WASHINGTON STATE UNIVERSITY
Energy Program

Pumped Storage Hydropower Siting Study Introduction and Overview

WSU Energy Program

Information Study for Pumped Storage Hydropower Siting

June 13, 2024

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Welcome and a few reminders…

- This meeting is being recorded and will be available on the study website—along with the slides and a meeting summary
- Please rename yourself with your affiliation or workplace in Zoom
- Attendees will be automatically muted
- To ask questions, please use the Q&A function in Zoom or "raise your hand" to speak, and you will be unmuted by the hosts
    - Please reserve chat for communicating any technical challenges with Zoom. If you are experiencing technical issues, please chat directly to "hosts and panelists" (or email at shayman@rossstrategic.com).
- Please be respectful of this process. Allow everyone the chance to speak and listen actively to understand others' views

WSU Energy Program

- Self-supporting department within Washington State University based in Olympia
- Other programs: resource conservation management, green transportation education and outreach, community solar, Washington state energy codes (residential) support, community energy efficiency, emerging technologies, and more

https://www.energy.wsu.edu

WSU PSH Study Team

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- Terri Parr

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- Susan Hayman
- Hogan Sherrow

- Jeff Boyce

Today's Objectives

- Introduce an information study designed to understand issues and interests surrounding the siting of pumped storage hydropower (PSH) in Washington
- Provide general overview of PSH
- Begin identifying participants' views on PSH siting factors, information needs, and questions
- Get input on the most useful types of open meetings (in the fall 2024)
- Describe opportunities to be involved and stay updated on the study

Agenda Overview

11:00 – 11:15 AM	**Welcome**
11:15 – 11:55 AM	**Study Overview and Introduction to PSH Technology**
11:55 AM – 12:05 PM	**Initial Participant Perspectives on PSH**
12:05 – 12:20 PM	**Future Meetings to Inform the Study**
12:20 – 12:30 PM	**Remaining Questions, Wrap up, and Adjourn**

Online polling

- We will be using PollEverywhere today to elicit insights from participants
- When prompted, please use a phone or browser screen to access the polls using the QR code or website address: PollEv.com/bigocean692
- You will be initially asked to share your name, but this can be skipped
- PollEverywhere will stay open throughout the webinar
- For short "word cloud" responses, you can join_words using an underscore

