

Executive Summary
U.S. Hydropower: Climate Solution and Conservation Challenge

Stanford University Uncommon Dialogue
October 13, 2020

The “*Joint Statement of Collaboration on U.S. Hydropower: Climate Solution and Conservation Challenge*” (Joint Statement), represents an important step to help address climate change by both advancing the renewable energy and storage benefits of hydropower and the environmental and economic benefits of healthy rivers.

The *Joint Statement* is the result of a two-and-a-half-year dialogue, co-convened by Stanford University’s Woods Institute for the Environment, through its Uncommon Dialogue process, Stanford’s Steyer-Taylor Center for Energy Policy and Finance, and the Energy Futures Initiative, to bring together the U.S. hydropower industry and the environmental and river conservation communities. The parties, listed on page three of this executive summary, are motivated by two urgent challenges. 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.

There are more than 90,000 existing dams throughout the country, of which about 2,500 have hydropower facilities for electricity generation. In the next decade, close to 30 percent of U.S. hydropower projects will come up for relicensing. As such, the parties focused on three potential opportunities:

- *Rehabilitating* both powered and non-powered dams to improve safety, increase climate resilience, and mitigate environmental impacts;
- *Retrofitting* powered dams and adding generation at non-powered dams to increase renewable generation; developing pumped storage capacity at existing dams; and enhancing dam and reservoir operations for water supply, fish passage, flood mitigation, and grid integration of solar and wind; and
- *Removing* dams that no longer provide benefits to society, have safety issues that cannot be cost-effectively mitigated, or have adverse environmental impacts that cannot be effectively addressed.

The potential development of new “closed loop” pumped storage to increase capacity to store renewable energy, including variable solar and wind, was also a focus of the dialogue. Closed

loop pumped storage systems do not involve construction of a new dam on a river, but they may have other impacts that need to be avoided, minimized or mitigated, including to surface and ground water.

The parties found inspiration in the precedent-setting 2004 agreement involving Maine's Penobscot River where the Penobscot Nation, the hydropower industry, environmentalists, and state and federal agencies agreed on a "basin-scale" project to remove multiple dams, while retrofitting and rehabilitating other dams to increase their hydropower capacity, improve fish passage and advance dam safety. After project completion in 2016, total hydropower generation increased, more than 2,000 miles of river habitat had improved access for the endangered Atlantic salmon and other species of sea-run fish, and the Penobscot River again helps support the realization of treaty rights and other aspects of tribal culture for the Penobscot Nation.

Driven by the urgent need to address the twin challenges of climate change and river conservation, the parties have identified seven areas for joint collaboration, detailed in the Joint Statement:

1. Accelerate Development of Hydropower Technologies and Practices to Improve Generation Efficiency, Environmental Performance, and Solar and Wind Integration
2. Advocate for Improved U.S. Dam Safety
3. Increase Basin-Scale Decision-Making and Access to River-Related Data
4. Improve the Measurement, Valuation of and Compensation for Hydropower Flexibility and Reliability Services and Support for Enhanced Environmental Performance
5. Advance Effective River Restoration through Improved Off-Site Mitigation Strategies
6. Improve Federal Hydropower Licensing, Relicensing, and License Surrender Processes
7. Advocate for Increased Funding for U.S. Dam Rehabilitation, Retrofits and Removals

Over the next 60 days, the parties have agreed to invite other key stakeholders, including tribal governments and state officials, to join the collaboration, and to address implementation priorities, decision-making, timetables, and resources.

In sum, the parties agree that maximizing hydropower's climate and other benefits, while also mitigating the environmental impact of dams and supporting environmental restoration, will be advanced through a collaborative effort focused on the specific actions developed in this dialogue. The parties commit themselves to seizing these critical and timely opportunities

Parties to the Joint Statement of Collaboration

American Rivers



National Hydropower Association



World Wildlife Fund



Eagle Creek Renewables



Union of Concerned Scientists



Low Impact Hydropower Institute



Great River Hydro



Rye Development



American Whitewater



Hydropower Reform Coalition



Natel Energy



Hydropower Foundation



Conveners of the Joint Statement of Collaboration

Stanford Woods Institute for the Environment



Energy Futures Initiative



Steyer-Taylor Center for Energy Policy and Finance



Joint Statement of Collaboration

U.S. Hydropower: Climate Solution and Conservation Challenge

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October 13, 2020

This Joint Statement of Collaboration (“Joint Statement”) is the product of a two-and-a-half-year dialogue entitled “*U.S. Hydropower: Climate Solution and Conservation Challenge.*” Stanford University’s Uncommon Dialogue process has brought together a diverse range of conservation and environmental organizations, companies, government agencies, and universities¹ committed to addressing the urgent challenge of climate change, and its impacts on rivers.

