SYSTEM VALUE OF WA OFFSHORE WIND

Includes summary information from E3 Study prepared for Trident Winds, Inc., June 2023

ENERGY DECARBONIZATION & CLIMATE CHANGE – POLICY DRIVERS

Clean Energy Transformation Act of 2019 (Senate Bill 5116)

Carbon neutral electric supply by 2030 and zero CO_2 emissions by 2045

Climate Commitment Act (2021) plus Zero Emissions Vehicles Act (2020) will create increasing demand for clean electricity

WA Policies require a fundamental shift from fossil fuels to clean energy sources

Electricity Transmission Grid constraints call for coordinated planning and implementation across Western states

GU0

INCREASING LOAD AND DECREASING GENERATING RESOURCES

3.3 GW of regional coal plants will be retired between 2023 and 2028 (Jim Bridger 2.3GW, Centralia 0.7 GW, and North Valmy2 0.3 GW)

Existing energy generating resources are decreasing while energy loads are increasing (*Update on Power Plan Needs Assessment, NW Power Council, 1/28/2021*)

Maximum regional load is in WINTER months, up to 40 GW per hour may be needed for extreme weather events to avoid blackouts

Slide 3

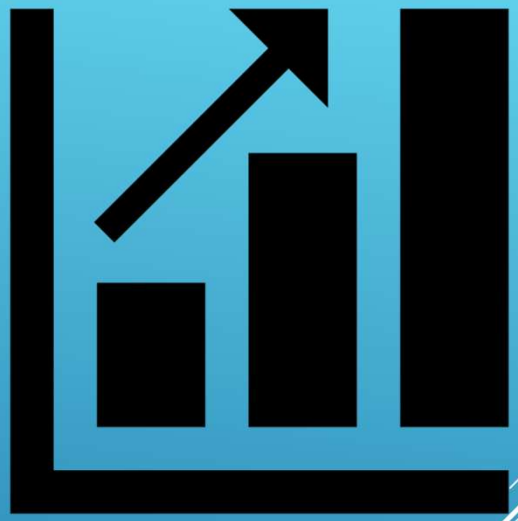
GU0 Bullet 1: Add coal plants capacity that is being retired in GW
Bullet 4: I do not understand the message of this bullet
NOTE: What about the comment made last week about WA state now having 2 peak demand events - WINTER and SUMMER?
Guest User, 2023-06-12T16:26:44.506

INCREASING RENEWABLES GAP

- NW Power Council Reference Resource Strategy assumes 5.4 GW of renewables will be available between 2020 and 2027. *(Power Council's Resource Adequacy Advisory Steering Committee, 12/5/22)*
- NW Power Council targets at least 3.5 GW of renewables be acquired by 2027 (The addition of another1/2 Grand Coulee Dam) *(2021 Power Plan)*
  - As of December 2022 only 0.59 GW of new renewables have been put into operation. *(Power Council's Resource Adequacy Advisory Steering Committee, 12/5/22)*
- By 2040 capacity shortfall could reach >14GW, more than two additional Grand Coulee Dams *(E3 Study)*

NW POWER COUNCIL PROJECTS NEAR-TERM WINTER SHORT FALL OF SYSTEM CAPACITY

- NW Power Council hopes the 2021 the Power Council's Reference Resource Strategy is fully implemented, which is not guaranteed
  - If the 2021 Reference Resource Strategy is not implemented the projected Winter shortfall is estimated at **5.2 GW** in 2027
  - If higher energy demand prevails, shortfall grows to **6.3 GW** in 2027, the addition of about one additional Grand Coulee Dam



- **Solar,** minimum production occurs during Winter months
- **Existing Columbia Gorge/Blue Mtns. Wind** not Winter peaking, limited capacity vs. Offshore
- **Green Hydrogen** relies on excess hydro and likely limited scale
- **Montana Wind** is good all year, but low-cost transmission is limited to get to the NW load centers
- **Small Modular Nuclear** is not yet commercialized