- Now, lets try it out…

Join by Web

PollEv.com/bigocean692

Join by QR code

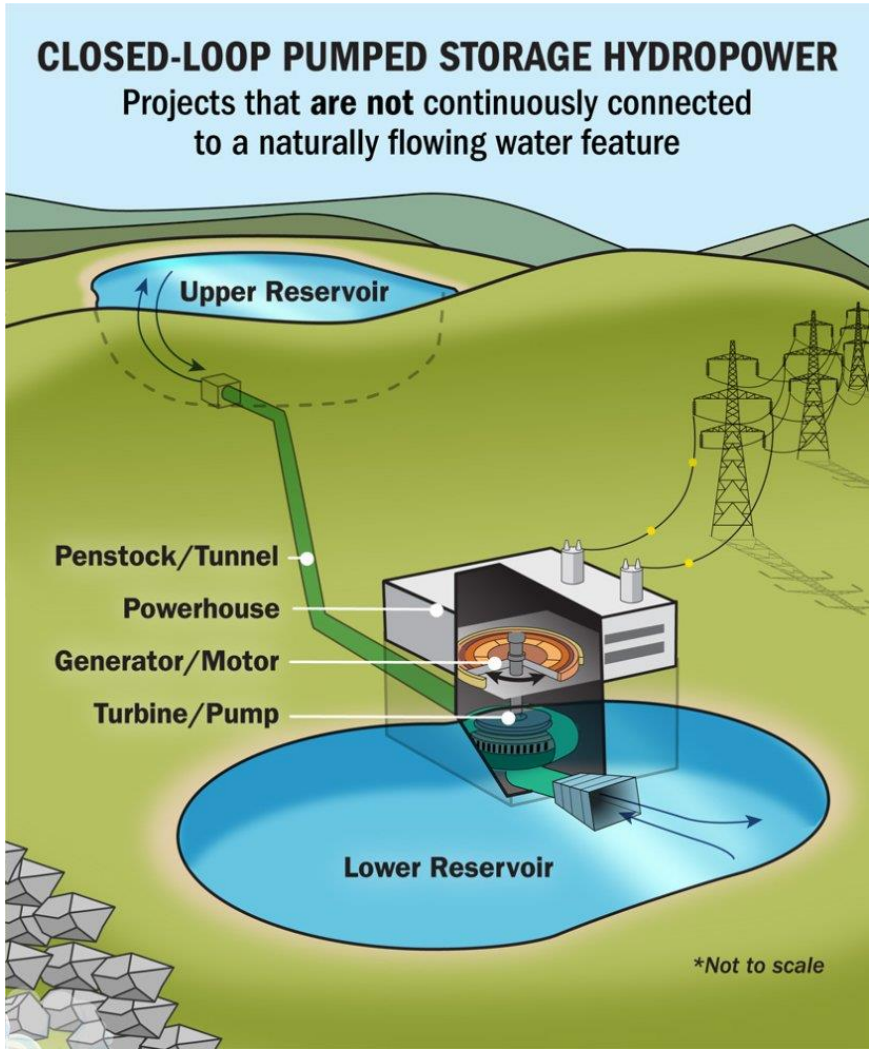
Scan with your camera app

Study Overview and Introduction to Pumped Storage Hydropower (PSH) Technology

No PSH sites or projects are endorsed or proposed by the WSU PSH Siting Study!

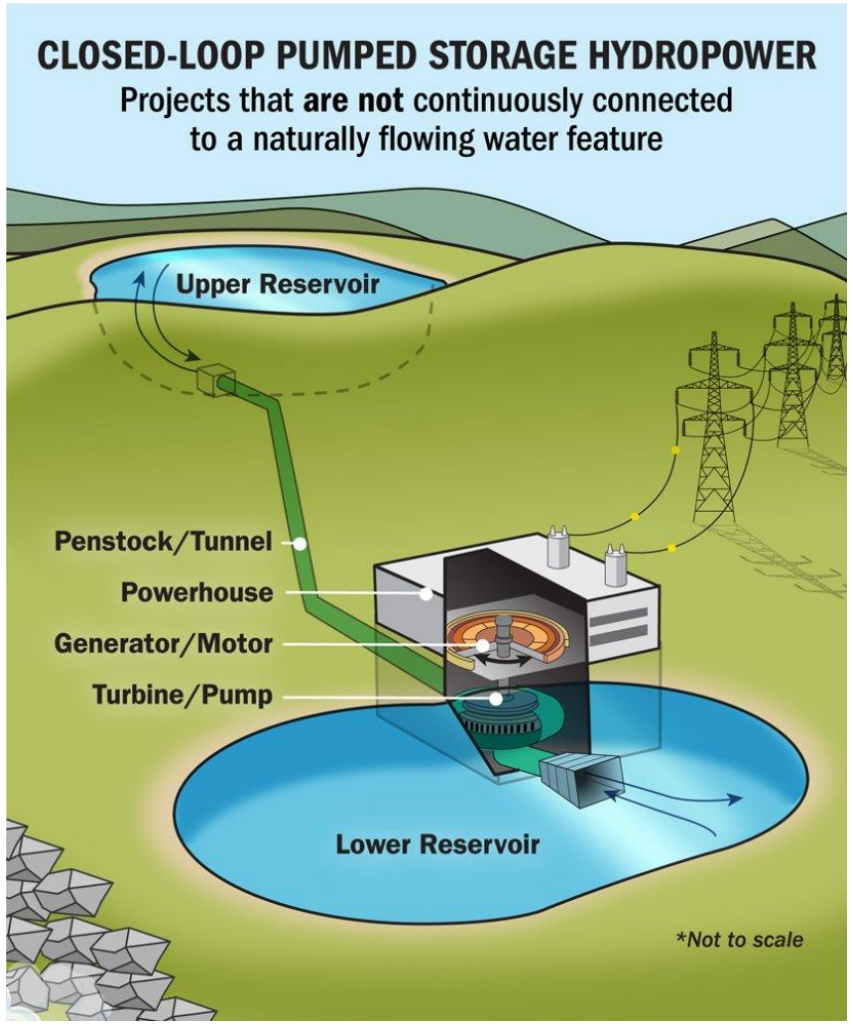
What is Pumped Storage Hydropower (PSH)