To mitigate climate change, the parties agree that the U.S. must rapidly and substantially cut its carbon emissions.² Decarbonizing the nation’s electricity system through a major transition to renewable energy is a key strategy.³ The parties recognize the role of U.S. hydropower as an important renewable energy resource and for integrating variable solar and wind power into the U.S. electric grid. At the same time, to restore the health of our nation’s rivers, the parties recognize the need to create new opportunities to reduce the environmental and safety impacts of U.S. dams, protect natural and cultural resources important to communities, such as Native American tribes, and increase the climate resilience of U.S. rivers.⁴

To jointly advance these goals, the parties have agreed to work together in good faith in seven areas, described below and detailed in an associated draft Action Plan. To achieve the goals outlined here, the parties recognize that Native American tribal governments, as well as other important stakeholders are not adequately represented in the dialogue and will need to be more fully engaged. The parties pledge to use their best efforts to do so.⁵

The Joint Statement is focused on the more than 90,000 dams in the federal National Inventory of Dams.⁶ Approximately 2,500 of these dams include hydropower facilities and the rest do not

¹ The parties to the Joint Statement and the conveners of the Uncommon Dialogue are listed on p. 15. The broader group of participants in the Uncommon Dialogue are listed in the Appendix.

² <https://www.ipcc.ch/sr15/chapter/spm/>

³ <https://www.hydro.org/news/u-s-renewable-and-clean-energy-industries-set-sights-on-market-majority/>

⁴ Grill et al 2019. <https://www.nature.com/articles/s41586-019-1111-9>

⁵ The participants agree that their communications relating to the Joint Statement will be governed by the Frequently Asked Questions approved by the participants.

⁶ National Inventory of Dams (NID) [https://nid.sec.usace.army.mil/ords/f?p=105:1:::~: For the purposes of inclusion in the NID, a dam is defined as any artificial barrier that has the ability to impound water, wastewater, or any liquid-borne material, for the purpose of storage or control of water that \(1\) is at least 25 feet in height with a storage capacity of more than 15 acre-feet, \(2\) is greater than 6 feet in height with a storage capacity of at least 50](https://nid.sec.usace.army.mil/ords/f?p=105:1:::)

currently generate electricity. Across the nation, dams serve many roles including electricity generation, flood control, irrigation, navigation, water supply, and recreation. Some dams, however, pose safety risks if not properly maintained, or have out-lived their useful lives.

The more than 90,000 existing U.S. dams present potential opportunities in three areas:

- *Rehabilitating* both powered and non-powered dams to improve safety, increase climate resilience, and mitigate environmental impacts;
- *Retrofitting* powered dams and adding generation at non-powered dams to increase renewable generation; developing pumped storage capacity at existing dams⁷; and enhancing dam and reservoir operations for water supply, fish passage, flood mitigation, and grid integration of solar and wind;
- *Removing* dams that no longer provide benefits to society, have safety issues that cannot be cost-effectively mitigated, or have adverse environmental impacts that cannot be effectively addressed.

The Joint Statement is also focused on the potential development of new “closed loop” pumped storage, to increase capacity to store renewable energy, including variable solar and wind. In contrast with traditional “open loop” pumped storage, with an on-river lower reservoir and an adjacent off-river upper reservoir, closed loop pumped storage involves two reservoirs, neither of which are continuously connected to a river or other naturally-flowing water feature.⁸ At the same time, new closed loop pumped storage development and operations may have impacts that need to be avoided, minimized or mitigated, including to surface and groundwater.

