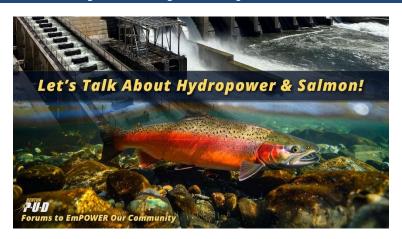
Pacific Northwest Hydropower Why Every Drop Matters



Rick Dunn, PE General Manager/CEO

October 2025

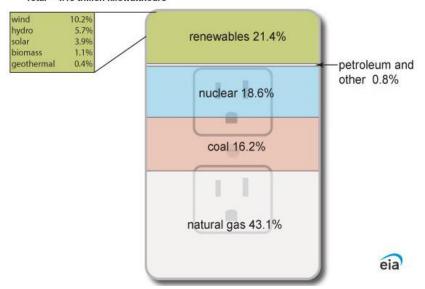


Agenda

- 1. Hydropower Perspective National, Northwest & Local
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3

Sources of U.S. electricity generation, 2023



Source: https://www.eia.gov/energyexplained/electricity/

□ Fossil Fuels = 60%

- □ Renewables = 21.4%
 - Wind & Solar = 14.1%
 - Hydro = 5.7%
- □ Nuclear = 18.6%

□ 39% Non-CO₂ Emitting

Hydropower = 5.7% of U.S. Electricity

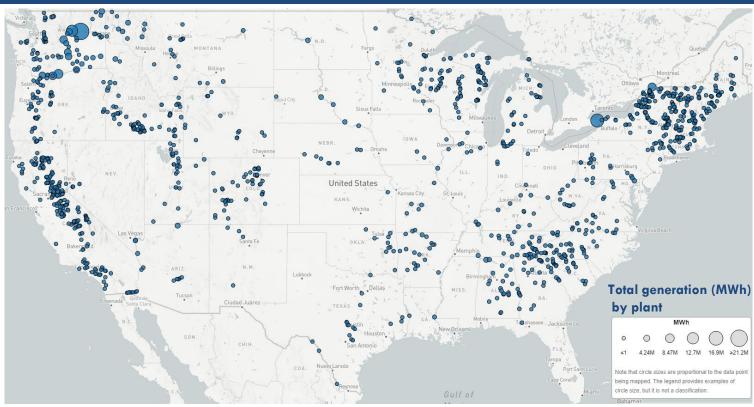
Northwest Hydropower Like Nowhere Else:

Electricity Provided

- √ 50% of PNW Region
- √ 60% of Washington

Hydro-Based

100% CO₂-Free
Electricity does
not scale to the
rest of the U.S.

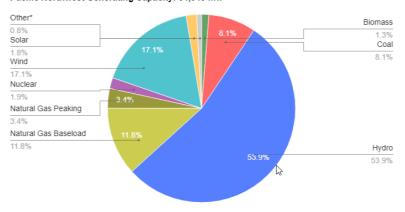


Source: epa.gov/egrid/data-explorer

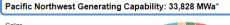
Hydropower: Foundation of Pacific Northwest Electricity Supply

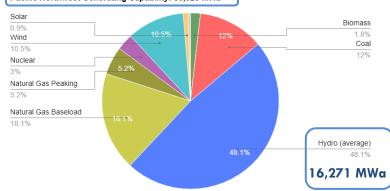
PNW Nameplate Capacity

Pacific Northwest Generating Capacity: 64,340 mw*



PNW Annual Electricity Production



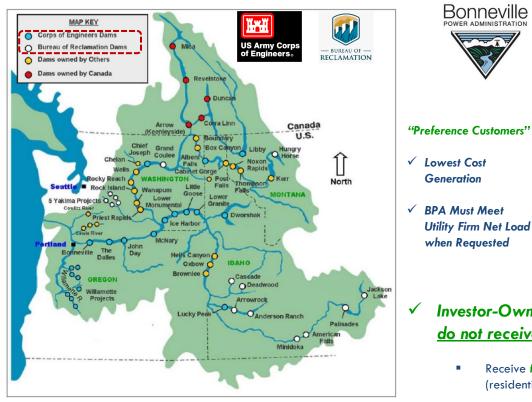


Capability is the maximum amount of energy the plants are capable of producing over the course of an average year. Download chart as PNG

Bonneville Power Administration \approx 50% of hydro generation in average year

^{*} Other (yellow segment) includes geothermal, petroleum, and solar

BPA Hydropower: Foundation of Public Power Supply





Generation

RPA Must Meet Utility Firm Net Load when Requested

Federal Power Marketer

- 31 Federal Hydroelectric Dams
- **Columbia Generating Station Nuclear Plant**

Customers

Cooperatives
Municipalities42
Public utility districts
Federal agencies
Investor-owned utilities
Direct-service industries
Port districts
Tribal utilities
Total 14

- **Investor-Owned Utilities** are not preference customers & do not receive physical firm electricity today
 - Receive *financial payments* on behalf of residential & farm customers (residential exchange program)

Northwest Utilities: Investor Owned

WASHINGTON MONTANA Jlym_lia Her a Kennewick DAHO DREGON Idaho Falls Medford * Salt Lake City https://data-bpagis.hub.arcgis.com/apps/90811a3f226041bf8657d73ff81e949c/explore

52% of Electricity Demand

Investor-Owned Customers

Avista Energy

Idaho Power Company

Northwestern Energy

PacifiCorp

Portland General Electric

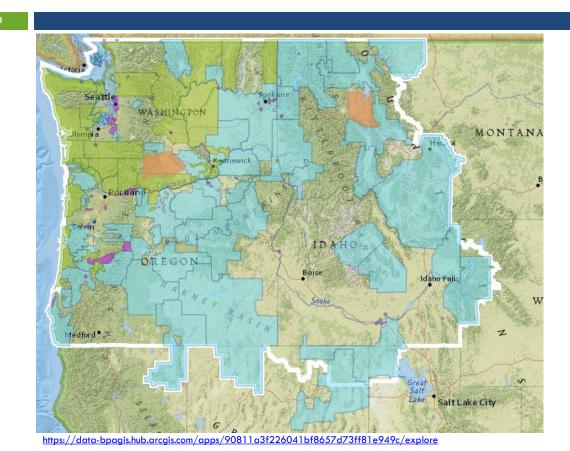
Puget Sound Energy

Rocky Mountain Power (PacifiCorp)

Sierra Pacific Power (NV Energy Inc.)

BPA Service Area

Northwest Utilities: Public & Tribal



43% of Electricity Demand

Tribal Customers



Public Customers









BPA Service Area

Tri-Cities Area: 2028 Electricity Demand

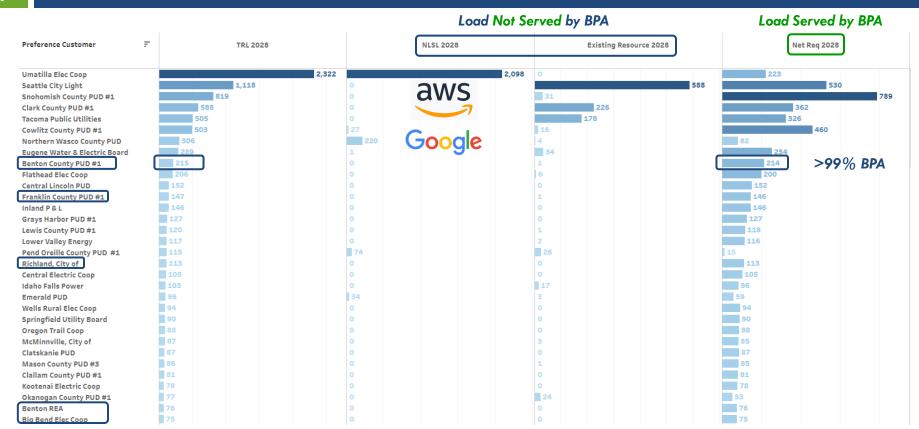
County Okanogan PUD#1 Northern County Elec Coop Lights Elec Coop Nespelem Valley Elec City of Montana Flathead Port Angeles. City of-Everett (Jim Creek) Elec Coop Clallam County PUD #1 Modern Elec -Electric ounty PUD #3 Seattle Port of Seattle Transer Elec Copgint Company Milton, Town of Tanner Elec Cop Milton, Town of Lakeview Light and Power County Seary, City of Tankland Light and Water Seary, City of Tankland Light and Water PuD #1 Valley Consolidated lason County PUD #1-Power Power and Light McCleary, City of Grays Harbor PUD #1 Missoula Eatonville, City of Ohop Mutual PUD#2 Elec Coop Light Lewis Company Ravalli County County PUD #1 Elec Coop Cowlitz County PUD #1 County PUD #1 -Franklin County PUD #1 Benton REA Skamania Benton County PUD #1 PUD #1 Idaho County Cascade Locks, City of Light and ·- County City of Elec Tillamook __ Grove, - * Vigilante Oregon Coop Wasco County PUD #1 City of McMinnville, City of River Columbia Wvomino Elec Coop Canby, City of Salem Elec Coop Columbia Salmon Power Coop River U.S. DOE Albany · Monmouth, City of Elec Coop Research Center Weiser. Consumers City of Lane Elec Elec Central Elec Coop Elec Coop Electric Coop Lincoln PUD Lower Coop Utility Board Falls Lane County Elec Coop Midstate Energy Power Emerald PUD Eugene Elec Coop Water and Electric Board Oregon City of Umpoua Indian Douglas East End Mutual City of Electric • • Cooperative Heyburn, City of Burley, City of Rupert, City of Southside Elec Lines Coos Curry Elec Coop Declo, City of

Utility	2028 Forecast MWa
Benton PUD	215
Franklin PUD	147
City of Richland	113
Benton REA	76
Big Bend Electric Coop	75
TOTAL	626

6% of Total State Demand 2023 Electricity Sales ≈ 10,200 MWa

0

BPA Firm Energy: Where it Flows & Doesn't



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WA Clean Energy Transformation Act (CETA)

AMERICA

Washington state commits to 100% clean energy

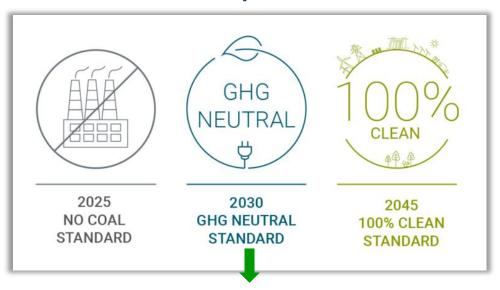
Washington is the latest state to go all-in on clean, carbon-free electricity.