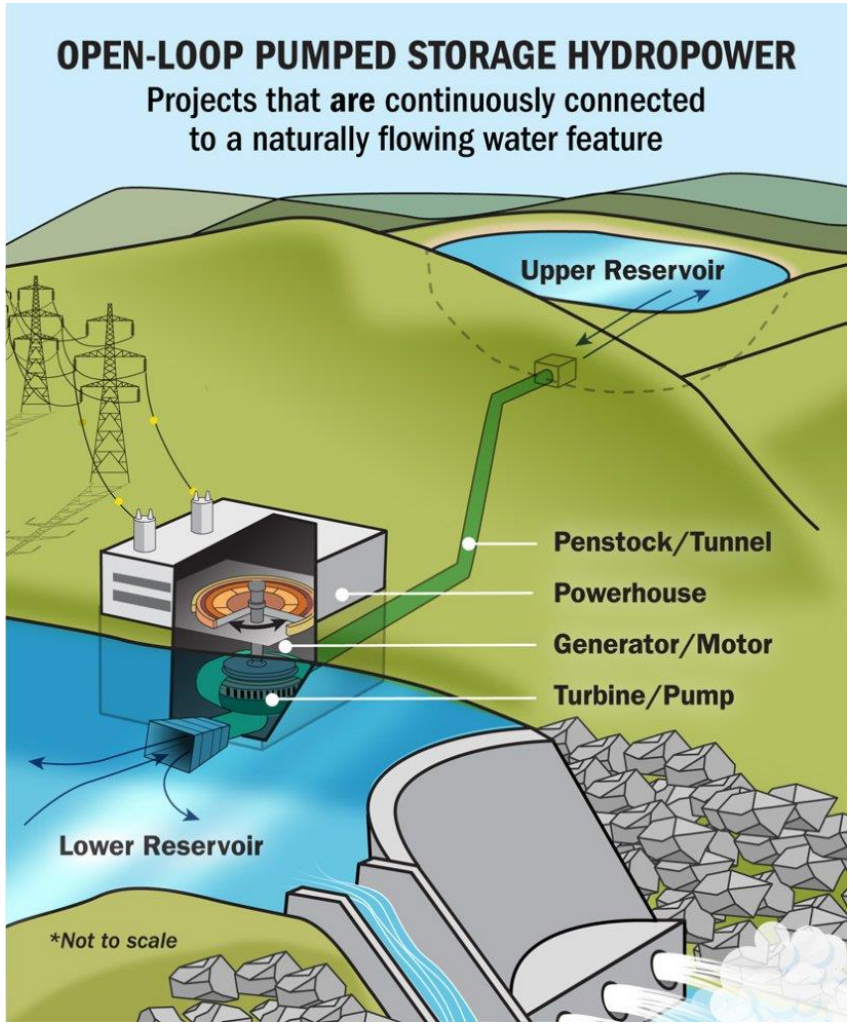
- Water battery
- Energy storage technology
- Stores energy in an upper reservoir, generates energy when water flows down to the lower reservoir
- Provides electricity when demand is high and energy production is low from renewables such as wind and solar (load balancing)