By focusing on the rehabilitation, retrofit, and removal of existing powered and non-powered U.S. dams (the “3 Rs”), plus new closed-loop pumped storage, and consistent with the 2016 DOE Hydropower Vision’s pillars of optimization, growth and sustainability,⁹ the parties to the Joint Statement can help improve dam safety, flood protection, water security, and recreation, while also increasing renewable energy generation and electricity storage capacity, better integrating variable solar and wind power, reducing environmental impacts, restoring and protecting rivers, and advancing U.S. economic development and job creation.¹⁰ Progress under

acre-feet, or (3) poses a significant threat to human life or property should it fail (i.e., “high-hazard” or “significant-hazard” dams). 33 U.S.C. §467.

⁷ See e.g. <https://www.utilitydive.com/news/los-angeles-considers-3b-pumped-storage-project-at-hoover-dam/528699/>

⁸ Dialogue participants have raised other potential storage options in the hydropower context, e.g. installation of utility-scale batteries at run-of-river hydropower facilities and production of hydrogen using lower-value hydropower capacity.

⁹ “For the purposes of the Hydropower Vision, sustainable hydropower projects are those that are sited, designed, constructed and operated to meet or optimize social, environmental and economic objectives at multiple geographic scales.” <https://www.energy.gov/eere/water/downloads/hydropower-vision-report-full-report> at 8.

¹⁰ The participants acknowledge that there are areas of uncertainty around estimating possible net greenhouse gas (GHG) emissions or sequestration (most importantly methane) from freshwater impoundments, lakes and rivers in the U.S. DOE, Oak Ridge National Lab and the Environmental Defense Fund are collaborating to review data from

the Joint Statement will require working with other key players, including federal, state and tribal governments.

Background on the Dialogue

The dialogue was launched in March 2018 by Stanford University's Woods Institute for the Environment and Steyer-Taylor Center for Energy Policy and Finance. The Energy Futures Initiative participated in the first meeting and joined the leadership team shortly thereafter.¹¹ Dialogue participants include non-governmental organizations, hydropower companies, trade associations, government agencies, universities, and investors.

Six dialogue meetings were held over two-and-a-half years to develop this Joint Statement. In parallel, the U.S. Department of Energy (DOE), a participant in the dialogue, is working to improve basin-scale decision-making, access to river-related data, and hydropower valuation. In support of the dialogue, Stanford University graduate students conducted research on hydropower economics, dam safety and basin-scale decision-making as part of a Stanford Law School policy practicum.¹² Stanford graduate students also supported the dialogue through DOE-funded work at the Woods Institute on improving access to river-related data and basin-scale decision-making.

Next Steps

The parties have agreed to jointly undertake actions in seven areas of collaboration, listed in Table 1, described below, and detailed in an associated draft Action Plan. Parties will make a good faith effort to implement the Joint Statement and draft Action Plan. Within 60 days of finalizing the Joint Statement, the parties will develop a plan to guide their joint efforts pursuant to the Joint Statement and draft Action Plan, addressing priorities, decision-making, the roles and responsibilities of individual organizations, timetables, and resources – and taking account of the need to consult with other parties with the authority and/or resources necessary to effectuate the outcome of the areas of collaboration the parties have identified. The parties will strive for progress across all three Rs.

around the world and better characterize the ranges and areas of uncertainty in estimating emissions from U.S. reservoirs, lakes and rivers, only a small percentage of which are used for hydropower generation. This work will review the science on pathways for reservoir emissions and also attempt to compare ranges of possible emissions from other major U.S. sources. In addition, DOE will also work with the International Hydropower Association (IHA) to explore whether IHA's G-res tool for estimating potential net GHG emissions from reservoirs, both new and existing, could be useful for estimating emissions potential in the U.S. at largely existing reservoirs.

¹¹ Dan Reicher, Senior Research Scholar at Stanford University's Woods Institute for the Environment, working with Jeanette Pablo, General Counsel and Senior Associate at the [Energy Futures Initiative](#), led the Uncommon Dialogue meetings and related drafting of the Joint Statement.