Washington is the latest state to go all-in on clean, carbon-free electricity.

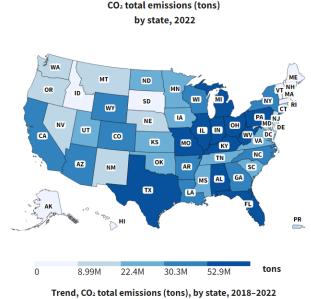
On May 7, Gov. Jay Inslee signed the 100% clean electricity bill into law,

CETA Requirements



- √ 20% of utility portfolio can be CO₂ emitting generation with offsets
- √ Has effectively eliminated investment in new natural gas generation so far

Washington & Oregon: What Dirty Energy Problem?

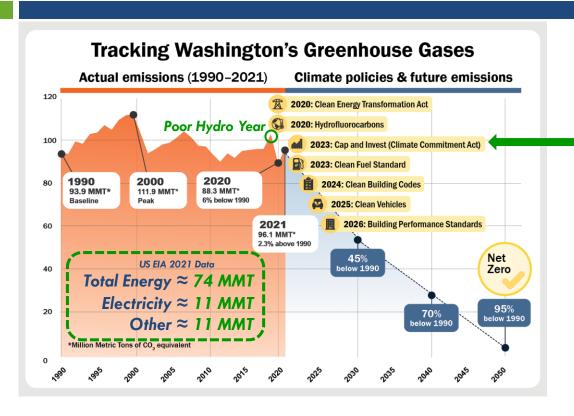


Select a state in the map above or the graphs at the right to see its trend here.

Sort A to Z Sort by Amount US: 1,745,134,437 (tons) tons TEXAS FLORIDA -PENNSYLVANIA · OHIO -INDIANA -MISSOURI -KENTUCKY · 59.5M MICHIGAN -58.9M ΔΙ ΔΒΔΜΔ -57M WEST VIRGINIA 55.5M ILLINOIS -54.5M GEORGIA · 46 6M CALIFORNIA · 46.3M NORTH CAROLINA · LOUISIANA -43M WYOMING -ARIZONA · 37.1M WISCONSIN -35.9M ARKANSAS -COLORADO -Hydropower Like Nowhere Else NEW YORK -30.5M MISSISSIPPI -UTAH -NORTH DAKOTA -OKLAHOMA -SOUTH CAROLINA -27.5M TENNESSEE -27.1M % of U.S. Total (1,745 MM) VIRGINIA -26.3M KANSAS -MINNESOTA -IOWA -NEBRASKA -NEW MEXICO -NEVADA - 14.2M PUERTO RICO - 14.2M MONTANA - 13.9M \checkmark WA = 10.8 MMT (0.62%) MARYLAND - 11.8M CONNECTICUT - 11.1M WASHINGTON - 10.8M OREGON - 9.13M MASSACHUSETTS - 8.95M HAWAII - 6.76M RHODE ISLAND - 3.17M ALASKA - 3.05M \checkmark OR = 9.13 MMT (0.52%) SOUTH DAKOTA - 2,91M NEW HAMPSHIRE - 2.84M DELAWARE - 2.39M MAINE - 2.15M IDAHO - 2.02M DISTRICT OF COLUMBIA - 44,384 VERMONT - 38,881

Source: https://www.epa.gov/egrid/data-explorer

WA CO₂ Reduction: Local versus Global



"...cuts are necessary to prevent the worst effects of climate change on our state's coastlines, water supplies, forests, environment, and economy."

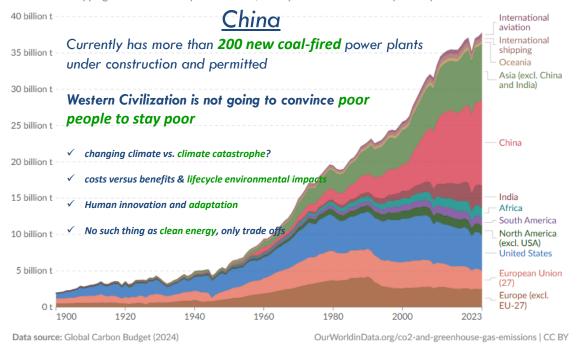


- √ Cap-and-Invest Quarterly Auctions
- √ \$3 billion in CO₂ taxes
- ✓ CETA & CCA increasing price of natural-gas-fired electricity by 50% to 100% so far.

CO₂ Emissions: Global Perspective

Annual CO₂ emissions by world region

Emissions from fossil fuels and industry¹ are included, but not land-use change emissions. International aviation and shipping are included as separate entities, as they are not included in any country's emissions.



Since 2007

✓ U.S. decreased by 1.22 billion t

in Data

- Mostly due to Coal-to-natural gas fuel switching in electricity generation
- ✓ China *increased* by 4.92 billion t

CO₂ from Energy Sector

 $Washington = 0.074 \ billion \ t$

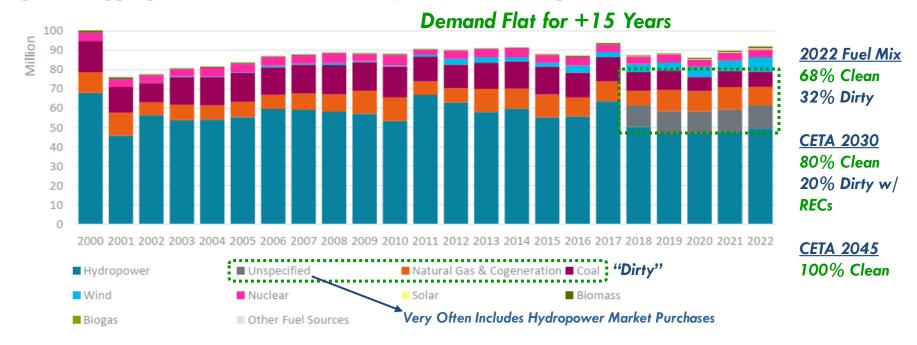
United States = **4.91** billion t

China = **11.9** *billion t*

Source: https://ourworldindata.org/grapher/annual-co-emissions-by-region

Washington Electricity: Demand & Fuel Mix

Figure 2: Aggregate Fuel Mix Time Series (MWh) for Washington Electric Utilities¹



WA Energy Strategy: Out of State Imports

Transmission Lines in Coordination with Other States? *

Decarbonizing the Electricity Sector

Sales in 2023 = 10,200 aMW



growth in electricity end use demand by 2050

of electricity imported by 2050





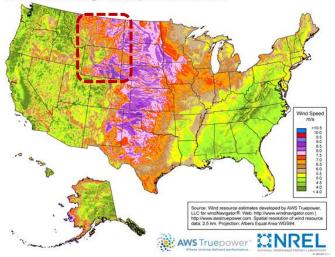


- Double end use electricity load by 2050 ✓ Electricity to displace fuels in transportation, industry,

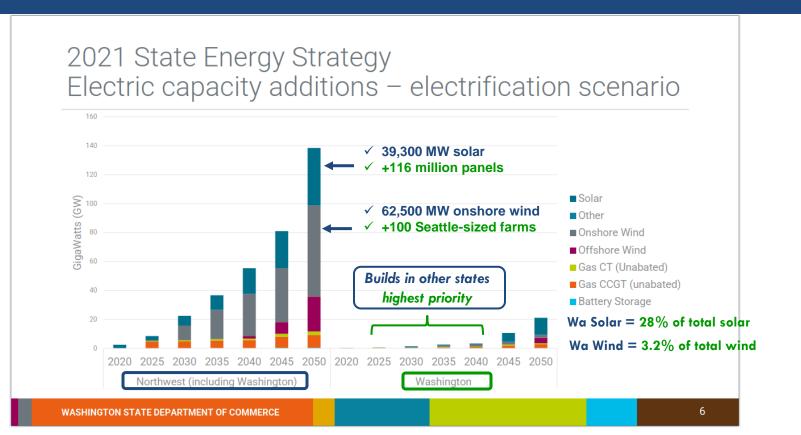
 - ✓ Hydrogen electrolysis and electric boilers as flexible demand resources
- Invest in new transmission capacity and renewable generation, coordinating with other states
- Develop distributed energy resources with smart grid capabilities to ensure reliability and flexibility
- Strengthen market mechanisms to ensure resource adequacy and efficient electricity markets.
 - ✓ Coordination with other states and federal government