U.S. Dept of Energy

Closed-Loop PSH vs Open-Loop PSH

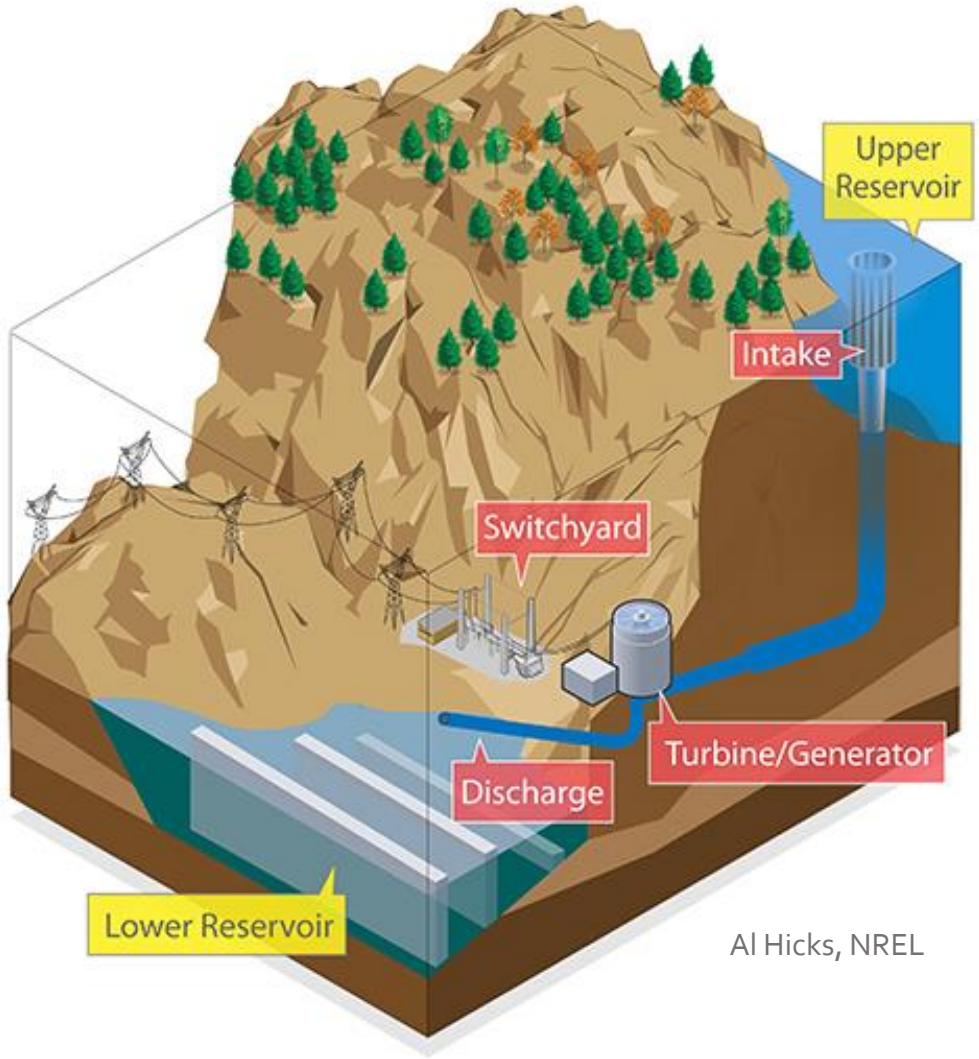




U.S. Dept of Energy

Benefits of PSH

- Well-established technology
- Efficient (~80-90%)
- Responds quickly
- Long duration storage
  - Can provide up to 8 hours or more of energy
- System lasts a long time (50-100 years)
  - Thus low life-cycle cost
- Provides grid resiliency



