



## The Washington State University (WSU) Energy Program

### Mission Statement

Creating Energy Solutions

### About Us

The WSU Energy Program creates evolving energy solutions within Washington, the Pacific Northwest, across the United States, and internationally.

Our staff of energy specialists work out of Olympia, Washington.

Our customers include local, state, and federal agencies; tribes; utilities; businesses; manufacturing plants; schools and universities; trade associations; and consumers.

The WSU Energy Program is a self-supported department within the University.

At WSU, we are part of the College of Agricultural, Human and Natural Resource Sciences (CAHNRS). Our Director reports to the Dean of WSU Extension.

It is the policy of WSU that no person shall be discriminated against in employment or any program or activity on the basis of race; sex/gender; sexual orientation; gender identity/expression; religion; age; color; creed; national or ethnic origin; physical; mental or sensory disability, including disability requiring the use of a trained service animal; marital status; genetic information and/or status as an honorably discharged veteran or member of the military.

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CleanFuelsAltEnergy/PSHSiting.aspx](http://www.energy.wsu.edu/CleanFuelsAltEnergy/PSHSiting.aspx)

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# Information Study for Pumped Storage Hydropower Siting

The state of Washington is committed to achieving an electricity supply free of greenhouse gas emissions by 2045, aiming to stem climate change and improve the health of communities while creating family-sustaining jobs.<sup>1</sup> To do this, more is needed than just replacing fossil fuel sources with carbon-free renewables such as solar and wind. By their very nature, solar and wind resources do not generate electricity consistently; at times they produce more electricity for the grid than what is needed, while at other times they do not produce enough.

Energy storage technologies, such as batteries, ensure that there are no disruptions in the energy supply with the use of renewable resources by storing energy and then releasing it when needed. While the use of different energy storage methods and technological advancements are increasing rapidly, one of the most established, reliable, and proven methods, dating back decades, is *pumped storage hydropower* (PSH).

## Background

The Washington State Legislature directed the Washington State University (WSU) Energy Program to conduct an information study on PSH siting in the 2023 Engrossed Second Substitute House Bill 1216 (Section 306)<sup>2</sup>. The bill, concerning clean energy siting, was signed into law May 3, 2023, and the

<sup>1</sup> Clean Energy Transformation Act (CETA), see

<https://www.commerce.wa.gov/growing-the-economy/energy/ceta/>

<sup>2</sup> Washington State Legislature, HB 1216. 68th Leg. Session (2023):

[https://lawfilesext.leg.wa.gov/biennium/2023-24/Pdf/Bills/Session Laws/  
House/1216-S2.SL.pdf](https://lawfilesext.leg.wa.gov/biennium/2023-24/Pdf/Bills/Session%20Laws/House/1216-S2.SL.pdf)

final report for the information study is due June 30, 2025. The goal of the process is to understand issues and interests related to areas where PSH might be sited, and to provide useful information to developers and for subsequent State Environmental Policy Act (SEPA) reviews of environmental impacts. A key part of the study is to provide ample opportunities for the engagement of federally recognized Indian Tribes, local governments and special purpose districts, land use and environmental organizations, and additional stakeholders that self-identify as interested in participating in the process. A map must also be developed to highlight areas identified through the process, although the map will not include sensitive Tribal information.

WSU's PSH Study team brings together the WSU Energy Program study lead, the WSU Tribal Liaison for Special Projects, a geographic information system (GIS) consultant, and facilitation and outreach professionals to carry out the study process as per the legislative directive.

## What is Pumped Storage Hydropower?

PSH acts similar to a giant battery by storing power and releasing it when there is demand for electricity. Using two reservoirs at different elevations, energy is released when water flows from the upper reservoir down to the lower reservoir, passing through a turbine that generates electricity to the electrical grid. When there is excess generated power (from solar power on a sunny day when energy demand is low, for example) water is pumped from the lower reservoir back up to the upper reservoir where it is stored as potential energy.

PSH is a mature and proven long-duration storage technology that can provide more hours of electricity to hundreds of thousands homes and businesses than other battery methods.<sup>3</sup> As of 2022, PSH provided approximately 96% of the energy storage

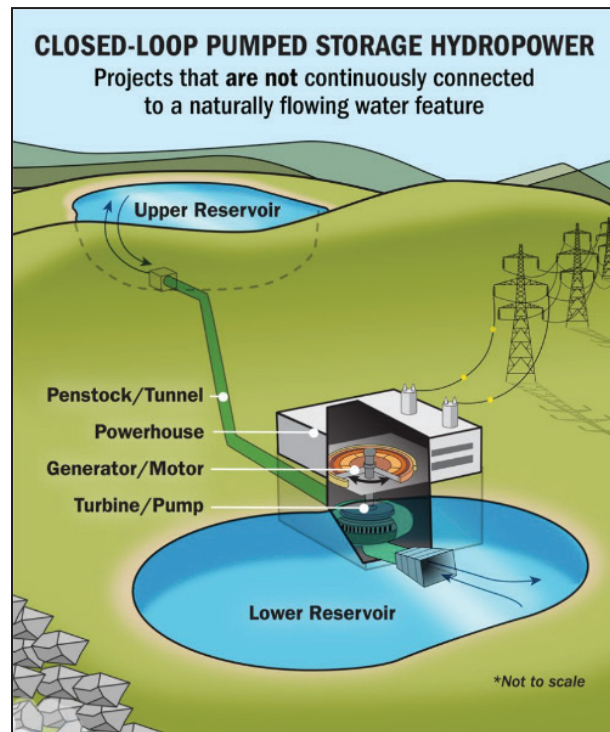


Photo courtesy of U.S. Department of Energy  
[www.energy.gov/eere/water/pumped-storage-hydropower](http://www.energy.gov/eere/water/pumped-storage-hydropower)

capacity in the United States, mostly from projects built decades ago.<sup>4</sup> As the technology uses a mechanical process, it does not rely on mined minerals such as lithium. It is an efficient technology and can quickly respond when needed. PSH's life-cycle costs are lower than most other battery technologies due to its long lifespan, and life-cycle impacts have also been found to have the lowest global warming potential compared with other storage methods.<sup>5</sup>