- \checkmark 7,200 aMW = WY & MT Wind
- ✓ 1,400 aMW = Other Imports

U.S. annual average wind speed at 80 meters



WA Energy Strategy: Out of State Imports



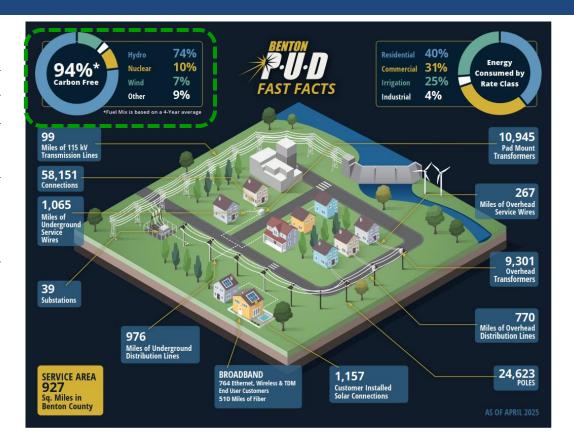
Benton PUD CETA Compliance: Looking Good

Load

POWER RESOURCES

	Load
	Served
Resource	(aMW)
BPA	211.2
Packwood Hydro	1.0
Total Wholesale Load	212.2
Distribution Losses	-6.3
Total Retail Load Billed	205.9

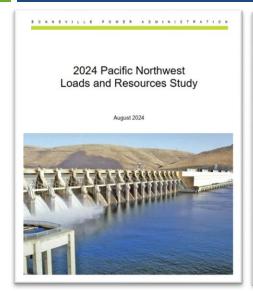
Fuel Mix	2024 Estimate	2020-2023 Average
Biogas	0.0%	1.7%
Riomass	0.0%	1.7%
Hydro	83.1%	73.5%
Natural Gas	0.0%	0.1%
Nuclear	11.1%	9.6%
VVind	0.0%	7.1%
Unspecified Source	5.8%	6.3%
Total	100%	100%
Total Carbon Free	94%	94%

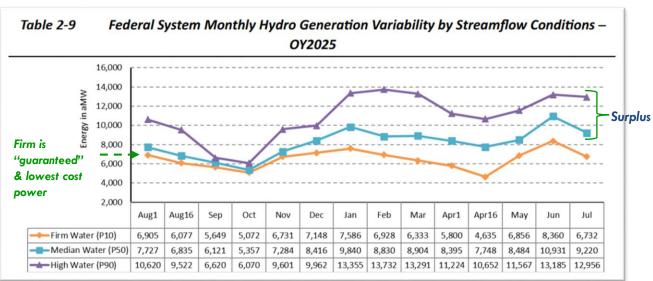


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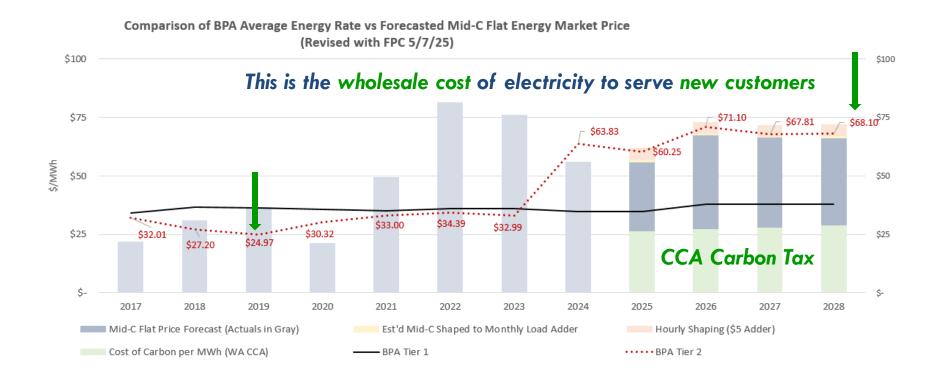
BPA Hydropower: Firm Energy is Spoken For





- 1. Lowest-cost firm Tier-1 Federal Hydropower is spoken for: < \$40 per MWh (45% of BPUD Residential Electric Bill)
- 2. Surplus meets firm demand above Tier-1 (new demand < 10 aMW): \$67 to \$70 per MWh (+75% higher than Tier-1)
- 3. Electricity Intensive Demand > 10 aMW (NLSL): \$92 to \$144 per MWh based on month (130 to 260% higher than Tier-1)

BPA Tier 2 Rates: +170% Increase Since 2019

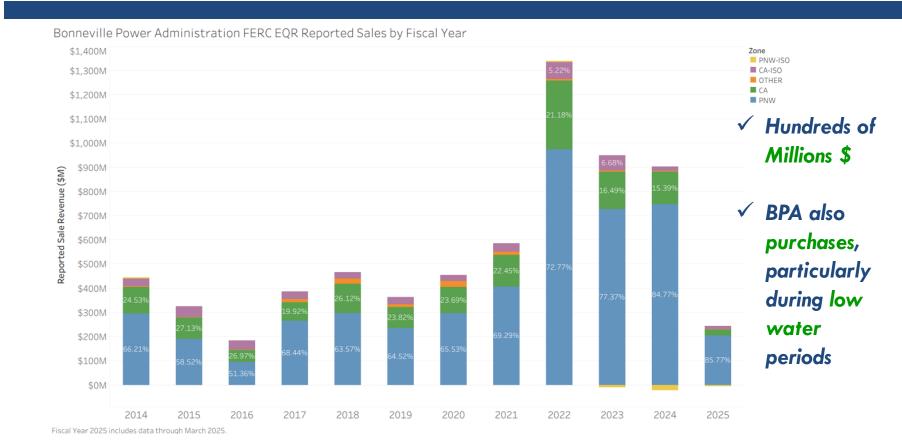




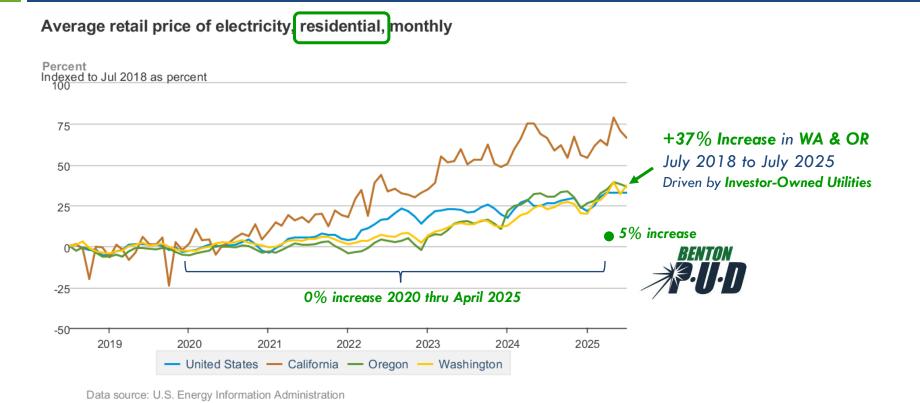
Fiscal Year 2025 includes data through March 2025.



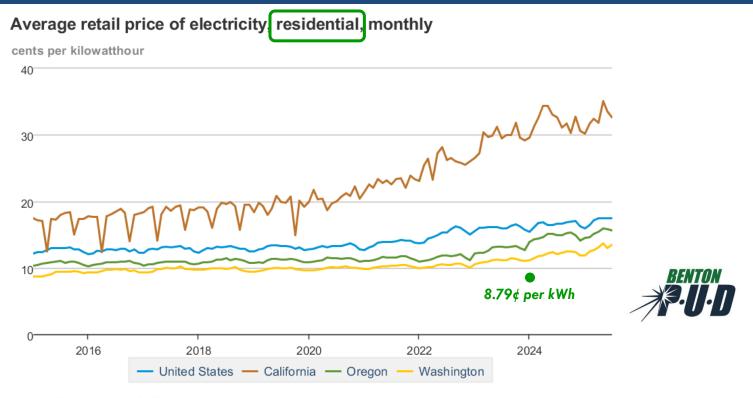
BPA Hydro: Surplus Energy Sales Revenue



Affordable Hydro: Has Mitigated Rate Increase %



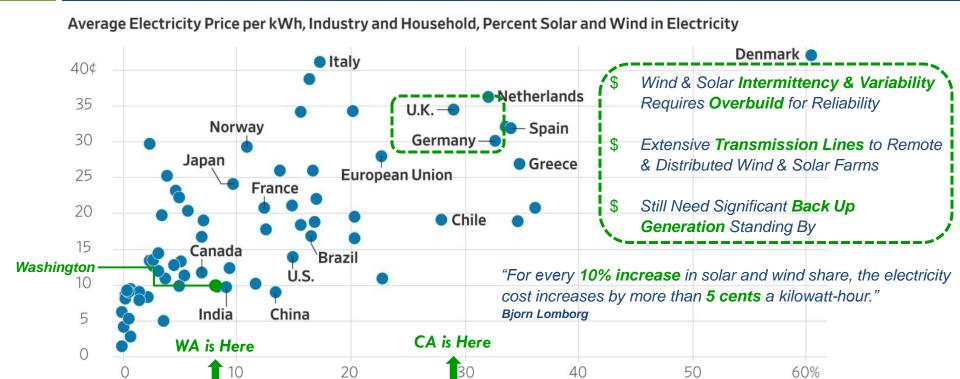
Affordable Hydro: Has Mitigated Rising ¢ per kWh