RENEWABLE "USUAL SUSPECTS" ARE LIMITED IN AVAILABILITY OR SCALE FOR WA

COMPARING TO GRAND COULEE DAM

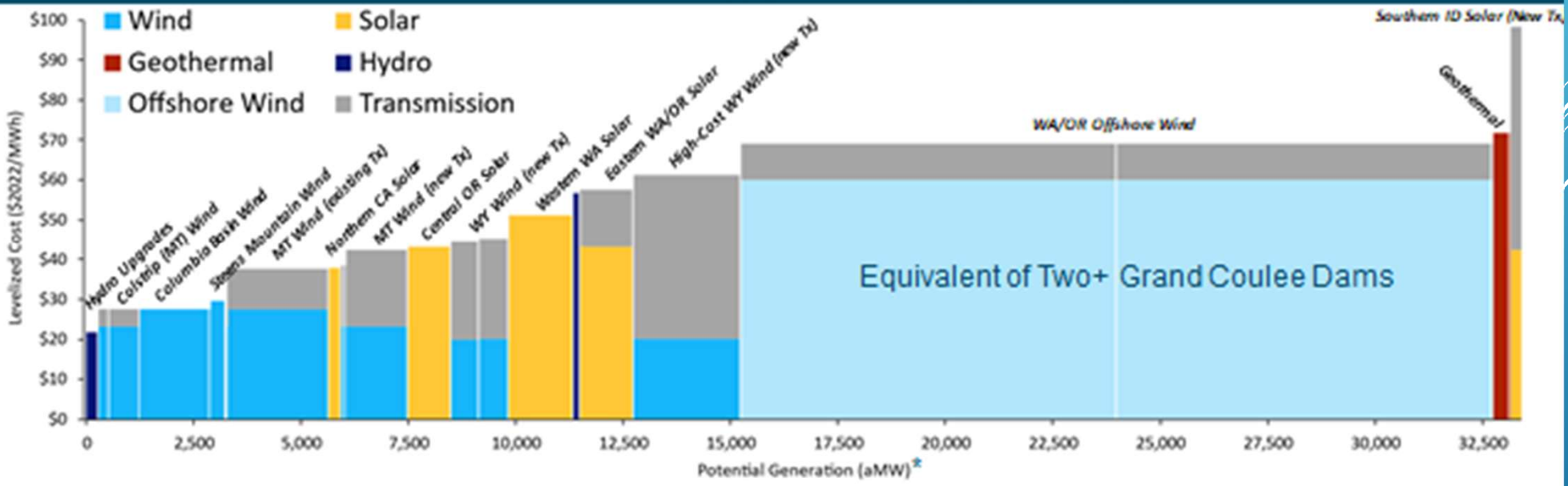
Grand Coulee Dam in Central WA is the largest hydro power generator in the US and has a capacity of 6.8 GW

