Northwest **Power** and **Conservation** Council

August 9, 2022

MEMORANDUM

TO: **Power Committee**

FROM: **Dor Hirsh Bar Gai, Abigail Marx**

SUBJECT: **Offshore Wind Update**

BACKGROUND:

Presenter: Dor Hirsh Bar Gai and Abigail Marx from staff will provide a high-level overview of the current state of offshore wind technology and timeline for Oregon and Washington to develop offshore wind farms.

Summary: Offshore wind is a seasonally consistent form of high-speed wind resource that could complement existing renewable resources and provide additional grid benefits. Diversification of renewable resource profile is of interest to provide adequacy and resilience to the power system.

The Oregon taskforce of the Bureau of Ocean Energy Management (BOEM) identified 14 GW of potential wind farms but narrowed down two possible call areas for 3 GW: Coos Bay and Brookings. The exact call areas will be finalized over the next 5 months. Overall, the process may take 10 years: permitting is estimated to take 5 years, with construction in Oregon estimated to begin in 2027 and first online date around 2032.

However, substantial limitations include lack of coastal infrastructure for supporting offshore wind logistics and need for transmission upgrades: current transmission supports 2.6 GW nameplate capacity across Oregon, and only 1.1 GW in the southern coast. The uncertain costs of upgrading infrastructure are not fully incorporated into current plant cost estimates.

Relevance: The Council's 2021 Power Plan calls on the region to continue to explore regional emerging technologies, including offshore wind. As part of implementing the plan, staff are monitoring advancements in these technologies. Recent activity in Oregon and Washington makes this topic timely for a Power Committee update.

Background: Due to the steep slope of the ocean floor off the West coast, floating offshore wind turbines will need to be used which have yet to be deployed in the United States. Since this technology is so new, environmental impacts are net yet understood. Given the technical challenges associated with deep ocean floating turbines, it is possible that traditional permitting timelines may take longer than the expected five years.

The needed coastal infrastructure to support offshore wind development include wharf upgrades, wet storage and navigation space, yards, cranes, and maintenance crews. These will have material impacts on local communities, in addition to the expected impact of offshore wind farms on the fishing industry. Broad stakeholder engagement across industries and sectors will be important for successful integration of offshore wind.