Data source: U.S. Energy Information Administration

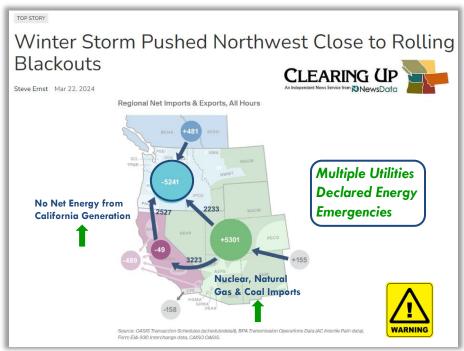
Note: International Energy Agency, Statista

Increased Costs: "Cheap" Wind & Solar is a Lie



% Solar & Wind

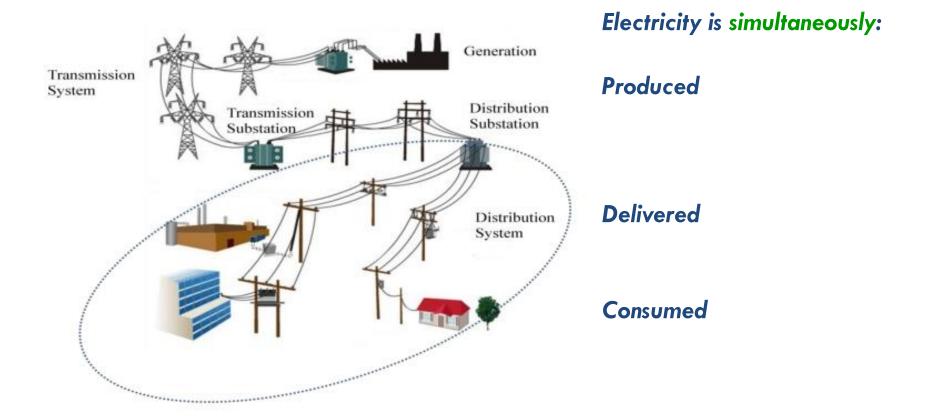
Northwest Close to Blackouts



- Northwest Imported Electricity for all 120
 Hours of Cold Snap
- Hydro short on water, natural gas maxed out
 & wind power collapsed to zero
- □ +2,000 MW of **coal retirements** so far
- Demand grew **2**% **to 6**% since December 2022 winter event
- Northwest electric grid & natural gas pipeline systems are at immediate risk with no margin for the unexpected

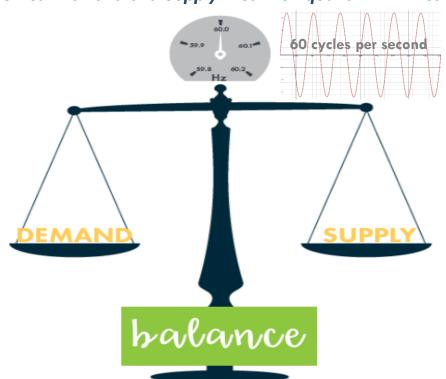
<u>January 12 – 16, 2024</u>

Power Grid Basics: A Service Like No Other!



Demand/Supply Balancing: Physics

Electrical Demand and Supply Must Be Equal at All Times



- √ 'Cruise Control' set at 60
 - No over supply
 - No under supply
- ✓ The Laws of Power Grid
 Physics are <u>Unforgiving</u>
- Consequences of not maintaining supply & demand balance are blackouts

Electricity Supply & Demand: Balancing Area Authorities

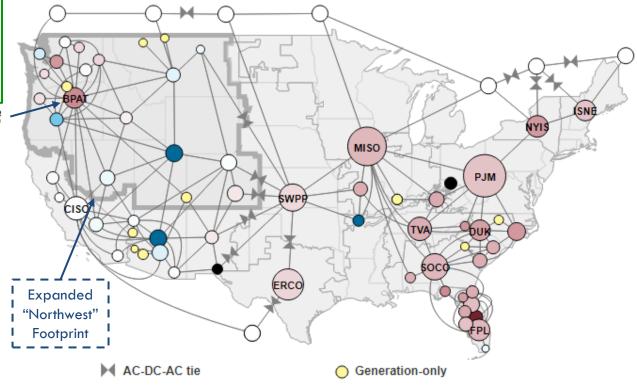
✓ Transmission Lines
enable electricity to
flow within & between
Balancing Areas

Bonneville POWER ADMINISTRATION

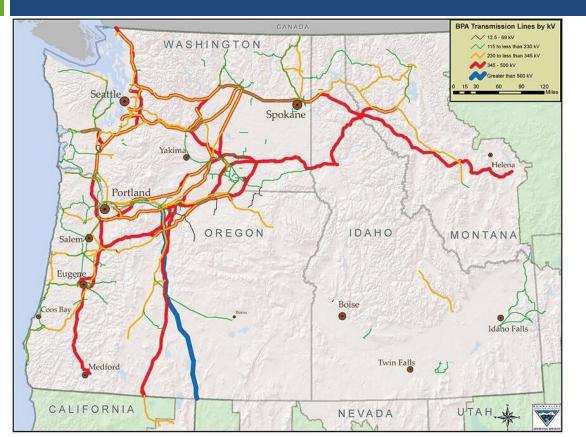
- √ 38 Balancing Area

 Authorities in Western

 Power Grid
- Maintain supply & demand balance using scheduled generation imports and exports



BPA Transmission: 75% of NW Grid





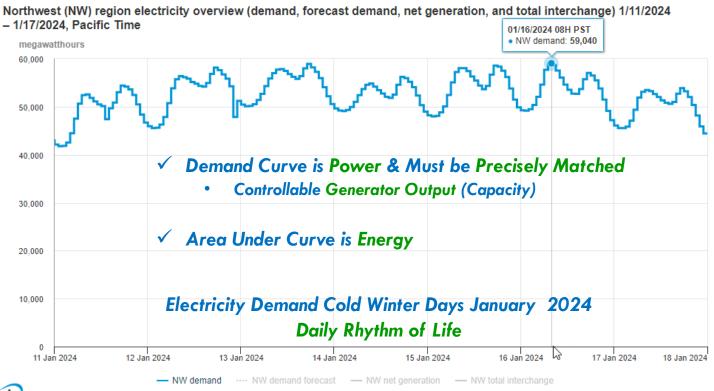
Transmission system

Operating voltage	Circuit miles
1,100 kV	1
1,000 kV	264 ¹⁰
500 kV	4,860
345 kV	570
287 kV	229
230 kV	5,337
161 kV	119
138 kV	56
115 kV	3,440
below 115 kV	301
Total ¹¹	15,179

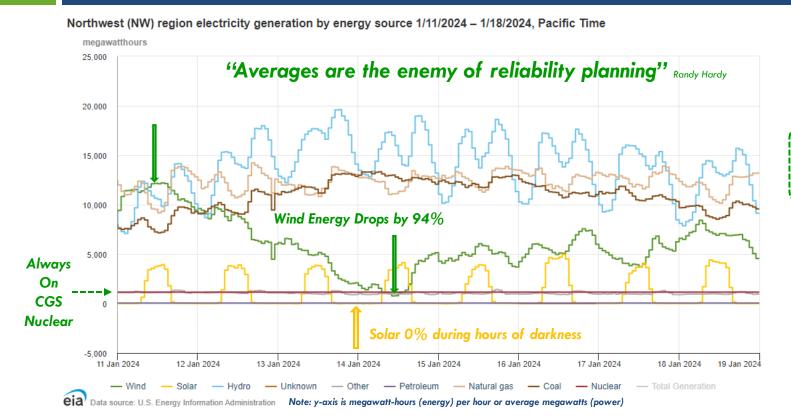
10/ BPA's portion of the PNW/PSW direct-current intertie. The total length of this line from The Dalles, Oregon, to Los Angeles, California is 846 miles.
11/ Total circuit miles as of February 2019.

- ✓ Arteries ≈ 11,261 miles (74%)
- √ Veins ≈ 3,916 miles (26%)

NW Electricity Demand: January 2024 Cold Snap



NW Electricity Supply: January 2024 Cold Snap



- Energy Policies
 Driving Deeper
 Dependence on
 Hydropower
- Natural Gas is
 Next Best for
 Balancing the Grid
- "Clean Grid" can be energy rich but capacity poor
- Increasingly Risky& CostlyProbability Game

NW Hydro: Flexes Polar Vortex Muscle



https://rickdunn.substack.com/p/northwest-hydro-flexes-its-polar

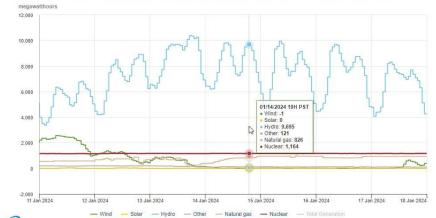
Northwest Hydro Flexes it's Polar-Vortex Muscle and 'Gone Went the Wind'

The question isn't, can you integrate tens-of-thousands of average megawatts of unreliable wind farms into the grid? The question is, should you?