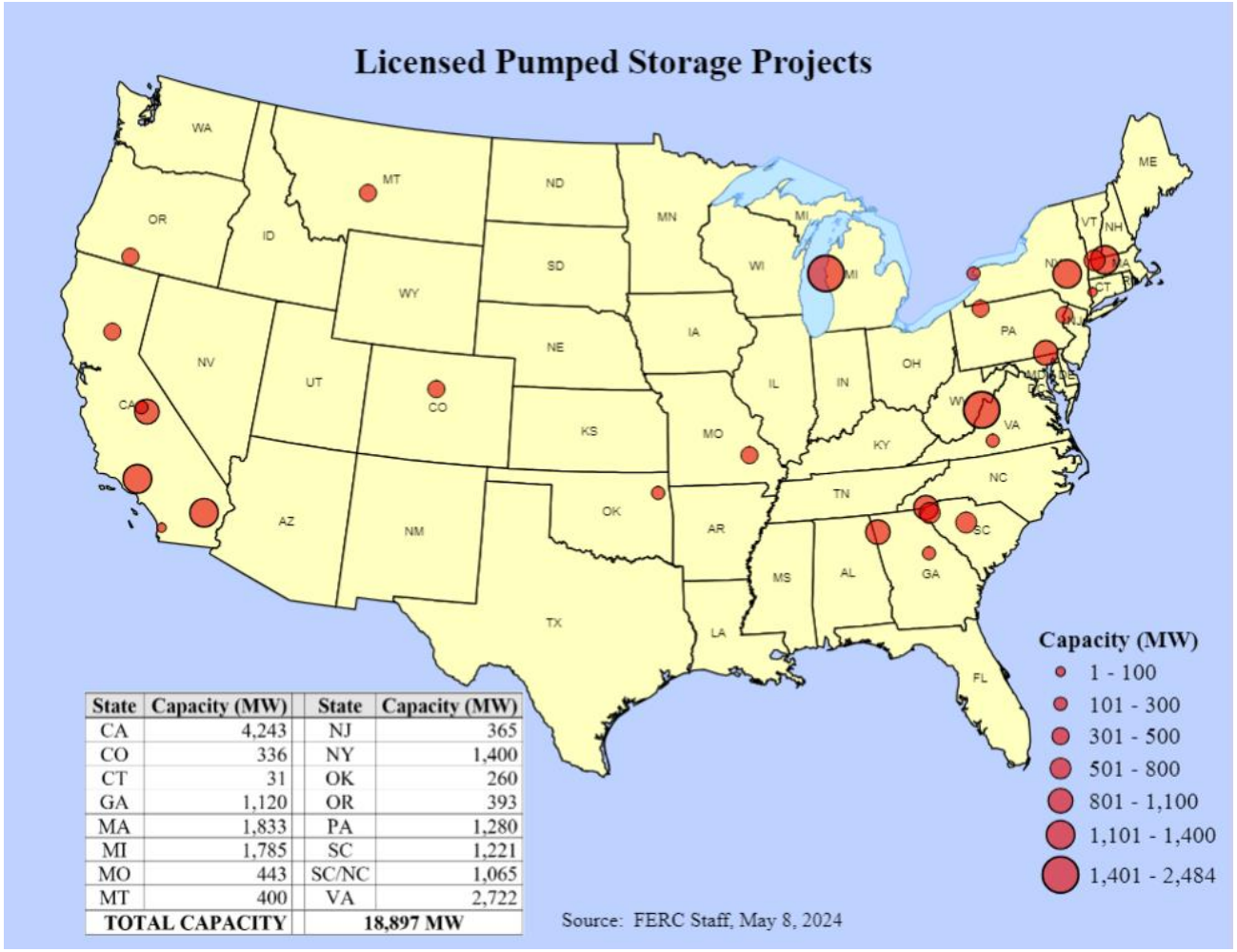
Al Hicks, NREL

PSH Drawbacks

- Expensive construction costs
- Long construction time
- Long and extensive permitting and licensing process
- Needs water to initially fill reservoirs (closed-loop)
- Siting may be difficult

Existing PSH in United States

- Most existing PSH in U.S. over 30 years old
- Provides over 90% of U.S. battery storage
  - Approximately 19,000 megawatt capacity (enough to power around 15 million homes)
  - Actual capacity may be greater



State	Capacity (MW)	State	Capacity (MW)
CA	4,243	NJ	365
CO	336	NY	1,400
CT	31	OK	260
GA	1,120	OR	393
MA	1,833	PA	1,280
MI	1,785	SC	1,221
MO	443	SC/NC	1,065
MT	400	VA	2,722
TOTAL CAPACITY		18,897 MW	

Washington State Directive

Clean Energy Transformation Act (CETA) (SB 5116, 2019)

Washington state's electricity supply:

- After 2025 – no coal in utility resource mix
- By 2030 – greenhouse gas neutral electricity supply
- By 2045 – 100% renewable or non-emitting sources

Clean Energy Project Siting – House Bill 1216, 2023

- Interagency Clean Energy Siting Coordinating Council
- Clean Energy Projects of Statewide Significance
- Coordinated Permit Process Available to Clean Energy Projects
- SEPA for Clean Energy Projects, new provisions
- **WSU Energy Program Pumped Storage Siting Process**
- Rural Clean Energy Stakeholder meetings
- Other

https://lawfilesext.leg.wa.gov/biennium/2023-24/Pdf/Bills/Session%20Laws/House/1216-S2.SL.pdf?q=20240327114612

PSH Siting Study in House Bill 1216, 2023

- WSU Energy Program will "provide ample opportunities" for engagement of
  - Tribes
  - Local governments
  - Special purpose districts
  - Land use and environmental organizations
  - Other interested stakeholders
- Develop a map & associated GIS data layers
  - Map is not decisive, makes no decisions

PSH Siting Study in House Bill 1216, 2023

- Information provided by Tribes can help inform map, but sensitive information will not be included in map or GIS layers
- Information "does not supplant the need for project developers to conduct early and individual outreach" to Tribes and other affected communities

Pumped Storage Hydro Siting Study Process

- PSH research
- Outreach, Engagement, Meetings, Webinars
  - Provide information on PSH
  - **Provide opportunities to hear from you**
- Mapping
  - Baseline map
  - Revised map based on input
  - Input not able to be presented on map will be in report
- Final report – completed by June 30, 2025