State of Offshore Wind Technology

Power Committee
8.16.2022

Dor Hirsh Bar Gai & Abigail Marx

Outline

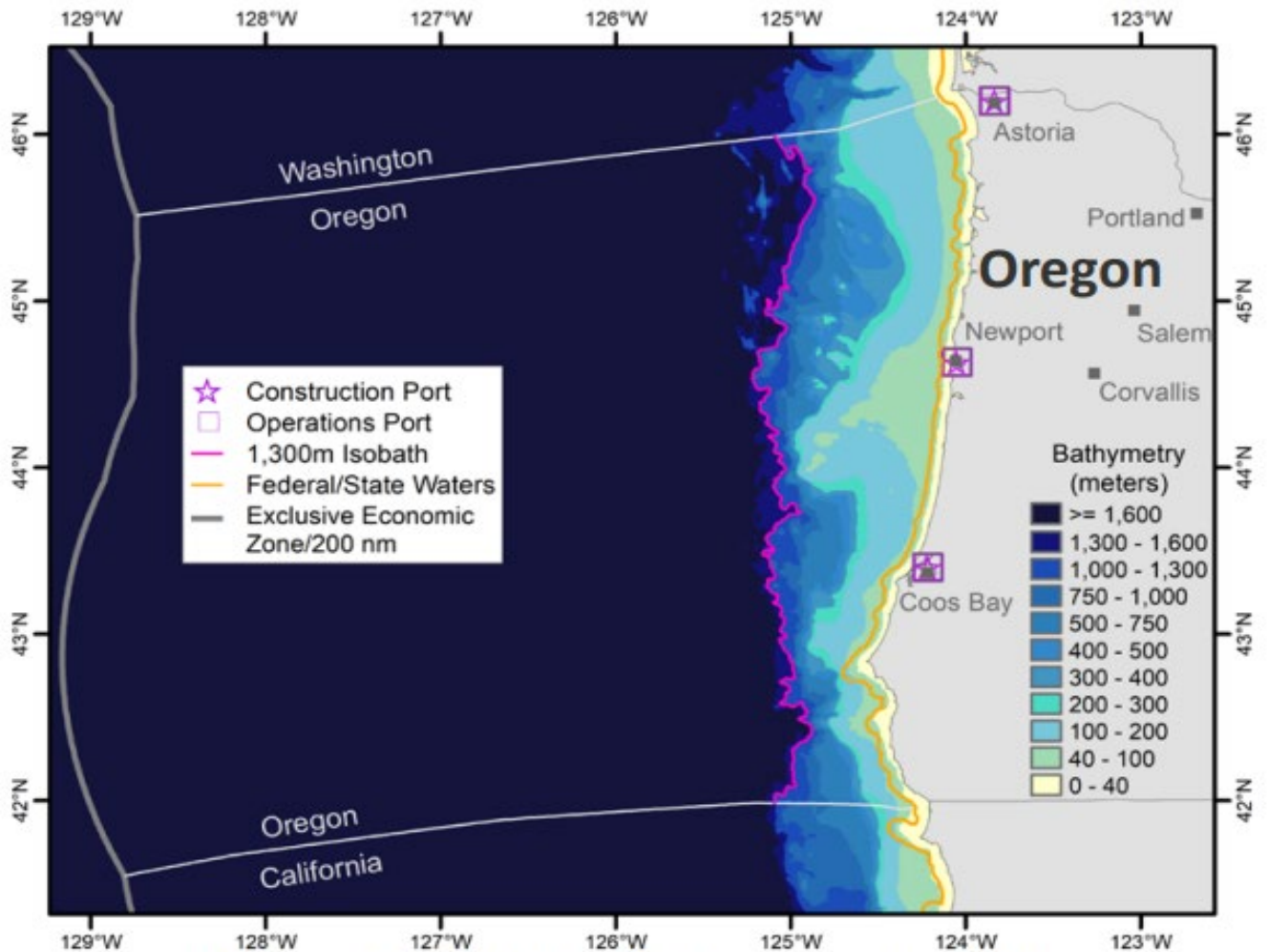
- State of Offshore Wind Technology
- Regional Effort
- Offshore Wind Prospects and Costs
- Grid Value
- Limitations and Challenges
- Adequacy Considerations
- WECC Dynamics
- Future Considerations

Significance of Offshore Wind

- Seasonally consistent wind resource
- Abundant development space
- >50% of U.S. population lives within 50 miles of the coast
  - ~17% Oregon population living in Coastal Areas
  - ~69% Washington population
- Local job creation
- Diversification of renewable portfolio

Types of Turbines

- Two main types:
  - Fixed bottom & floating
- Floating turbines in this area due to steep slope of ocean floor