¹² <https://law.stanford.edu/education/only-at-sls/law-policy-lab/practicums-2018-2019/hydropower-climate-solution-and-conservation-challenge/>

Table 1 – Areas of Collaboration Under the Joint Statement

1. Accelerate Development of Hydropower Technologies and Practices to Improve Generation Efficiency, Environmental Performance, and Solar and Wind Integration
2. Advocate for Improved U.S. Dam Safety
3. Increase Basin-Scale Decision-making and Access to River-Related Data
4. Improve the Measurement, Valuation of and Compensation for Hydropower Flexibility and Reliability Services and Support for Enhanced Environmental Performance
5. Advance Effective River Restoration through Improved Off-Site Mitigation Strategies
6. Improve Federal Hydropower Licensing, Relicensing, and License Surrender Processes
7. Advocate for Increased Funding for U.S. Dam Rehabilitation, Retrofits and Removals

1. Accelerate Development of Hydropower Technologies and Practices that Improve Generation Efficiency, Environmental Performance and Solar and Wind Integration

There are significant opportunities to accelerate the development and deployment of advanced hydropower-related technologies in two areas. The first is to better leverage hydropower’s capability to integrate rapidly increasing amounts of variable solar and wind generation with advancements such as software for hydropower dispatch and closed loop pumped storage capacity. The second opportunity is to accelerate progress in mitigating the environmental impacts of dams (including potential impacts from the increased use of hydropower as peaking units) and increasing the climate resilience of U.S. rivers. The hydropower industry currently invests hundreds of millions of dollars annually to improve the health of our nation’s rivers, but there is more to do. This area of opportunity includes the development and deployment of

various technologies such as safe and effective fish passage strategies, new monitoring technologies, innovative “restoration hydro” projects, conduit hydropower, and improved dam rehabilitation, retrofit, removal and inspection technologies and techniques.

To advance these goals, the parties agree to conduct coordinated outreach in support of:

- a. Increased hydropower-related research, development, demonstration, and deployment (RDD&D) funding at DOE and the National Labs;*
- b. Demonstration and validation of the enhanced efficiency, environmental performance, and reliability of new hydropower and pumped storage technologies to increase developer, investor and NGO confidence; and*
- c. Related policy supporting these RDD&D efforts.*

2. Advocate for Improved U.S. Dam Safety

Fewer than 10% of U.S. dams are federally regulated, either by agencies such as the Federal Energy Regulatory Commission (FERC) which oversees non-federal U.S. hydropower dams or by the federal agency owners of U.S. government dams. Instead, most U.S. dams are regulated by states under individual dam safety programs, which are often understaffed and underfunded. While many of these dams have responsible owners and are properly staffed, funded, and maintained, some have safety issues that need to be addressed. Importantly, in 1996 Congress charged the Federal Emergency Management Agency (FEMA) with broad responsibility, for “the establishment and maintenance of an effective national dam safety program...” under the National Dam Safety Program Act (NDSP).¹³ Although some federally-owned and federally-regulated dams have safety issues, given the more than 80,000 U.S. dams under state oversight – and the significant related regulatory and resource challenges – the dialogue has focused its primary attention on these facilities.

To advance these goals the parties agree to:

- a. Advocate for greater state dam safety authority over non-federally regulated high-hazard and significant hazard dams by encouraging states to avoid broad exemptions of these dams from state safety regulation. States have primary responsibility over non-federally regulated dams. In carrying out this responsibility, states should ensure that their dam safety regulators have, like FERC, adequate authority to require key elements of dam safety such as emergency action plans, prescribed inspection schedules, and penalties for violations of dam safety requirements.*
- b. Encourage the federal government to provide its substantial expertise and resources to states to support improved safety at state-regulated dams. Such dams should be expected to achieve a similar level of safety as expected of federally-regulated dams. FEMA, given its national dam safety responsibilities under the 1996 NDSP Act, is*

¹³ 33 U.S.C. § 467.

important to this effort and should receive increased direction and funding from Congress. FERC operates the most extensive dam safety program in the U.S. and has substantial expertise and resources.¹⁴ As set forth in the associated draft Action Plan, the parties agree to work collaboratively to leverage the federal government's expertise and resources to enhance safety at state-regulated high hazard and significant hazard dams. This will involve coordination with other dam safety experts, including the Association of State Dam Safety Officials (ASDSO).