Grand Coulee supplies about 2 million households with electricity every year

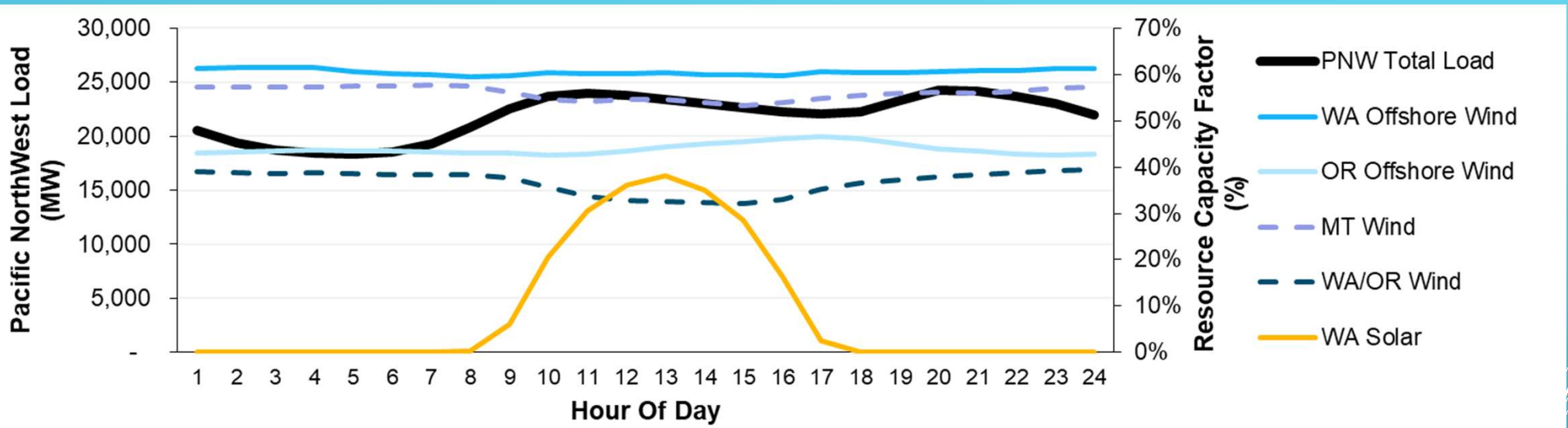
Renewable Resource Supply Curve

- Transmission costs are included within cost curves that RESOLVE sees for resource selection
  - Some resources, particularly out-of-state wind, have large transmission costs relative to the base resource cost
- WA and OR offshore wind are given the same cost curve but have different generation profiles and capacity accreditation based on coincidence of generation and historic peak load hours

Renewable Resource Supply Curve in 2035 ($2022/MWh)