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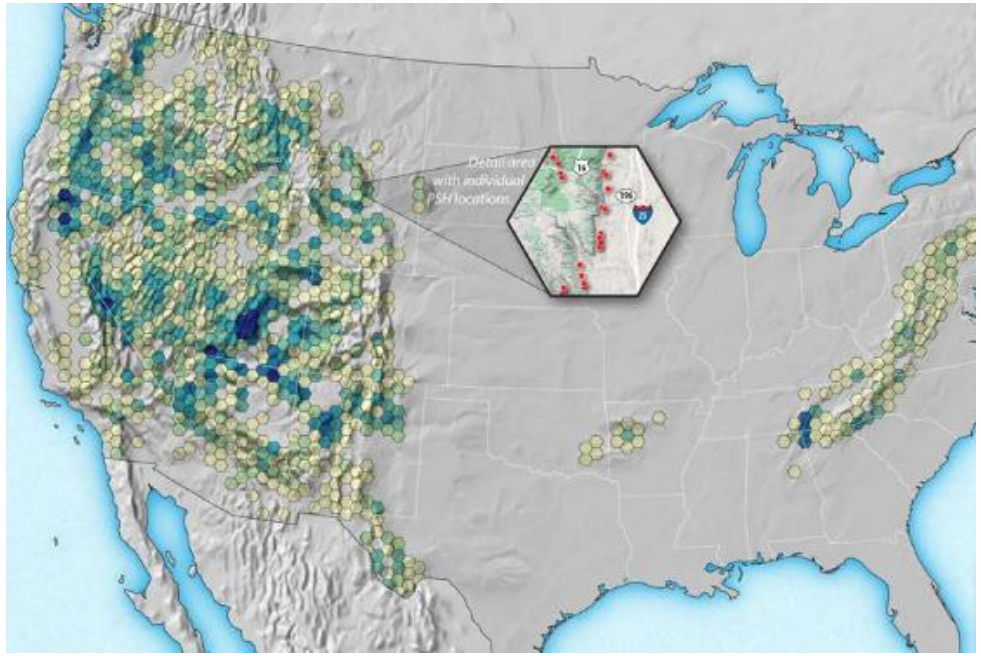
Using Data as a Starting Place

- National Renewable Energy Laboratory (NREL) identified potential sites for closed-loop PSH in the U.S.*
  - Our study focuses on NREL's sites in Washington state
- NREL added certain constraints, reducing the number of sites



* Closed-Loop Pumped Storage Hydropower Resource Assessment for the United States, https://www.nrel.gov/docs/fy22osti/81277.pdf

Using Data as a Starting Place

Our study's intention:

Use the areas and sites from NREL's research as a place to start conversations and listen to you.

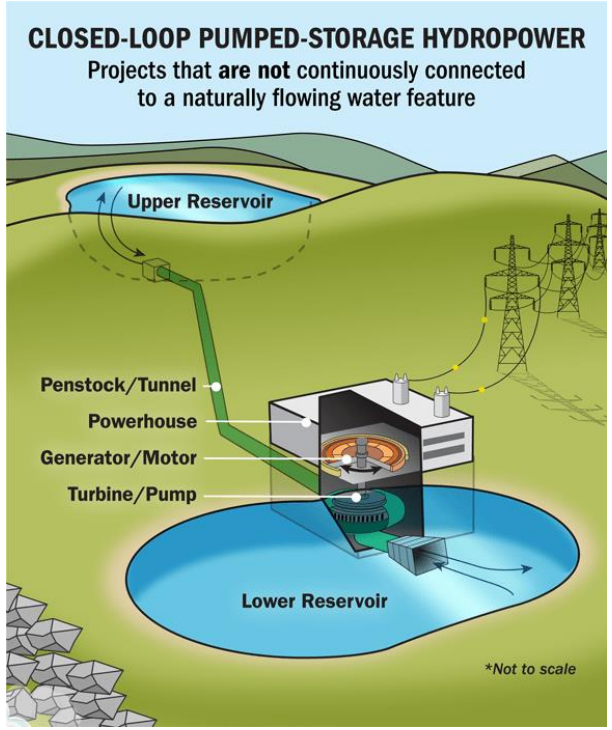
No PSH sites or projects are endorsed or proposed by the WSU PSH Siting Study!

National Research Energy Lab Study (NREL)

- Study area included Contiguous US, Alaska, Hawaii, and Puerto Rico.

- Objective was to provide energy storage for a 10-hour duration of energy production.

  - Model potential reservoir sites.
  - Filter out sites based on potential barriers to development.
  - Group reservoir sites into optimum pairs.
  - Apply economic model to identify cost-competitive pairs.