RICK DUNN, P.E. JAN 22, 2024

Bonneville Power Administration (BPAT) electricity generation by energy source 1/11/2024 - 1/17/2024, Pacific Time



eia Data source: U.S. Energy Information Administration



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Federal & State: Threats to Hydro



RICKDUNN.SUBSTACK.COM

Sawing Off the Branch We're Sitting On and Deepening our Dependence on Northwest Hydro for 'Blackout Insurance'

Washington and Oregon have Teamed with the Federal Government to Undermine the Very Hydropower on Which 100% Clean Electricity Mandates were Based

- Risky & Excessive Spillway Flows
 - 125% Total Dissolved Gas
- Water Temperature Regulation
 - Washington Stds. may be Impossible to Meet
- Lower Snake River Dam Breaching
 - "Centerpiece Action" for Salmon Recovery
- U.S. Government Commitments
 - "12/14 Agreement" with "6 Sovereigns"
 - Washington, Oregon & 4 Tribes NOT MT or ID
 - Failed to Engage Utility Sector

High Spill: Risks to Smolt & Adult Salmon

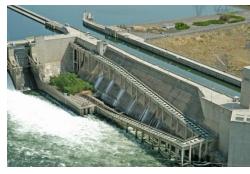
125% Total Dissolved Gas Super Saturation of Water



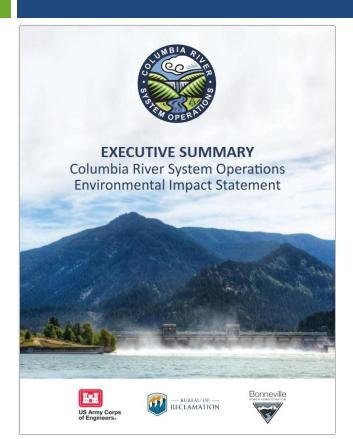








High Spill: Worse than LSRD Breaching



- Multiple Objective Alternative 4 (MO4)
- Highest volume and longest duration spill considered in EIS alternatives
- 125% total dissolved gas during spring & summer
- Average hydropower decreases 1,300 aMW
- Highest probability of power shortages
- Blackouts or emergency conditions in roughly 1 in 3 years

Hydro: Pays for Fish & Wildlife Programs

Figure 1A: Costs by Major Area, FY2023

(all figures in millions) Direct F&W Program 260.9 Forgone Revenue (est.) 89.3 Corps of Engineers O&M (est.)² 46.0 Lower Snake Comp Plan 34.9 Bureau of Reclamation O&M (est.) 6.5 NW Power & Conservation Council 5.9 Interest Expense (est.)³ 30.3 Amortization/Depreciation (est.) 77.0 Power Purchases for Fish Enhancement (est.) 879.3 Total4 1.430.1 Capital investments¹ 19.3 Federal credits from U.S. Treasury 4(h)(10)(C) (257.7)

Power Purchases for Fish Enhancement (est.), \$879.3M, 61.5%

Direct F&W Program, \$260.9M, 18.2%

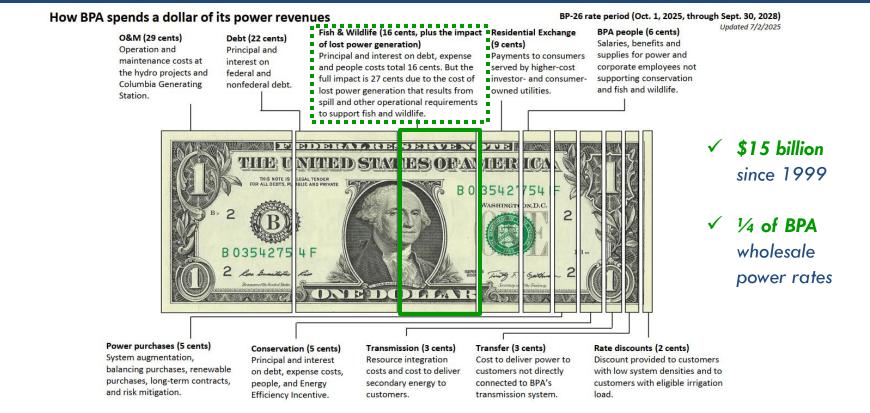
Forgone Revenue (est.)*, \$89.3M, 6%

Total reimb. expenses, \$93.3M, 6.5%

Total fixed expenses \$107.3M, 7.5%

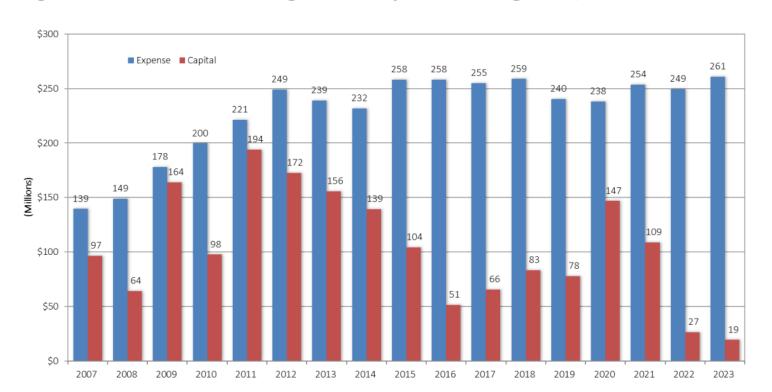
Credits are U.S. Treasury reimbursements to BPA for the share of fish & wildlife mitigation costs attributable to non-power purposes

Hydro: Pays for Fish & Wildlife Programs

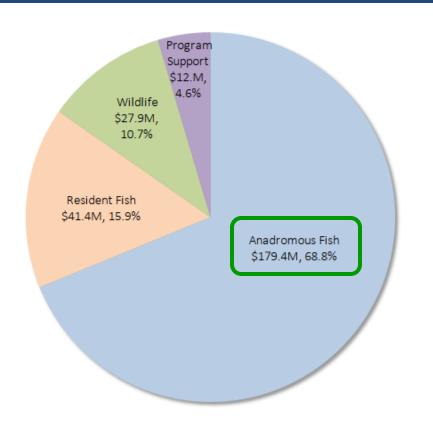


Hydro: Pays for Fish & Wildlife Programs

Figure 1B: Combined Direct Program and Capital Borrowing Costs, FY 2007-2023



Hydro: Salmon are Highest Priority





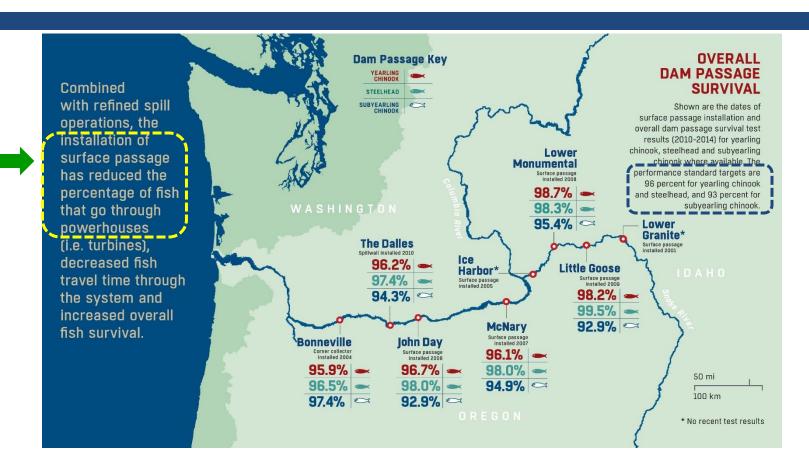
Hydro: Salmon Restoration Efforts



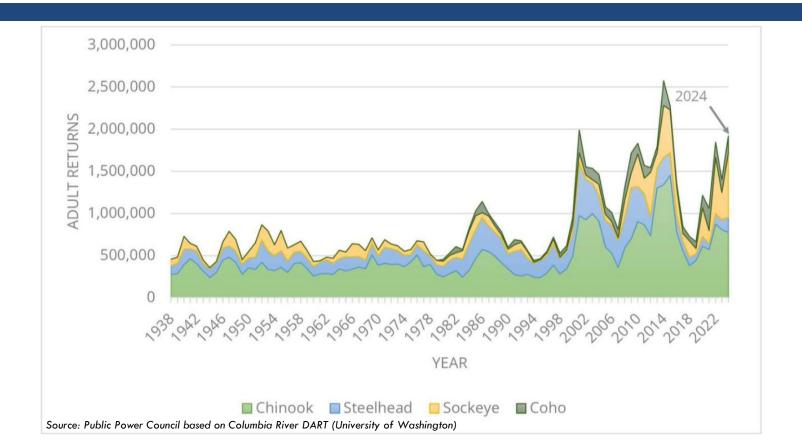
4 H's

- ✓ Habitat
- ✓ Hatcheries
- √ Hydro
- √ Harvest

Dam Passage: Fish Survival Rates



Salmon Returns: Ups, Down & Trends

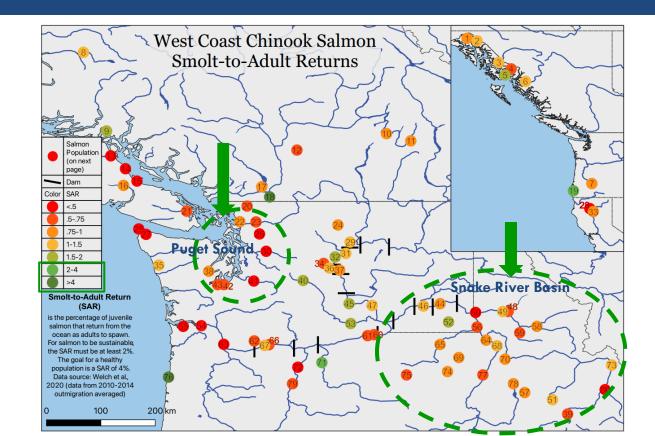


Chinook Salmon Struggling: Dams or Not

Smolt-to-Adult Return Sustainable runs >2%







Hydropower: Back in the Courts

Columbia River System Operations Federal Lawsuit

- √ Federal Oregon District Court (Judge Michael Simon)
- ✓ Plaintiffs = 10 nonprofit groups (National Wildlife Federation, et al.,) + Oregon + Washington (as of October 9th)
- ✓ Proposed Order Granting Oregon's Motion for Injunctive Relief (October 8, 2025) = Year-Round 24/7 Spill