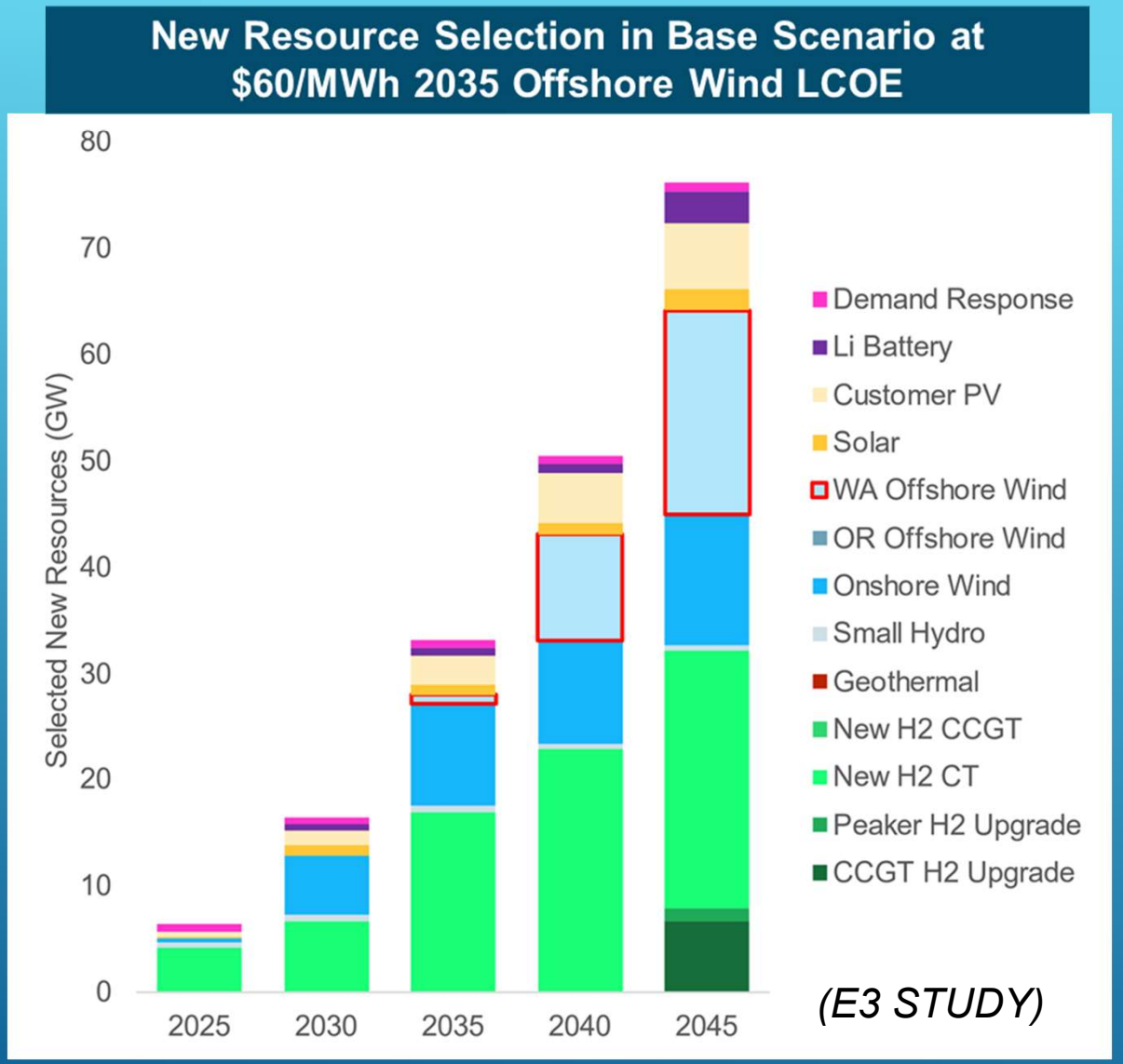


*aMW represents the resource capacity adjusted for level of production



WASHINGTON OFFSHORE WIND HAS THE HIGHEST AVERAGE GENERATION (CAPACITY FACTOR) COMPARED TO SOLAR, ONSHORE WIND, AND OREGON OFFSHORE WIND ACROSS ALL WINTER HOURS *(E3 STUDY)*

E3 MODEL PAIRS WA OSW WITH SUBSTANTIAL CONTRIBUTIONS FROM OTHER RENEWABLE RESOURCES



(E3 STUDY)

REGIONAL CALL TO ACTION

- Northwest Power and Conservation Council "*recommends that national labs, research institutions, trade allies, and utilities continue to work with developers and manufacturers to research and explore the regional resource potential of supply side emerging technologies such as **offshore wind**... and other carbon-free resources."*

- *"In addition, the Council urges the region to identify potential barriers to deployment, including costs, transmission, siting, etc., and work together toward solutions when it is in the best interest of the region."*

(2021 NW Power Plan, page 114)

System Value of Offshore Wind in Washington

Prepared for Trident Winds Inc.

May 2023

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Energy+Environmental Economics

RESPONSIBILITIES ARE DIFFUSE

- ORGANZATIONS RESPONSIBLE for ELECTRICITY SYSTEM & SUPPLY/DEMAND/TRANSMISSION FORECASTS & PLANNING
- Bonneville Power Administration (BPA)
- NW Power Planning Council
- Western Electricity Coordinating Council (WECC)
- Pacific NW Utilities Conference Committee (PNUCC)
- NW Power Pool
- WA Utilities that have system "balancing authorities" and planning responsibilities under Energy Independence Act (EIA) and Clean Energy Transition Act (CETA)
- Public Power Council (Reprsents consumer-owned utilities in NW who rely on the federal columbia river power system.)

ELECTRIC SYSTEM OVERVIEW

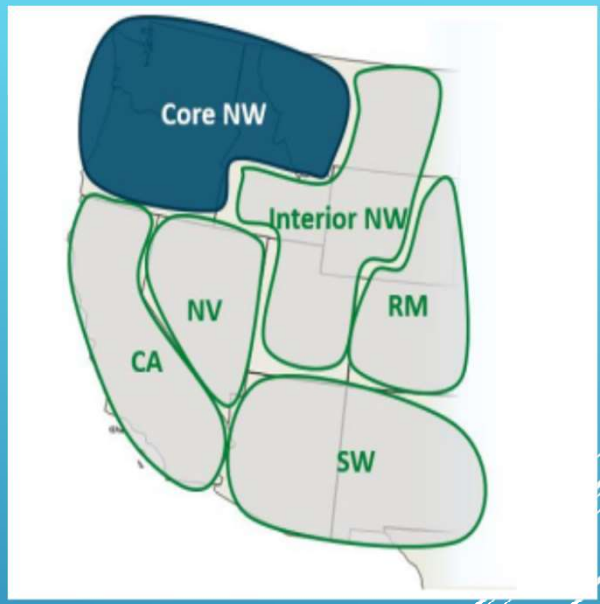
- BASELINE SYSTEM GENERATION CAPACITY &, DEMAND
- TRANSMISSION SYSTEM CAPACITY
- CURRENT FORECAST FOR DEMAND in 2030 / 2050
- CURRENT FORECAST FOR GENERATION in 2030 / 2050
- TRANSMISSION SYSTEM CAPACITY CONSTRAINTS/NEEDED EXPANSION for 2030 / 2050 FORECASTS