Bathymetry Offshore Oregon – source NREL

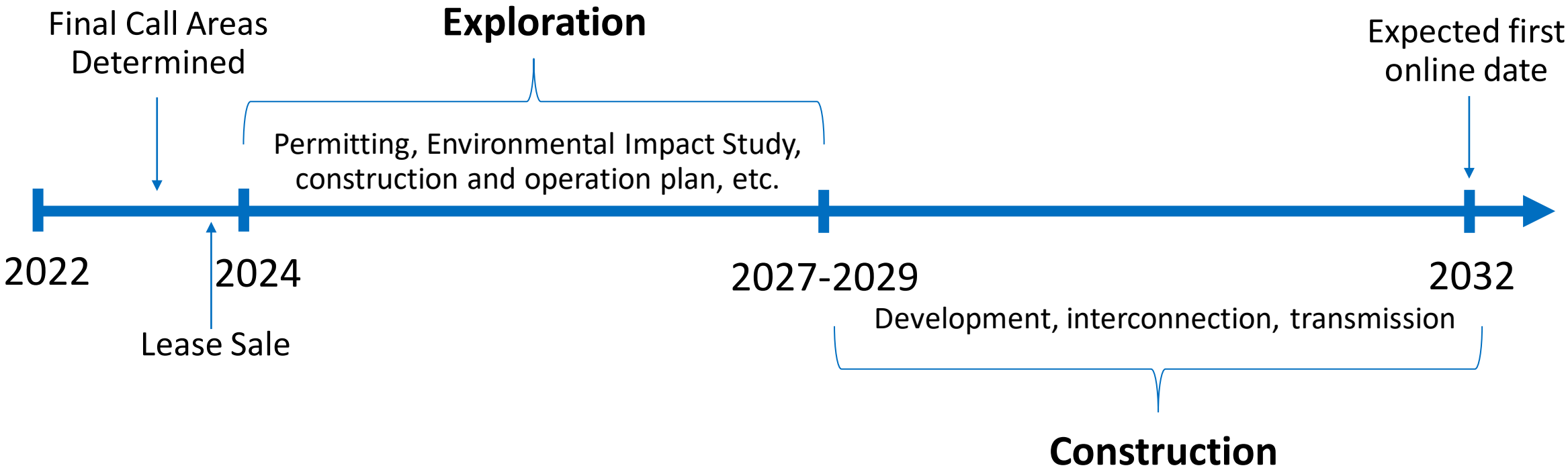
Environmental Impacts

- Existing research gaps:
  - Impact to upwelling
  - Whales caught in derelict nets entangled in tethering lines
  - Avian resources
  - Artificial reefs (observed in fixed-bottom)
  - Impact on ocean floor

Regional Efforts

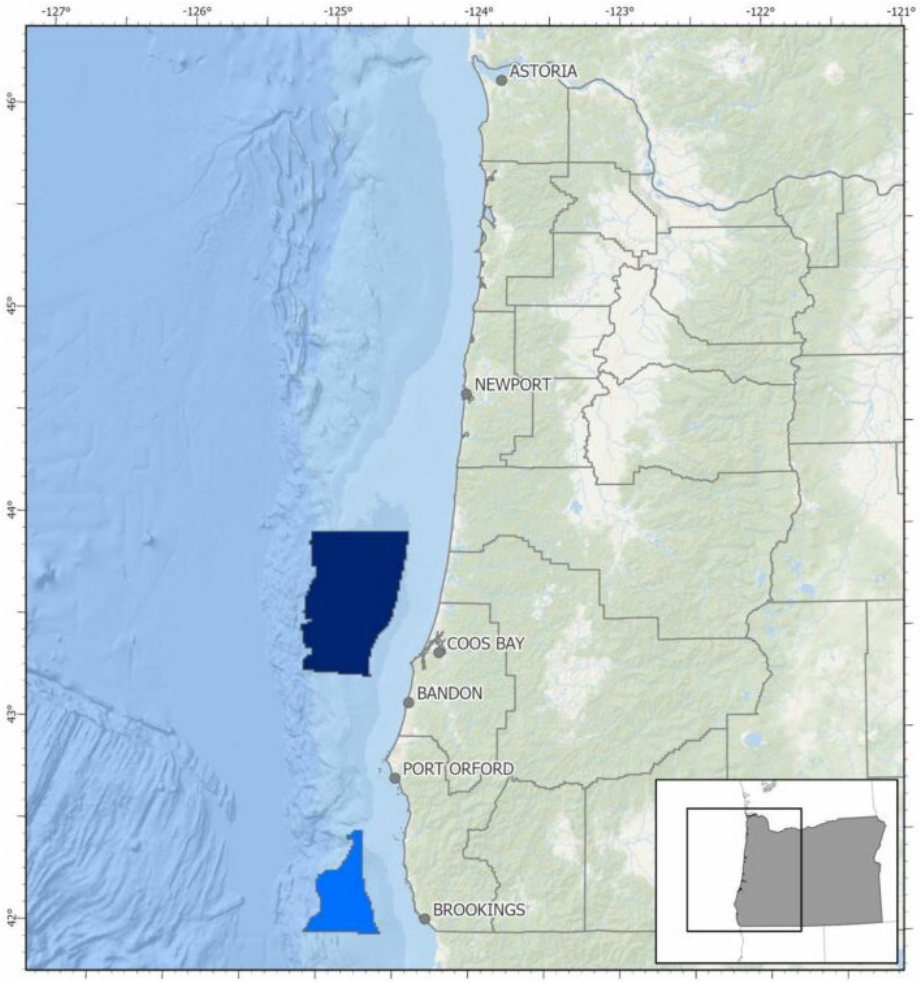
- Bureau of Oceanic Energy Management (BOEM)
  - Determines call area
  - Solicits public comment
  - Narrows down call area
  - Lease Auction Sale
    - Recent $4.4 billion sale in New York
- Several million dollars to permit:
  - Environmental Impact Study
  - Construction and Operation Plan
  - Federal and State permits
- Driver for time:
  - Stakeholder engagement – including mitigating impact on fishing industry
  - Infrastructure upgrades
  - Permitting
  - Transmission and interconnection