The Seattle Times

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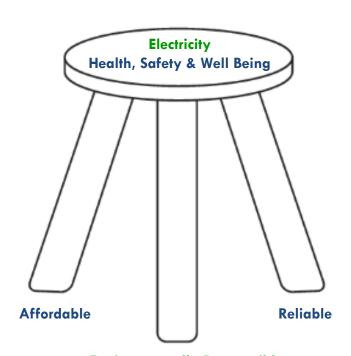








Balancing Act: Increasingly Difficult



Environmentally Responsible

- Hydropower Erosion
 - Increased spill & threats of dam breaching



- Eliminating CO₂ valued above all factors
 - □ Coal-plant retirements & no new natural gas in WA & OR
- Wind & Solar: Weather Dependent & Energy Dilute
 - Located remotely from population centers & require vast swaths of land due to need for extreme overbuild
- Increasing Costs & Risk of Blackouts



Conclusions/Questions

- ✓ Pacific Northwest needs **every drop of hydropower** we can get!
 - Firm and low-cost hydro is **spoken for** . . . the glory days are over
 - Hydro & Salmon can co-exist . . . but what does it mean for salmon to be "abundant"

- √ 100% CO₂-Free Electricity Mandates
 - Deepening dependence on hydro Capacity & flexibility
 - Increasing blackout risk = drought + cold/hot weather
 - Desperately need more firm (dependable) capacity
 - New *Nuclear* is long-game solution with *Natural Gas* as a bridge fuel

Agenda

New Nuclear Challenges and Opportunities

Big Tech Knows: Reliable = Natural Gas + Nuclear



Big Tech's "Dirty Little Secret" Natural Gas Power + Renewable Energy Certificates "Greenwashing"

Wind & Solar 'Green Industry' Fantasyland #1

How 'Big Tech's' 100% renewable deception, detached from reality politicians, and the legacy of Northwest hydropower are fueling false hopes of industrial development in Washington and Oregon.



RICK DUNN, P.E. FFR 25 2024

Al could drive a natural gas boom as power companies face surging electricity demand



Driving Nuclear

Renaissance

AWS acquires Talen's nuclear data center campus in Pennsylvania

Cloud company pays \$650 million - plans 960MW campus

March 04, 2024 By: Dan Swinhoe D Have your say

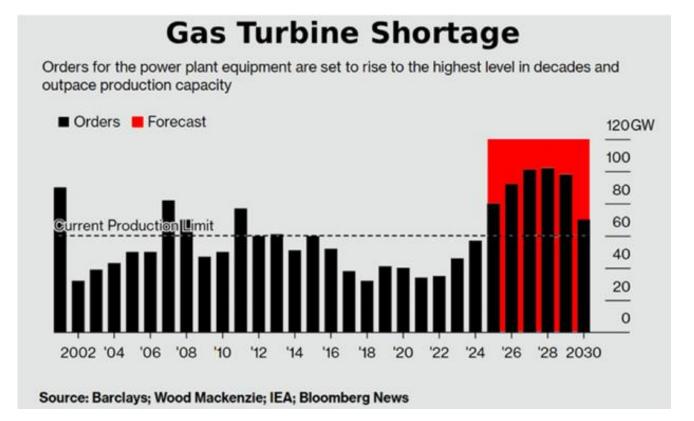
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https://rickdunn.substack.com/p/wind-and-solar-areen-industry-fantasyland

Artificial Intelligence: Driving Power Demand



- ✓ U.S. Al power capacity estimated at 5 GW today
- ✓ Could reach **50 GW** by 2030
- ✓ Capacity increase equivalent to 37
 CGS Nuclear Plants

Source: Electric Power Research Institute August 2025

AWS Funding New Nuclear: Site-1 SMR









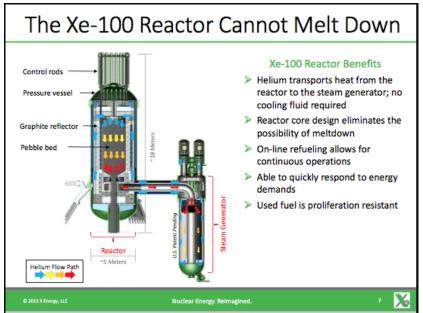
- Amazon providing development funding for 4 modules
- Energy Northwest has option to build additional 8 modules
 - Additional power available to *Amazon and northwest utilities*

On-Line Goal = Early 2030s

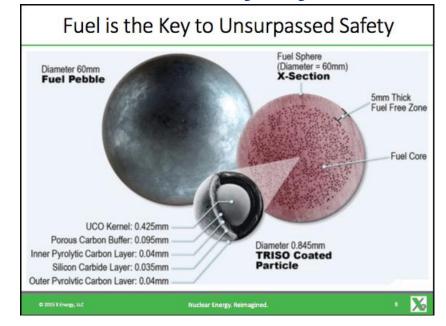
"Long Game" Solution: Scalable, CO2-Free & Safe

High Initial Cost, Supply-Chain Constrained & Operationally Unproven

Meltdown-Proof



Walk-Away-Safe



Land-Use vs. CO₂ Footprint: Finding Common Ground





Energy contained in a gummy bear pellet of uranium fuel

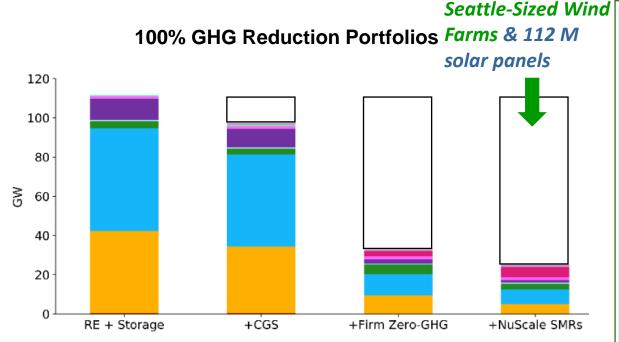
= **2,000 pounds** of coal

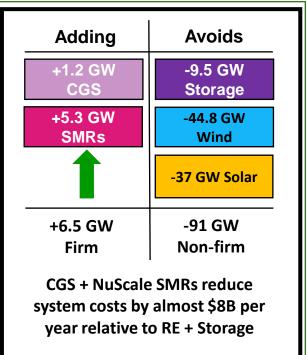
An artist's rendering of NuScale Power's small modular nuclear reactor plant. Photo courtesy of NuScale



Benefits of zero-emitting firm capacity at 100% GHG reductions







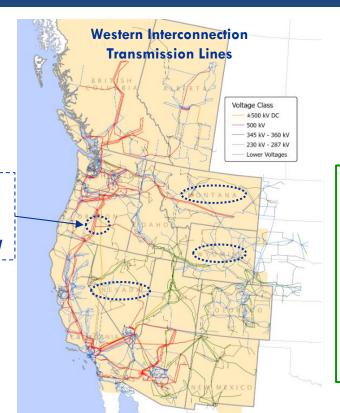
Agenda

21st Century Power Grid

Western Power Grid: Interconnected Transmission Lines

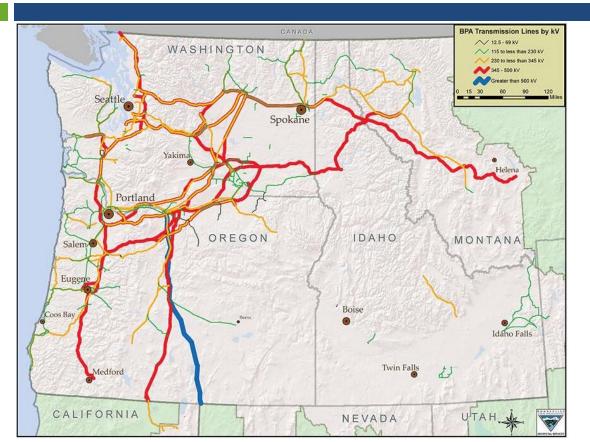
- ✓ Pacific Interties went into service 1968 - 1970
- ✓ Path for Hydropower surpluses in the Northwest to flow to California

Pacific
AC & DC
Interties
8,000 MW



- ✓ PNW Transmission Interconnections to:
 - Montana
 - Wyoming
 - Nevada
- Washington & Oregon Electricity
 Imports Expected to Increase from
 remote wind and solar farms

BPA Transmission Lines: 75% of NW Grid





Transmission system

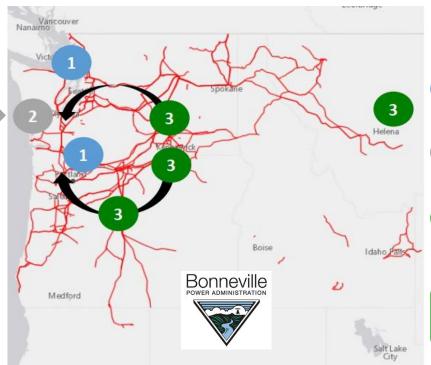
Operating voltage	Circuit miles
1,100 kV	1
1,000 kV	264 ¹⁰
500 kV	4,860
345 kV	570
287 kV	229
230 kV	5,337
161 kV	119
138 kV	56
115 kV	3,440
below 115 kV	301
Total ¹¹	15,179

10/ BPA's portion of the PNW/PSW direct-current intertie. The total length of this line from The Dalles, Oregon, to Los Angeles, California is 846 miles.
11/ Total circuit miles as of February 2019.