E3 CONSULTING FIRM

- 30 years of energy policy, economics, and engineering, 98% of staff with advanced degrees (master's or PhDs)
- Cutting edge work and modelling of the PNW system plans/forecasts
- 100% renewable and resource adequacy modeling for NW Utilities
- Diverse clients across US including utilities, state energy commissions, investors, public agencies/non-profits, developers, and system operators

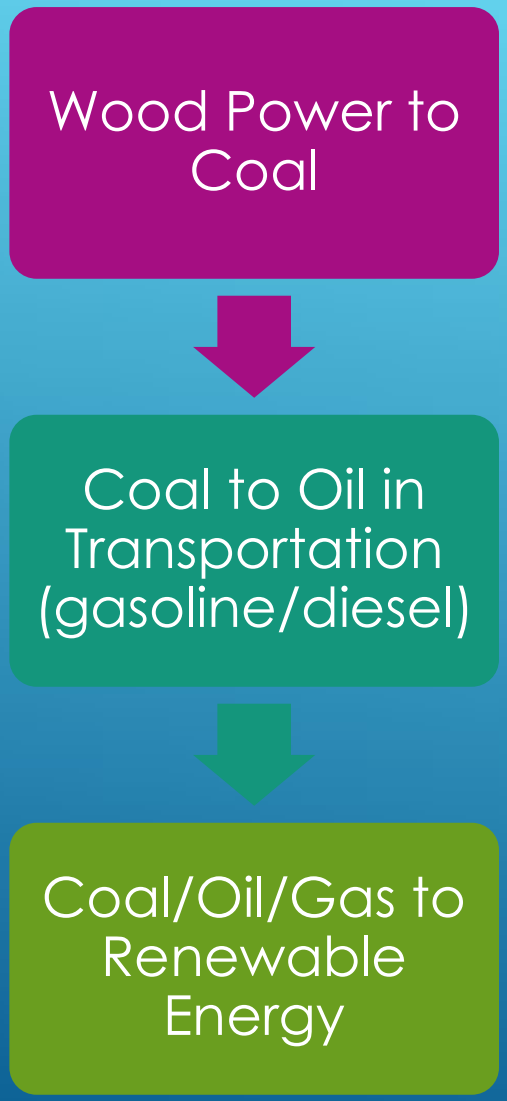
KEY INPUTS TO E3 ENERGY CAPACITY EXPANSION MODEL

- **E3 Study Load Forecasts used**
  - 2021 NW Power Council Plan, the study adjusted the boundaries for the NW Core study area
  - WA State Energy Strategy with high electrification load
- **Projected build outs from**
  - WECC 2020 Anchor data set
  - 2021 NW Power Council Plan
- **Achieving WA & OR Energy Policy Goals** *(CETA, GHG, Climate Commitment Act, etc.)*
- **Cost projections from nationally-recognized sources**



Energy+Environmental Economics

SYSTEM CHALLENGES TO MEETING THESE FORECASTS



MAJOR ENERGY SHIFTS ARE NOTHING NEW

HOW MUCH IS A GIGAWATT (GW)?

- Energy generators are rated by how many watts of energy they can produce, called the generator "capacity".
- A Generator with a 10 Megawatt (MW) capacity can routinely produce 10 Megawatt per hour (MWh) of electricity when operating at full capacity.
- Single-family homes in the NW use an average of 1 Megawatt hours (MWh)of electricity per month, or about 12 MWh per year
- A Gigawatt (GW) is 1,000 MW