- c. Advocate for greater funding at the federal and state levels for dam safety-related oversight, rehabilitation, retrofit, and removal. This element of the Joint Statement is described in area 7 below.*

3. Increase Basin-Scale Decision-making and Access to River-Related Data

U.S. dam relicensing, retrofits, removals, and environmental mitigation decisions are typically analyzed on a dam-by-dam basis. Yet, as demonstrated in the Penobscot River Restoration Project¹⁵, basin-wide approaches, considering the full complement of dams, regional water supply and security needs, and related natural systems¹⁶ in a watershed, can reveal efficiencies and opportunities that might not be apparent in a site-by-site analysis. A voluntary basin-scale approach may help increase the resilience and flexibility of the hydropower fleet in the face of climate change and could make possible innovative, system-scale approaches to environmental restoration and mitigation. Among various options is the potential for simultaneous FERC relicensing of multiple dams in a basin. This comprehensive, basin-wide approach, pursued on a voluntary basis, could decrease the time, cost, and complexity associated with the FERC relicensing process – reducing workloads for licensees, stakeholders, resource agencies and FERC – while also enhancing environmental and climate objectives.

There are two high-potential areas where federal investments, guidance, and incentives can be developed to increase consideration of, and participation in, basin-scale decision-making: 1) promoting basin-scale approaches in the FERC relicensing process; and 2) improving access to river-related data.

To advance these goals, the parties agree to:

- a. Collaborate with key resource agencies on piloting voluntary basin-scale relicensing efforts, meet with FERC to express their joint interest in developing related guidance, issue a report exploring potential basin-wide relicensing opportunities nationwide, with*

¹⁴ <https://www.ferc.gov/industries/hydropower/gen-info/regulation/dam-safety.asp>

¹⁵ <https://www.nrcm.org/programs/waters/penobscot-river-restoration-project/>

¹⁶ These natural systems include, e.g., fish migration routes, habitat for rare or endemic species, flow regimes, spawning habitat and river-related recreational values.

technical support from DOE, and explore the potential for federal legislation providing direction and incentives for basin-scale efforts.

- b. Support an ongoing DOE effort to demonstrate the value of improved water data access for energy and water planning stakeholders in three geographically-diverse watersheds with a long term goal of identifying potential pathways to improve access, discovery, sharing, and usability of water data.*

4. Improve the Measurement, Valuation, and Compensation for Flexibility and Reliability Services Supplied by Hydropower and Support for Enhanced Environmental Performance

The parties have agreed that the flexibility and reliability services hydropower provides should be appropriately measured, valued, and compensated in order to both meet clean energy and environmental performance goals. The parties also support the work of the U.S. Department of Energy and other experts to develop a tool to assist with the measurement and valuation of these services.

Organized regional energy markets often do not fully recognize or compensate hydropower, and other generating sources, for flexible generation and grid reliability services (such as frequency control, operating reserves, voltage regulation, and black start). This is an increasing problem, as demand for these flexibility and reliability services expands, particularly with increasing variable solar and wind generation. and decreasing grid reliability under more intense weather and rising cybersecurity threats.

At the same time, federal and state legislators and other public policy decisionmakers offer hydropower operators few economic incentives to provide enhanced environmental services or that meet explicit environmental performance standards. For example, existing hydropower resources are often not eligible to participate in state Renewable Portfolio Standards (RPS), although several states and voluntary markets encourage hydropower that meets enhanced environmental performance standards by allowing existing facilities that are certified as “low impact” to qualify for RPS.¹⁷

To advance these goals, the parties agree:

- a. As with other generating sources, the flexibility and reliability services that hydropower provides should be appropriately measured, valued and compensated. The parties will work together to identify areas of agreement on how different hydropower technologies (existing hydropower, new hydropower, pumped storage, etc.) and low-impact hydropower should be compensated by organized regional energy markets for grid resiliency and reliability benefits, in potential state and federal clean energy standards for enhanced environmental performance, or through other mechanisms; and*

¹⁷ For example, Massachusetts, Oregon, Pennsylvania, Delaware, recognize Low Impact Hydropower Institute Certified hydropower in their RPS.