- ✓ Arteries ≈ 11,000 miles (74%)
- ✓ Veins \approx 4,000 miles (26%)

BPA Transmission: What "We" want BPA to Do

"The Evolving Grid Update on the State of Transmission"



The following factors:

- 1. Load growth in Portland and Seattle driven by high tech industry, transportation and building electrification
- 2. Reduced operation of 4.5 GW of carbon emitting generators on the west side along the I5 corridor
- 3. Replacement wind and solar resources are located east of the Cascades

Will increase flows on cross-Cascades transmission paths and throughout the load centers

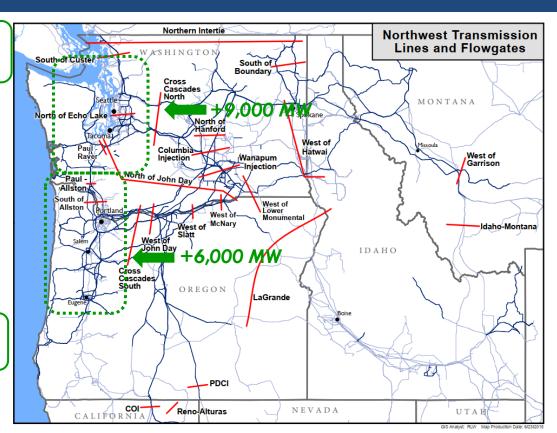
BPA Transmission: East-to-West Flowgates

Total West Peak Load = 21,000 MW (62% of Northwest)

Seattle/West 11,000 MW

Portland/Vancouver/West 10,000 MW

East-to-West Flowgates = +15,000 MW (74% of West Load Served from East)



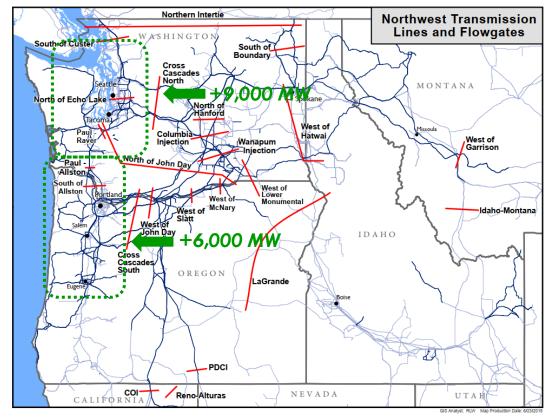
BPA Transmission: Cascades Bottleneck

WA & OR Policies Double Demand & Reduce/Eliminate Natural Gas

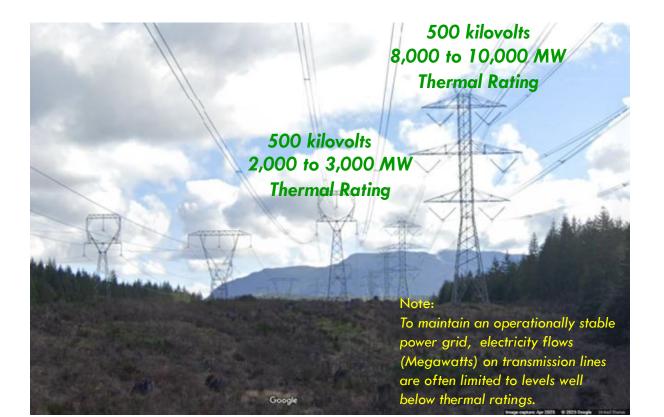
- ✓ Feasible Capacity in existing ROW?
- ✓ How much New ROW & Where?



Kirsten Strough/Yakima Basin/Flicki



Transmission Lines: Anatomy & Megawatts



3-Phase AC Apparent Power

S =
$$\sqrt{3} \times V \times I$$
 [cosØ + j sinØ]

Megawatts (MW)

How to Double Power (MW)

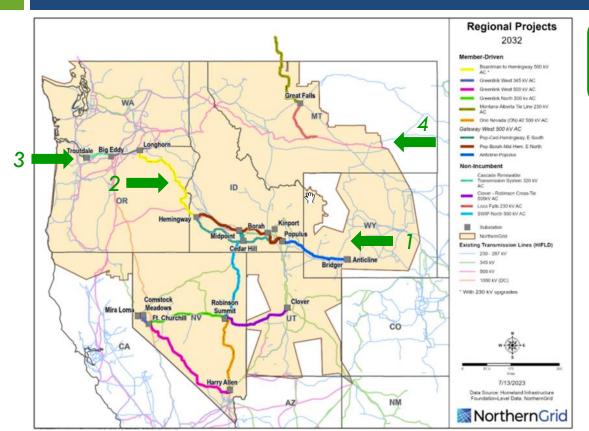
Double Voltage (V) - pressure

- increase insulator length
- tower height & width
- right-of-way width

Double Current (I) - flow

- increase conductor (cable) size
- cost & weight
- tower size & strength

New Transmission: Lines to Other States



- Very Limited New Transmission Lines to Best Wind & Solar
 - Montana, Wyoming & Nevada
- 2) Boardman-to-Hemingway 500 kV(1,000/3,000 MW)
 - MW limited system/thermal
 - Project defined 2006
 - Complete by 2027?
- 3) Cascade Renewable 320 kV (1,100 MW)
 - High Voltage Cable Buried in Columbia River downstream of Bonneville Dam
- 4) North Plains Connector 525 kV HVDC (**3,000 MW**)

Western Transmission: Expansion Coalition

10-year Horizon Initial Transmission Plan: Working draft of transmission expansion subject to refinement



Developing themes of WestTEC 10-year Horizon Report:

- » Transmission needs are being driven by load growth and the need to integrate and deliver generation resources
- » Region must construct planned projects on schedule or reliability issues will be exacerbated
- » Additional reliability upgrades are required to assure system reliability under a range of probable operating conditions
- » Projects enhancing interregional connectivity allow for the system to realize diversity benefits the future grid will rely on for system adequacy

TBD

» Economic upgrades offer congestion relief projects

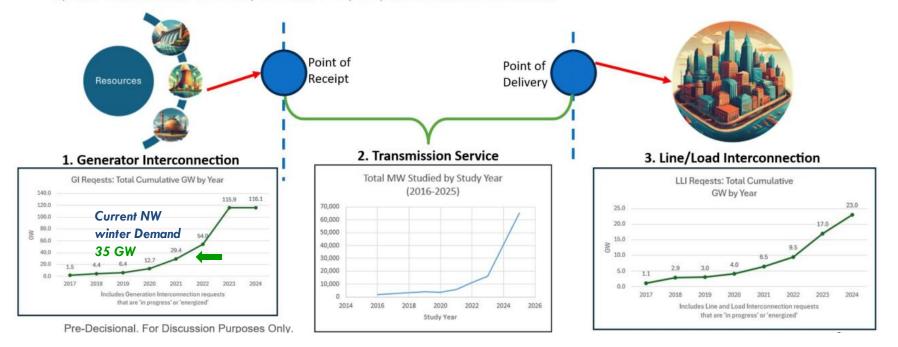


- » West-wide 10 and 20-year transmission study
- » Industry-led with unprecedented regional partner inclusion
- » Goal is to produce an actionable transmission study

BPA's Transmission Queue: Overwhelming # of Requests

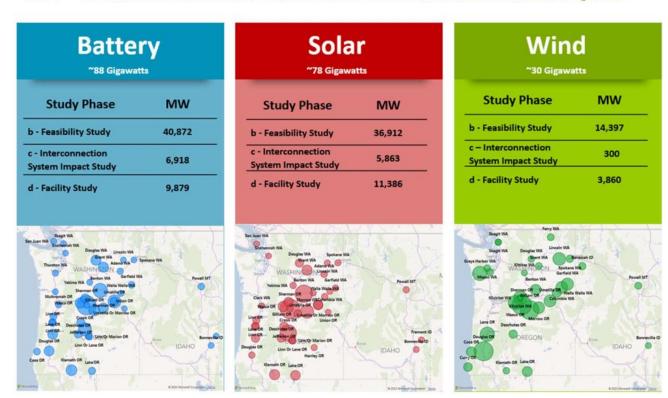
Analysis Paralysis

BPA identifies transmission upgrades in response to customer needs in three general areas: 1) Generator Interconnection, 2) New Transmission Service (NITS and PTP) & 3) Line/Load Interconnection



BPA's Transmission Queue: Mostly WA/OR Wind & Solar

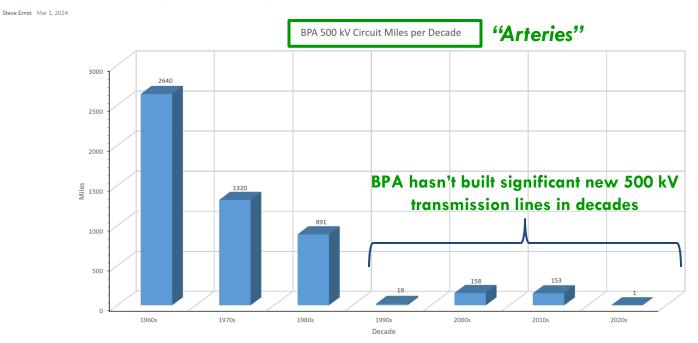
1.2.4 Potential Renewable Resources in the Generation Interconnection Queue



BPA Transmission: "Artery" Miles per Decade



BPA Transmission Expansion Study Hits a 'Brick Wall'



BPA Transmission: How far do "We" want BPA to Go?