See: https://www.usbr.gov/pn/grandcoulee/pubs/factsheet.pdf

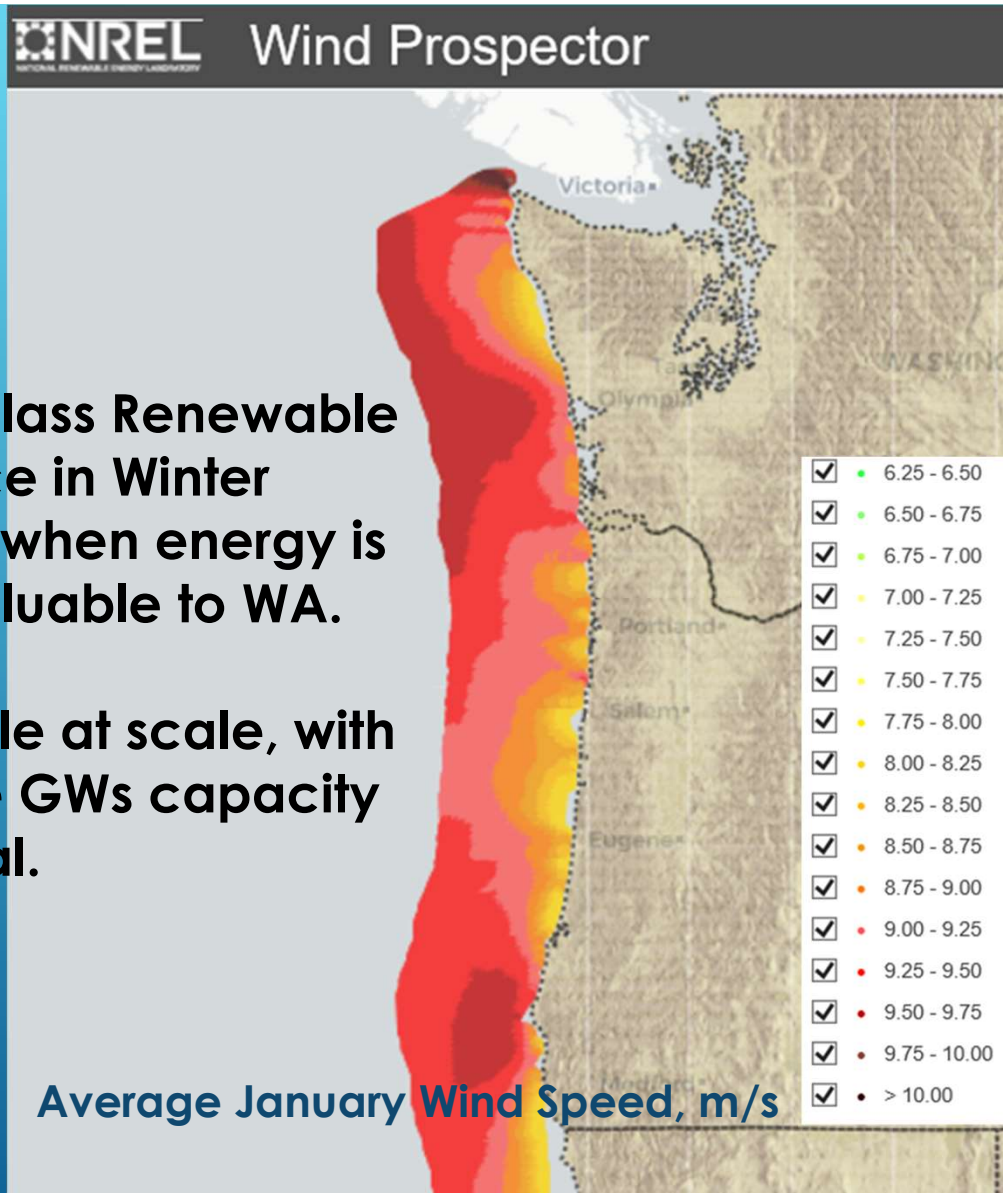
WA OFFSHORE WIND (OSW)

A UNIQUE SOLUTION FOR PNW SYSTEM CHALLENGES

NW OSW UNIQUELY ALIGNS WITH NW WINTER SHORTFALL NEED

World Class Renewable Resource in Winter months when energy is most valuable to WA.

Available at scale, with multiple GWs capacity potential.