Expected Timeline



Oregon Plans

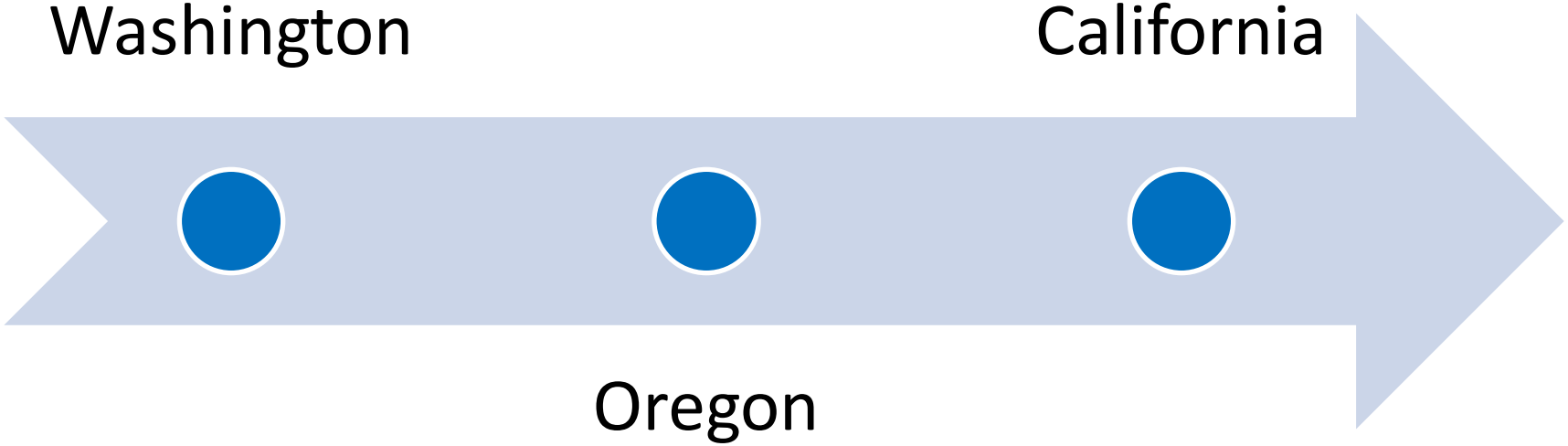
- BOEM estimated up to 20 GW potential
- Two identified call areas with 14 GW potential
  - Coos Bay & Brookings
  - Narrow down sites to 3 GW total
  - Final areas determined in the next 5 months
- Lease sale by 2024
- First online date – around 2032
  - ~5 years of permitting
  - ~5 years construction