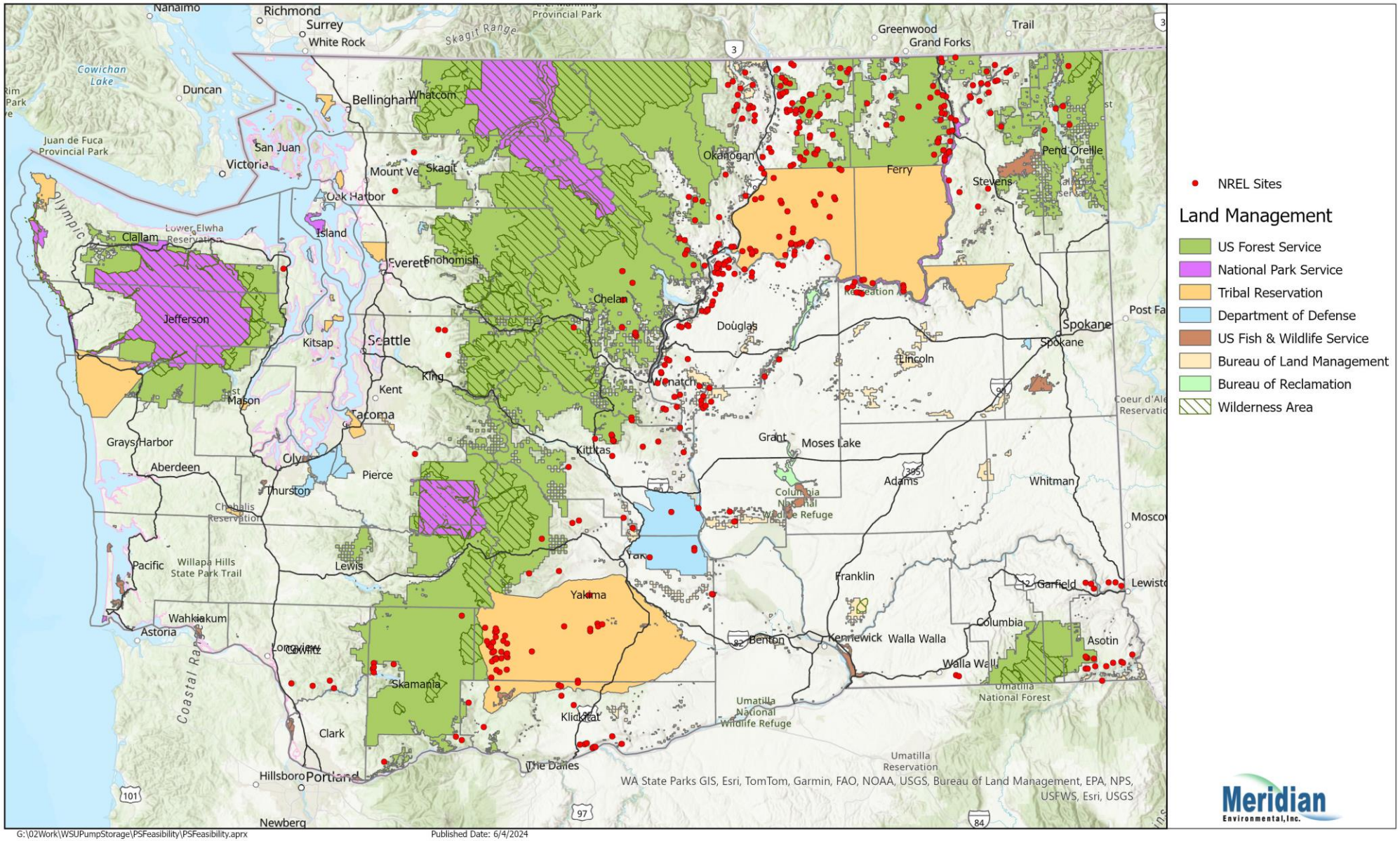
NREL Siting Characteristics

- Used 30-meter digital elevation data to identify location of potential reservoirs.
- Reservoirs sized using a 40-meter (131 feet) dam height criteria.
- Minimum reservoir surface area; 10 hectares (25 acres).
- Minimum head (elevation differential) between sites; 300 meters (984 feet).
- Maximum distance to head ratio of 15:1.
- Pair reservoirs of relatively equal size; larger to smaller ratio of 1.2.

NREL Results

- In Contiguous US, 6.5 million lower reservoir and 2.1 million upper reservoir sites initially identified.
- After filtering for Land Use and Environmental constraints, fewer than 1 million potential reservoirs remained.
- After identifying reasonable economic pairs of sites, only 14,800 potential site pairs of reservoirs remained.
- In Washington, only 391 pairs of reservoir sites are identified by NREL.