Several factors affect feasibility of where PSH can be located. Siting needs include specific

<sup>3</sup> The amount of energy this amounts to depends on the rate of discharge and the maximum rating of the system.

<sup>4</sup> US Department of Energy, U.S. Hydropower Market Report (2023 Edition): <https://www.energy.gov/sites/default/files/2023-09/U.S.%20Hydropower%20Market%20Report%202023%20Edition.pdf>

<sup>5</sup> Simon et al, "Life Cycle Assessment of Closed-Loop Pumped Storage Hydropower in the United States," *Environ. Sci. Technol.* 2023, 57, 12251-12258: <https://pubs.acs.org/doi/epdf/10.1021/acs.est.2c09189>

## Draft Timeline *(Subject to Change)*

2024								2025					
May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Intro webinar		Public meetings						Review webinar	Draft report review			Final report	
Ongoing meetings and discussions with Tribes and interested parties													

geology and a sufficient elevation difference between the reservoirs, often between 1000 and 2000 feet. (The greater the difference, the more power can be generated.) PSH projects are expensive to build, and construction can take a long time. Very importantly, and of interest to our information study, there are possible impacts to resources, including land use, the environment, and Tribal cultural resources.

The WSU study focuses on closed-loop PSH, which has been shown to have the fewest potential environmental impacts to wildlife, habitats, and the hydrologic cycle of various PSH methods. In closed-loop PSH, neither reservoir is connected to an existing water body. Most existing PSH plants, which were constructed primarily in the 1970s, are open loop, where the lower reservoir uses water from a river or other water source.

## Data

Locations that have the topography where PSH could theoretically be sited have been identified for the United States by researchers from the National Renewable Energy Laboratory (NREL).<sup>6</sup> They used existing elevation data, and then reduced the number of sites due to protected areas and economic factors. The WSU PSH study team's

GIS consultant is reviewing and assessing the NREL data. The number of theoretical sites will be further assessed and reduced using data factors unique to Washington. For example, we will remove the PSH sites that NREL shows within some state protected lands. Some data identified during the Least-Conflict Solar Siting on the Columbia Plateau project<sup>7</sup> may be used, however the goal of the PSH siting information study is to gather interests and concerns about PSH siting, not to create a mapping tool as was one of the outcomes of the Least-Conflict study.

## Information Study Process

The WSU PSH study team seeks to listen to, and talk with, as many people as possible across Washington State and bring the resulting information back to the legislature. Identifying and understanding people's issues and interests concerning the siting of PSH in Washington is the focal point of the information study, and necessary if PSH is to be used to help achieve the state's greenhouse gas

<sup>6</sup> NREL, Closed-Loop Pumped Storage Hydropower Resource Assessment for the United States, 2022:

<https://www.nrel.gov/docs/fy22osti/81277.pdf>

<sup>7</sup> WSU Energy Program, Least Conflict Solar Siting:

<https://www.energy.wsu.edu/RenewableEnergy/LeastConflictSolarSiting.aspx>

emission limits, transition off fossil fuels, and reduce the impacts of climate change.

**This is an information gathering process only – there are no PSH projects being proposed or reviewed.**

To this end, we invite Tribes, agencies such as local governments and special purpose districts, land use and environmental organizations, and all other interested parties to participate in a process to discuss PSH and share their issues, concerns, and interests about the location of PSH in the state. We are meeting with Tribal staff, attending Tribal conferences, and working with a WSU Tribal Liaison to offer as many methods of engagement with Tribes as possible.

We will hold facilitated virtual and in-person gatherings during fall 2024 (locations and dates to be announced). Any in-person gatherings will be focused in the geographic regions where the landscape topography is more suitable for closed-loop PSH and where other factors do not impede siting. As it is not feasible for the study team to visit all suitable

locations, we hope that those in regions we cannot visit will participate in the online gatherings. Our first informational webinar will be in June 2024, with more held throughout the study period.

A report is due to the legislature at the end of the study period, on June 30, 2025. We will provide a draft version of the report in time for feedback, corrections, and edits. Our website will continue to be updated to provide information about PSH, this study, and ways for people to comment and participate in our process.

## How can you participate?

We invite you to sign up for our PSH Siting email distribution list at our webpage to receive updates and information about meeting dates and locations. Please let other individuals and groups who may be interested in participating know about this process.

We encourage you to contact us for information or to request meetings with the WSU PSH Study team. Email Karen Janowitz, Project Lead, at [janowitzk@energy.wsu.edu](mailto:janowitzk@energy.wsu.edu) or visit the webpage at [www.energy.wsu.edu/CleanFuelsAltEnergy/PSHSiting.aspx](http://www.energy.wsu.edu/CleanFuelsAltEnergy/PSHSiting.aspx).

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