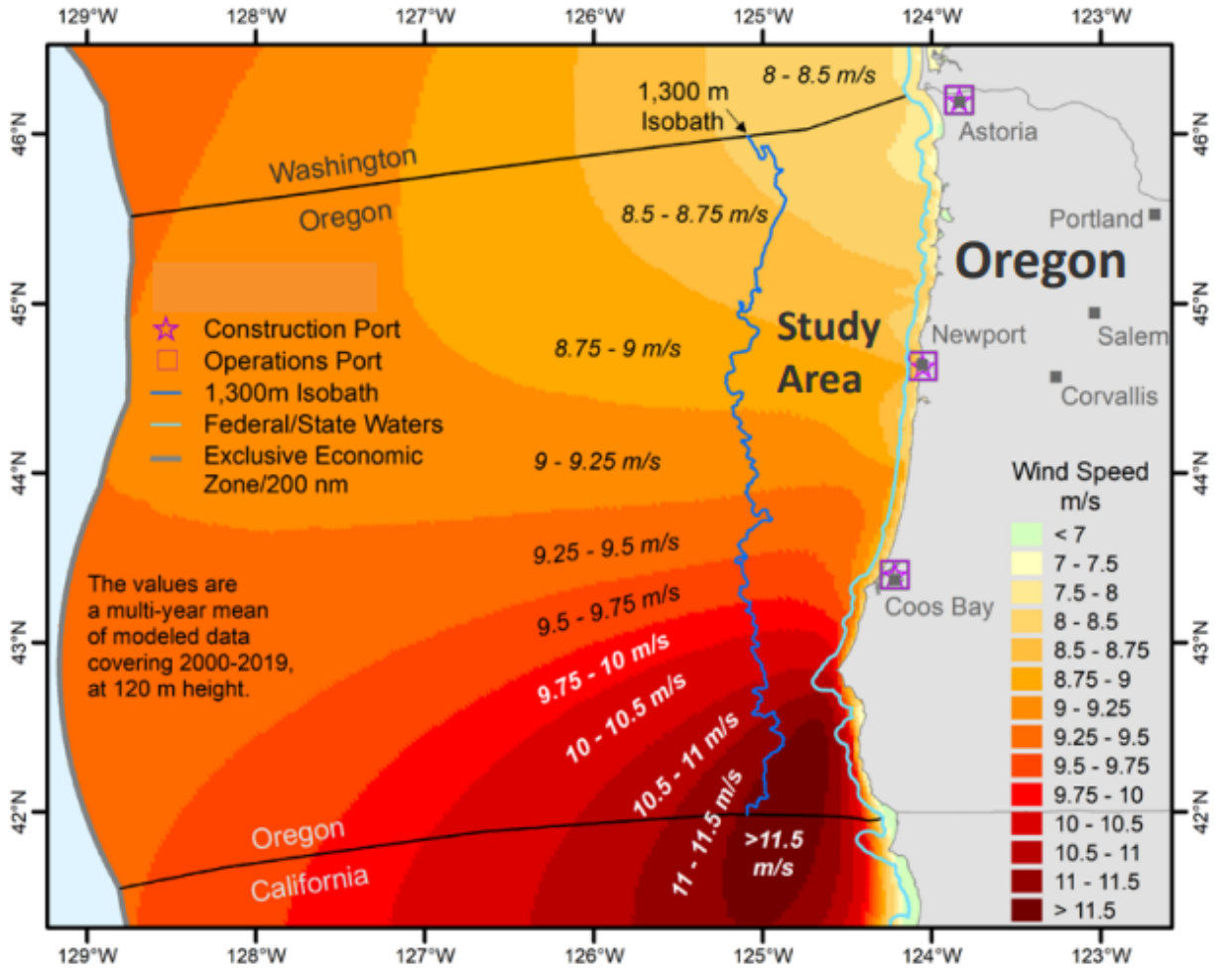
Washington Plans

- No BOEM task force
- 2 unsolicited lease requests
  - Trident Wind wants to develop a 2 GW project offshore from Olympic Peninsula
  - BOEM still needs to review these requests
    - Assess legal, technical, and financial qualifications
    - Work with stakeholders to determine next steps