NREL Sites in Washington



Permitting / Licensing Requirements for PSH

- FERC Licensing or State Permitting
  - Congress gave FERC the authority to regulate waterway development, when a project :
    - is located on navigable waters of the US;
    - is located on federal lands or reservations;
    - uses surplus water from a federal dam; or
    - affects interstate commerce.
  - State permitting process if a project is not within FERC authority.
  - Licensing or Permitting process includes Tribal and stakeholder input and environmental review (NEPA or SEPA).

Questions?

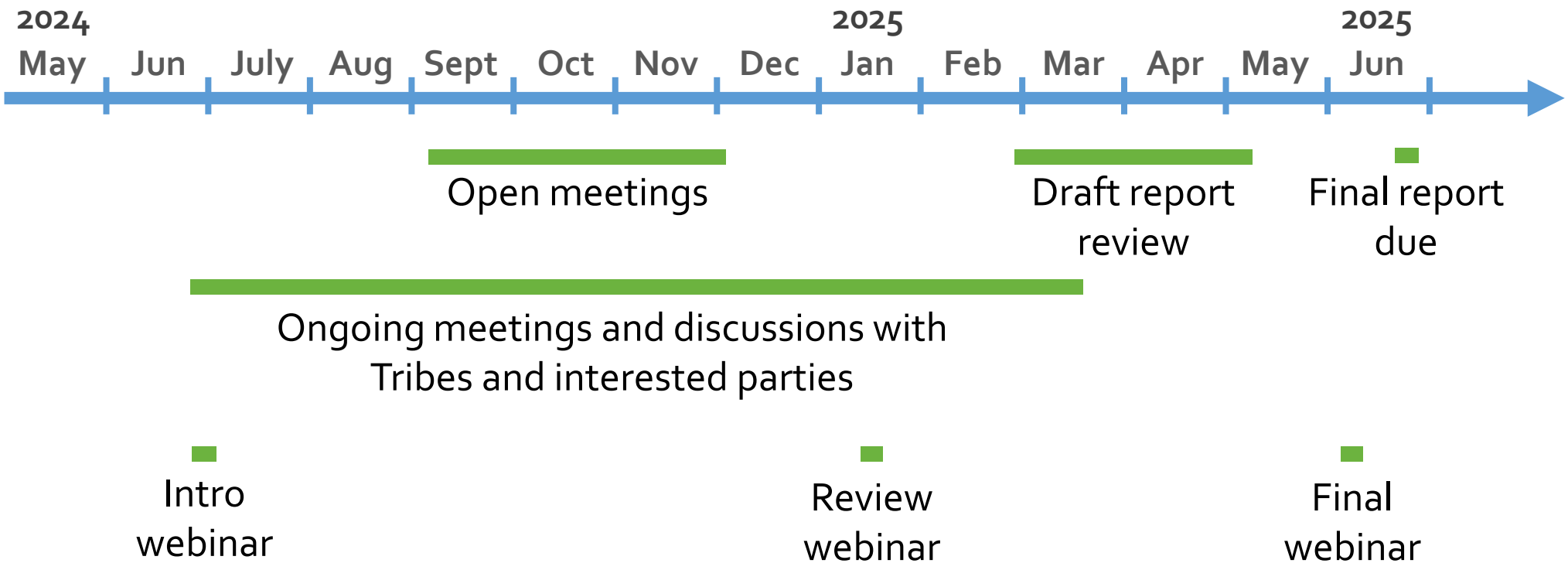
Initial Participant Perspectives on PSH

Future Meetings to Inform the Study

Future open meetings to inform the study

- Potential discussion topics about PSH and siting
  - Tribal cultural and natural resources
  - PSH permitting and licensing
  - Washington state's role in PSH
  - Water quality/quantity
  - Environmental impacts
  - other

Timeline *(subject to change)*



Your Input is the Core of the Study

In addition to the open meetings:

- One-on-one meetings or interviews (as requested)
- Small group Tribal or stakeholder discussions
- Other?

- Open meetings—what should they look like?

Remaining Questions and Wrap Up

Any more questions about the study?

Stay Informed

Please spread the word!

WSU Information Study for PSH Siting webpage
https://www.energy.wsu.edu/CleanFuelsAltEnergy/PSHSiting.aspx

PSH Study mailing list registration
https://www.energy.wsu.edu/CleanFuelsAltEnergy/PSHSiting/PHSSitingEmailRegistration.aspx

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Thank You!

Karen Janowitz and the PSH study team