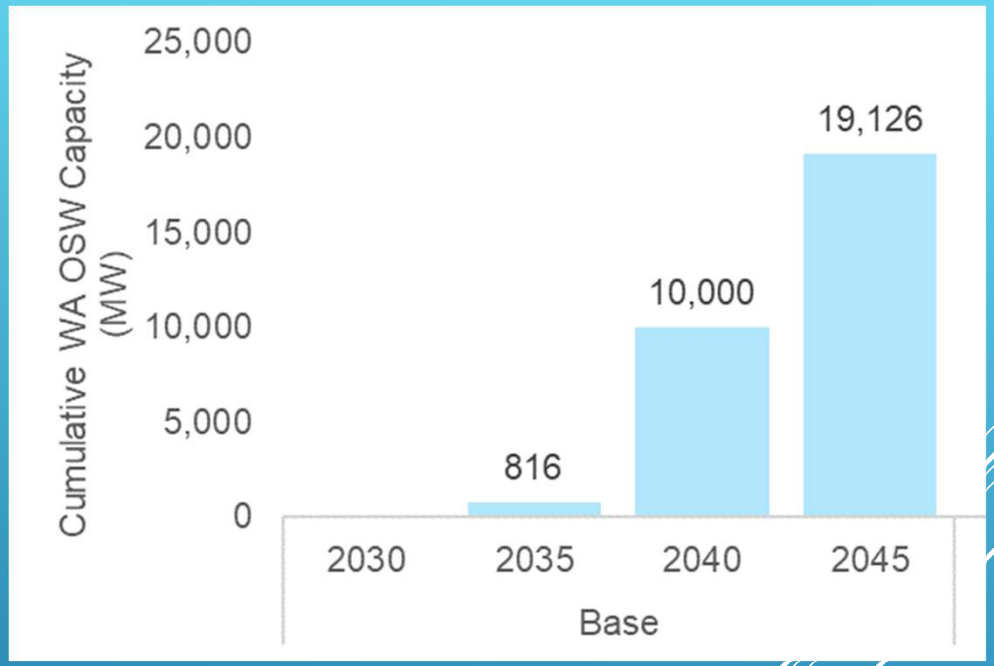
Average January Wind Speed, m/s

E3 MODEL SATISFIES RENEWABLE ENERGY NEEDS AND COSTS

- E3 Study modeled energy needs and economics with and without NW offshore wind
- Found that in Winter months WA offshore wind was more available and a better resource than OR offshore wind
- Leveraging NW Offshore Wind showed large system and Washington state financial benefits to energy consumers/ratepayers

ALL E3 MODEL SCENARIOS FIND THAT LARGE AMOUNTS OF WA OSW BY 2045 IS OPTIMUM

- WA OSW builds start at 2035 in base case, 816 MW of WA OSW.
- By 2045 in different scenarios WA OSW builds between 15.5 GW to 20.0 GW of capacity. The equivalent of about 2 to 3 additional Grand Coulee Dams



LARGE ENERGY SYSTEM BENEFITS TO WA USING WA OSW

Annual System Cost Savings Over Time ($ Millions)						
Scenario	**2025**	**2030**	**2035**	**2040**	**2045**	**NPV**
Base	$0	$0	-$14	$134	$1,674	**$6,242**
95% GHG Target	$0	$0	$2	$85	$1,292	**$4,818**
Limited OOS Wind	$0	-$1	$26	$726	$3,992	**$15,595**
Slow H2 Build	$0	$2	-$50	$1,281	$4,463	**$17,990**

(E3 STUDY)

NPV = $4.8 TO $18 BILLION BY 2045

SIGNIFICANT WA CUSTOMER SAVINGS BENEFITS USING WA OSW

Average Rate Savings (cts/kWh)						
Scenario	**2025**	**2030**	**2035**	**2040**	**2045**	**Levelized**
Base	0.0	0.0	0.0	0.3	1.8	**0.6**
95% GHG Target	0.0	0.0	0.0	0.3	1.4	**0.4**
Limited OOS Wind	0.0	0.0	0.0	1.0	3.8	**1.2**
Slow H2 Build	0.0	0.0	0.1	1.5	4.2	**1.5**

(E3 STUDY)

OSW WIND GENERATION & TRANSMISSION OPPORTUNITIES

- Transmission of electricity is constrained across Cascade Mountains that limits significant levels of eastern energy delivery to I-5 corridor at low cost.
- Best existing NW transmission lines from I-5 corridor to coast are high-voltage lines to Satsop & Aberdeen, with ideal grid landing between Seattle and Portland metro areas, major N/S transmission.

CURRENT SEA-SPACE CONSTRAINTS, BENEFITS & BALANCING IMPACTS

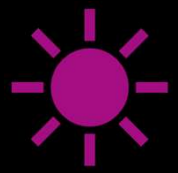
Current estimates of available sea-space for WA OSW is 7 GW of offshore generation, which shows significant benefits, representing $5.1 billion in ratepayer savings. (E3 Study)

Development impacts of renewable energy should be balanced across our state's resource potential, geographic regions, and local communities.