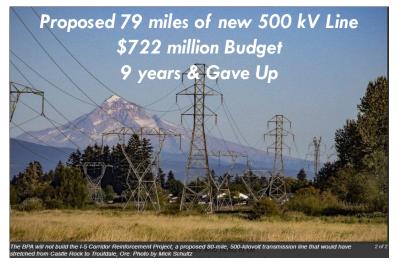
Eminent Domain = Last Resort or Required Strategy?

Transmission Lines are Not Popular (NIMBY)



BPA kills I-5 corridor power-line project

Plan would have placed high-voltage transmission lines in Camas, Washougal



NW/BPA Transmission: Issues to Watch Closely



1. State Transmission Authorities?

- Divergent State & Federal Energy Policies
- Washington & Oregon Energy Policies Driving Needs
- Cascade Bottleneck ROW Acquisition & Development
- Exercising Eminent Domain: BPA, Utilities and/or State?

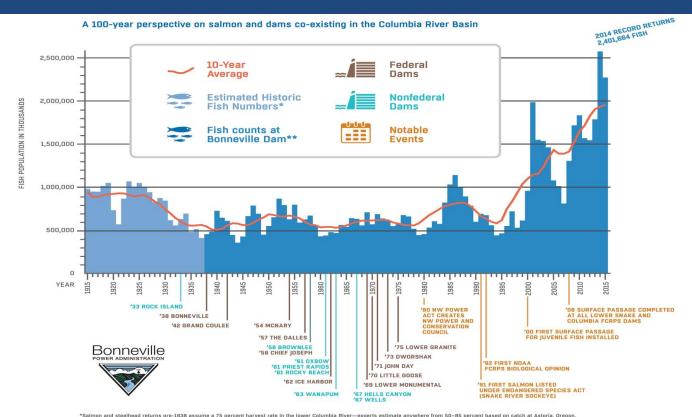
2. BPA Transparency More Important than Ever

- Resource/Planning priorities & execution metrics
- Why, Where, How Much & When (& Who is Paying?)

Agenda

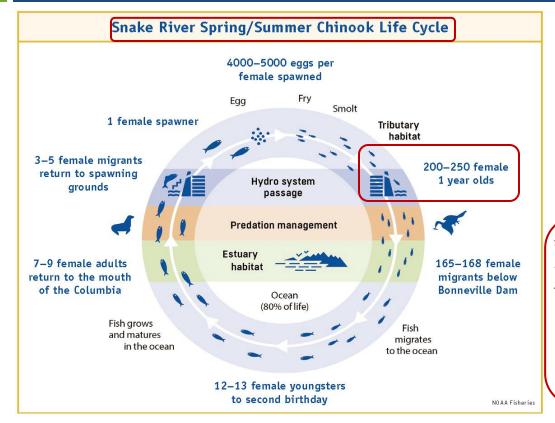
Salmon in Depth

Salmon Returns: Historical Perspective

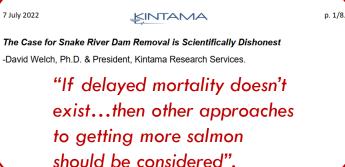


^{*}Salmon and steelhead returns pre-1938 assume a 75 percent harvest rate in the lower Columbia River—experts estimate anywhere from 50-85 percent based on catch at Astoria, Oregon.
**Actual counts at the fish window at Bonnevillo Dam, 138 miles upriver from Astoria.

Chinook Salmon: Life Cycle



- ✓ Smolt take 10 to 50 days to travel rivers and get to the estuary/ocean
- ✓ Delayed mortality hypothesis is driving calls for LSRD breaching w/o scientific evidence



Salmon Competition: Non-Native Species

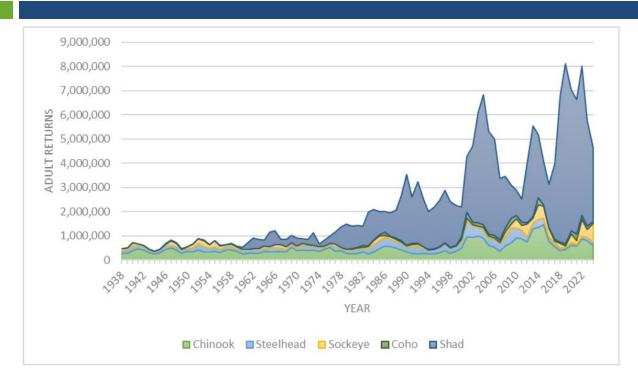


Figure 6. Returns Bonneville Dam for salmon, steelhead, and shad, 1938–2024. Chinook and Coho data account for adults and jacks. The steelhead data account for wild and hatchery fish. Calculated from Columbia River DART (University of Washington).

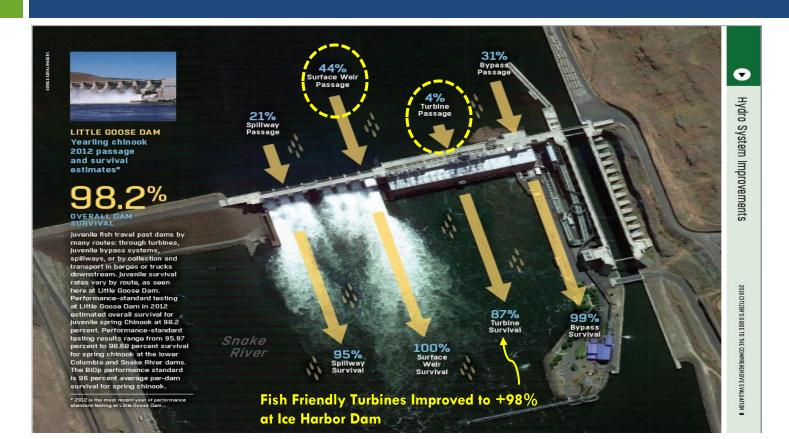


Bass

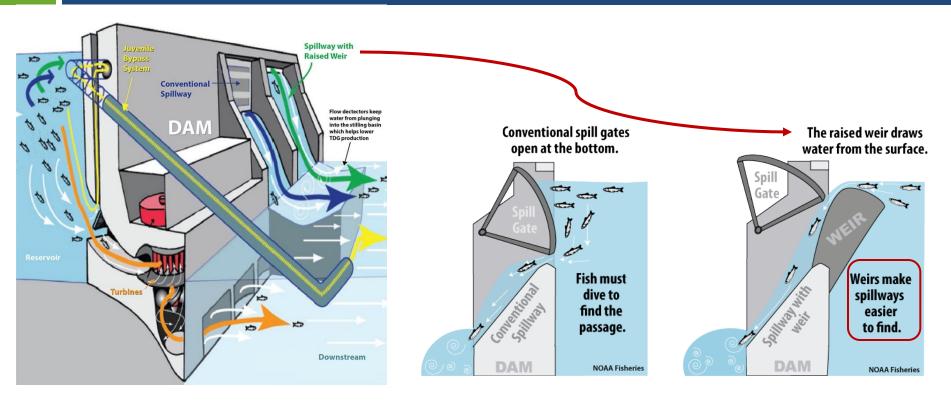


Walleye

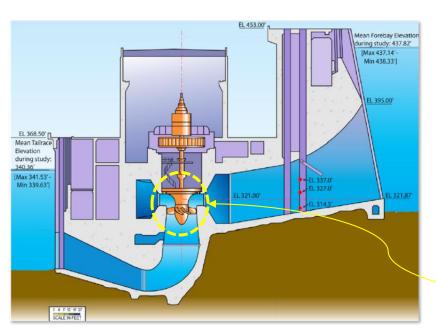
Technology Investments: Bypass



Technology Investments: Raised Spillway Weirs



Technology Investments: Fish Friendly Turbines







 ${\color{blue} \underline{https://www.nww.usace.army.mil/Media/News-Stories/Article/2991190/modernizing-hydropower-on-the-snake-river/article/299$



Killer Whales and Snake River Chinook

Abundance of Orcas Related to Snake River Chinook Salmon?



Photo by Leigh Calvez



6 articles

JKL Orca populations declined during time of increasing Snake River Chinook Salmon abundance

