reclamation to preserve and increase capacity and generation at existing federal hydropower facilities.

Summary

Preserving and enhancing the waterpower industry, including traditional hydropower, pumped storage, and marine energy technologies, will support efforts to address climate change and reduce carbon emissions, create green-energy jobs, assist in grid reliability and resilience, and advance our national economic goals. To achieve these important objectives, financial incentives are needed to retain, improve, and grow the fleet of existing renewable generation assets. Similarly, improvements in the licensing process are needed in advance of the coming wave of expiring licenses. With Congressional support, the hydropower industry can continue to power America's prosperity for generations to come.