- b. *The U.S. Department of Energy and other experts will work to develop a tool to assist with the measurement and valuation of grid services and aid decision-making in various contexts.*

5. Advance Effective River Restoration through Improved Off-Site Mitigation Strategies

Over the next ten years, the federal licenses for over three hundred hydropower dams will expire and require a new license for continued operation. Under current regulations, policies and guidance, including related requirements under the Federal Power Act, Clean Water Act, Endangered Species Act, and National Environmental Policy Act, there is a strong preference for on-site protection, mitigation and enhancement measures that address environmental effects at individual dams. In some cases, however, limiting mitigation alternatives to on-site measures can unnecessarily constrain both dam owners and the potential ecological benefits of mitigation investments. Building from basin-scale successes, like the Penobscot River Restoration Project, the parties in this dialogue have agreed to jointly assess the national potential for greater use of voluntary off-site mitigation tools that have demonstrated potential to increase the ecological effectiveness of mitigation investments and improve the flexibility and efficiency of mitigation alternatives for dam owners seeking FERC licensing, in order to maintain valuable hydropower assets.

To advance these goals the parties agree to:

- a. *Undertake a process to develop a more robust framework for voluntary off-site mitigation in the FERC hydropower relicensing process. The process will first focus on three voluntary mitigation tools: effective river restoration through dam removal, particularly at non-powered facilities¹⁸; effective flow restoration; and river protection mechanisms¹⁹*
- b. *Implement this process by: assessing the technical, legal, economic, and environmental feasibility of off-site mitigation; then, if parties are willing, identifying potential guidance, policy or legislative proposals to implement off-site mitigation; and, finally, depending on progress, developing mechanisms for improving the selection of high-priority mitigation projects, increasing their replicability in other dam relicensing projects, and reducing regulatory concerns.*

¹⁸ Wilkinson, J. et al. 2017. Environmental Markets and Stream Barrier Removal: An Exploration of Opportunities to Restore Freshwater Connectivity Through Existing Mitigation Programs. The Nature Conservancy: Arlington, VA.

¹⁹ Designation of a U.S. river under the federal National Wild and Scenic Rivers Systems is an example of a river protection mechanism. <https://www.rivers.gov/designation.php>

6. Improve Federal Hydropower Licensing, Relicensing, and License Surrender Processes

To better facilitate hydropower's role in addressing climate change and mitigate hydropower's environmental impacts, the existing FERC hydropower licensing, relicensing and license surrender processes needs to be improved. Thirty percent of the existing hydropower fleet – more than 300 facilities – have licenses that expire by 2030. The existing FERC licensing and relicensing process typically takes five to seven years, and other agency approvals can take longer, for proposed new projects or the continued operation of existing projects. Delays in the relicensing process, in particular, often result in the deferment of investments in advanced technologies or other improvements that benefit power production and environmental performance. In addition, the existing process is time-consuming and expensive, which discourages both industry investment and citizen participation. License surrender is often even more time consuming than relicensing. Moreover, the current process for license surrender is far less defined than relicensing and has significant uncertainty for licensees and other stakeholders.

The parties agree to examine improvements to the licensing, relicensing, and license surrender processes that will benefit federal and state agency decision-making, license applicants, and interested organizations and which can be adopted without compromising environmental outcomes or public engagement.

To support these goals, the parties agree to:

- a. Explore improvements that would bring greater certainty to the licensing, relicensing, and license surrender processes, reduce costs, enhance environmental protection, and improve agency data gathering and decision making regarding non-federally owned hydropower.*
- b. Examine specific legislative and/or regulatory improvements which could: (i) encourage timely decision-making by federal and state agencies in licensing and relicensing; (ii) preserve the ability of federal and state resource agencies to assemble the data and conduct the environmental reviews and public engagement necessary to determine and impose mandatory conditions addressing a project's effects; (iii) establish a mechanism for reasonable and timely resolution of disputes between the various federal and/or state permitting agencies; and (iv) provide greater clarity regarding hydropower decommissioning and license surrender, and other opportunities to promote effective river restoration.*

7. Advocate for Increased Funding for U.S. Dam Rehabilitation, Retrofits and Removals

Increased funding of the 3Rs could yield substantial benefits. Rehabilitating a significant number of the nation's dams, some of which pose safety concerns, could save lives and reduce property damage and resulting economic losses. The Association of State Dam Safety Officials estimated in 2019 that \$70 billion is required to rehabilitate federal and non-federal U.S. dams. There are

several federal programs focused on dam safety, but they are typically significantly underfunded.²⁰ A potential solution to inadequate funding of state dam safety programs would be to require owners of high hazard or significant hazard state-regulated dams to pay for inspections, similar to the annual charges paid by hydropower licensees to fund FERC safety regulation and as established by a handful of states.