- TRIDENT WINDS SUBMITTED AN UNSOLICITED LEASE REQUEST TO BOEM IN SPRING 2022 FOR A ~2 GW OLYMPIC WIND PROJECT, FOR A SITE OVER 40 MILES OFF THE WA COAST, WITH NO VISUAL IMPACTS FROM SHORE

BOEM = Bureau of Ocean Energy Management, US Dept. Of Interior

FILLING THE RENEWABLES GAP



To meet energy shortfalls WA needs large scale GW-size renewable resources that match NW Winter energy peak demand season

WA and OR offshore wind is available at GW-scale and is a necessary renewable to meet future load at the least cost, combined with other renewables

WA state has not notified federal agencies and energy labs of their interest in WA offshore wind resources

WA POLICY COORDINATION & INTEGRATION IS LACKING

No regional entity assures that the required renewable resources are built to avoid anticipated shortfalls (blackouts) *(A legacy of our historic abundant hydro system.)*

No WA state agency has authority to proactively acquire needed renewables for WA customers *(WA Commerce, WUTC)*

Individual Energy Utilities are normally internally-focused on meeting loads in their individual balancing authorities

EARLY WA COORDINATION NEEDED

- BOEM needs a statement from WA state that it needs OSW in order for BOEM to move forward with defining lease areas
- Federal Advisory Committee Act limits participants in a BOEM lead process to governmental agencies (https://www.gsa.gov/policy-regulations/policy/federal-advisory-committee-management)
- Offshore wind development is complex and involves many stakeholder groups over time, not just governmental agencies
- Need to initiate a coordinated WA effort to address local, state, tribal, and commercial issues ASAP, to advance the BOEM process and define leases

Similar economic analysis should be done to fully understand the economic opportunity of developing current sea space for 7 GW of offshore wind off WA

- **NREL Economic Study in Oregon:** By 2050, developing 5.5 GW of offshore wind "could support 65,000–97,000 job-years and add $6.8 billion–$9.9 billion to the state GDP"
- **Cal Poly Economic Study for California Central Coast:** Development of 7 GW off California's Central Coast supports 72,162 jobs and more than $22 billion in economic output through 2060.

EXAMPLE IMPACTS, EFFECTS & OPPORTUNITIES

POLICY AND INITIATIVE KICK STARTERS

Notify	WA state should request BOEM to initiate the OSW development process
Initiate	Initiate ASAP a coordinated WA effort to address local, state, tribal, and commercial issues
Develop	Set-up Goals for WA Offshore Wind development, suggesting 2 GW by 2035 and 20 GW by 2045 Quantify economic and employment OSW benefits to the state
Engage	Engage with ongoing West Coast Offshore Wind key regional initiatives such as Transmission, Infrastructure and Workforce Devlopment

EXTRA SLIDES

U.S. State Offshore Wind Procurement Policies
Total 17,597 MW as of May 31, 2022

State	Offshore Target (MW)	Goal Year	Amount Procured (MW)	Authorities	Year Implemented
Maine	-	-	12	None	
Ohio	-	-	21	None	
Massachusetts	5,600	2035	3,236	An Act to Promote Energy Diversity An Act to Advance Clean Energy An Act Creating a Next Generation Roadmap for Massachusetts Climate Policy	2016 2018 2021
Rhode Island	-	-	430	None	-
Connecticut	2,000	2030	1,104	Public Act No. 19-71	2019
New York	9,000	2035	4,362	Case 18E-0071 Climate Leadership & Community Protection Act	2018 2019
New Jersey	7,500	2035	3,758	Offshore Economic Development Act Executive Order 8/AB 3723 Executive Order 92	2010 2018 2019
Maryland	2,022	2030	2,022	Maryland Offshore Wind Energy Act Clean Energy Jobs Act	2013 2019
Virginia	5,200	2034	2,652	Virginia Clean Economy Act	2021
North Carolina	8,000	2040	-	Executive Order 218	2021
Total	**39,322**		**17,597**		

NREL'S OFFSHORE WIND MARKET REPORT: 2022

OFFSHORE WIND TRANSMISSION PLANNING IS RAMPING UP ON WEST COAST

PNW ELECTRICITY SYSTEM 101 -- GENERATION & TRANSMISSION