Retrofitting existing power dams with more efficient turbines and other technology, adding electrical generation to non-powered dams, and developing closed loop pumped storage capacity would add to the nation's supply of renewable electricity, improve the integration of variable solar and wind into the electric grid, and reduce environmental impacts on fish, other wildlife, and related ecosystems. Increasing U.S. generating capacity by adding generation to currently non-powered dams and increasing output at existing powered facilities represents a multi-billion-dollar investment need – and opportunity. Developing closed loop pump storage projects, each often in the 400-1000 megawatt range, typically require more than \$1 billion in investment.

Removing dams with significant safety problems or adverse environmental impacts which cannot be effectively addressed, would reduce risks and restore miles of free-flowing rivers.²¹ As demonstrated in the Penobscot River Restoration Project, these projects can be a one-time investment with permanent watershed-scale benefits for ecosystems and socio-economic benefits for communities. However, implementation can also be costly, as dam removals often are complex engineering and environmental projects, ranging from a few hundred thousand to hundreds of millions of dollars.

To advance these goals, the parties agree to:

- a. Explore opportunities for a more coordinated approach to increasing public and private investment in rehabilitation, retrofits and removals of the nation's dams and improve related processes. Potential funding options may include but are not limited to: federal and state grants and loans for dam rehabilitation and innovative energy projects; infrastructure-related funding; federal dam removal funding; tax credits; private activity bonds; master limited partnerships; state carbon programs; and philanthropic investment in river restoration and dam removal.*
- b. Evaluate the creation of a broad-based coalition to advocate for the funding of the three Rs and thereby advance renewable energy, river conservation, and public safety.²²*

²⁰ For example, the budget for the USDA Small Watershed Dam Rehabilitation Program, which either repairs or removes dams constructed under the U.S. Department of Agriculture's Natural Resources Conservation Service, was just \$10M in FY19.

²¹

Grill et al 2019. <https://www.nature.com/articles/s41586-019-1111-9>

²² See e.g. the Carbon Capture Coalition, a nonpartisan coalition of NGOs, companies, unions and others "supporting the deployment and adoption of carbon capture technology." <https://carboncapturecoalition.org/about-us/>

Conclusion

In sum, the parties agree that maximizing hydropower's climate and other benefits, while also mitigating the environmental impact of dams and supporting environmental restoration, will be advanced through a collaborative effort focused on the specific actions developed in this dialogue. The parties commit themselves to seizing these critical and timely opportunities.

[Parties and Conveners Follow]

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Conveners of the Joint Statement of Collaboration

Stanford Woods Institute for the Environment



Energy Futures Initiative



Steyer-Taylor Center for Energy Policy and Finance



Stanford

Steyer-Taylor Center for
Energy Policy and Finance

Appendix

Participants in the Stanford University Uncommon Dialogue

Hydropower: Climate Solution and Conservation Challenge October 3, 2020

The Uncommon Dialogue was launched in March 2018 by Stanford University's Woods Institute for the Environment and Steyer-Taylor Center for Energy Policy and Finance. The two Stanford groups and the Energy Futures Initiative are the co-conveners. Participants in the Uncommon Dialogue, listed below, are encouraged by the spirit of collaboration and the learning opportunities it has offered. Listing as a participant does not imply that there is, or will be, consensus on the documents, decisions and/or recommendations resulting from this process moving forward. Participants will work on phase two of the Dialogue, consistent with their respective organizational missions and capacity.

- American Rivers
- National Hydropower Association
- World Wildlife Fund
- Union of Concerned Scientists
- Eagle Creek Renewables
- Low Impact Hydropower Institute
- Great River Hydro
- American Whitewater
- Troutman Pepper
- Natel Energy
- Rye Development
- Hydropower Reform Coalition
- Hydropower Foundation
- General Electric
- Black and Veatch
- The Nature Conservancy
- Sonosky, Chambers, Sachse, Endreson & Perry
- U.S. Department of Energy (*Observer*)
- U.S. Army Corp of Engineers (*Observer*)
- Stanford Woods Institute for the Environment (*Convener*)
- Stanford Steyer-Taylor Center for Energy Policy and Finance (*Convener*)
- Energy Futures Initiative (*Convener*)