Relative Offshore Maturity Perspective



Offshore Wind Prospects



Wind Resource Offshore Oregon – source NREL

Offshore Wind Prospects

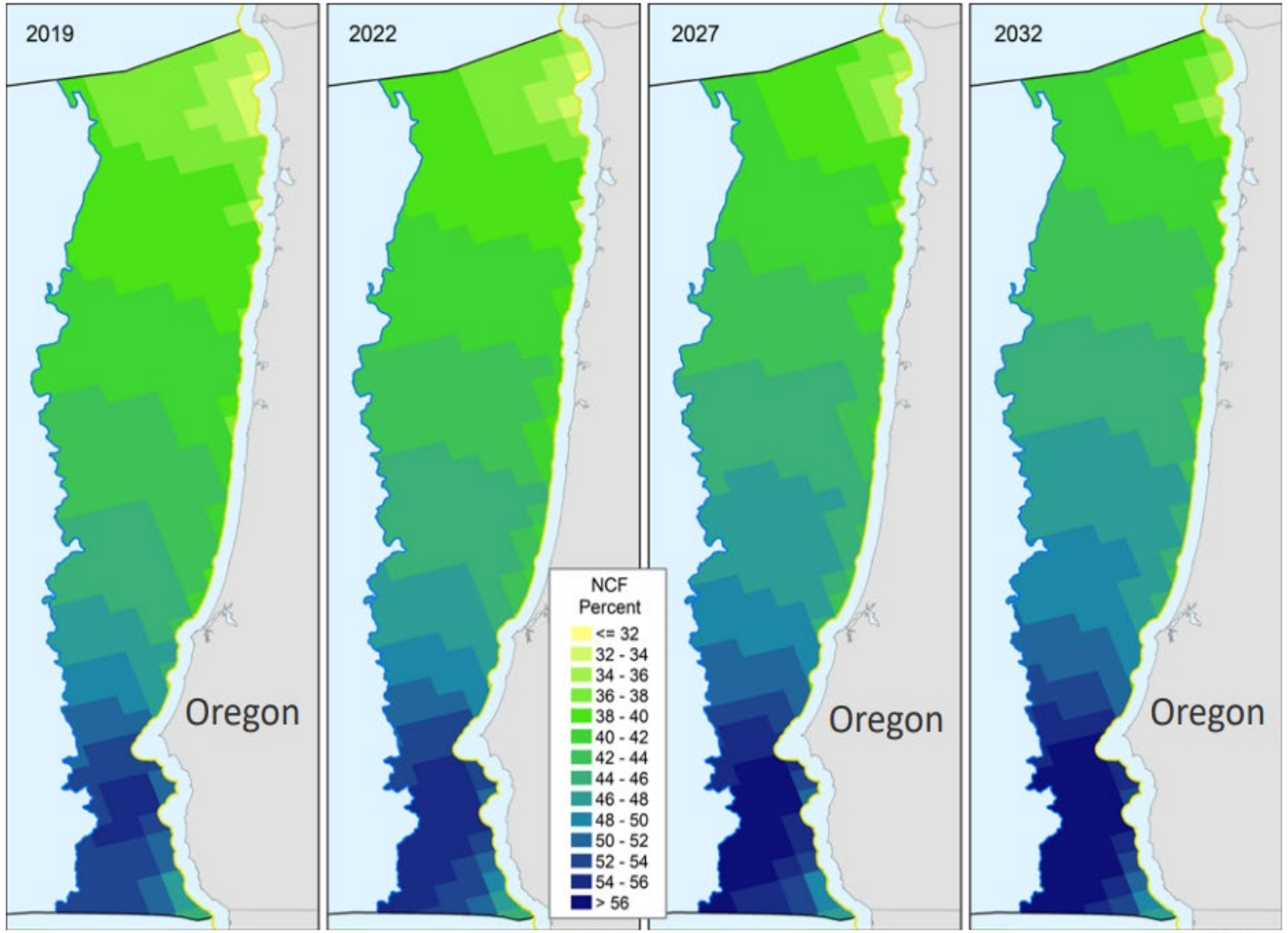


Image source NREL

Offshore Wind Prospects

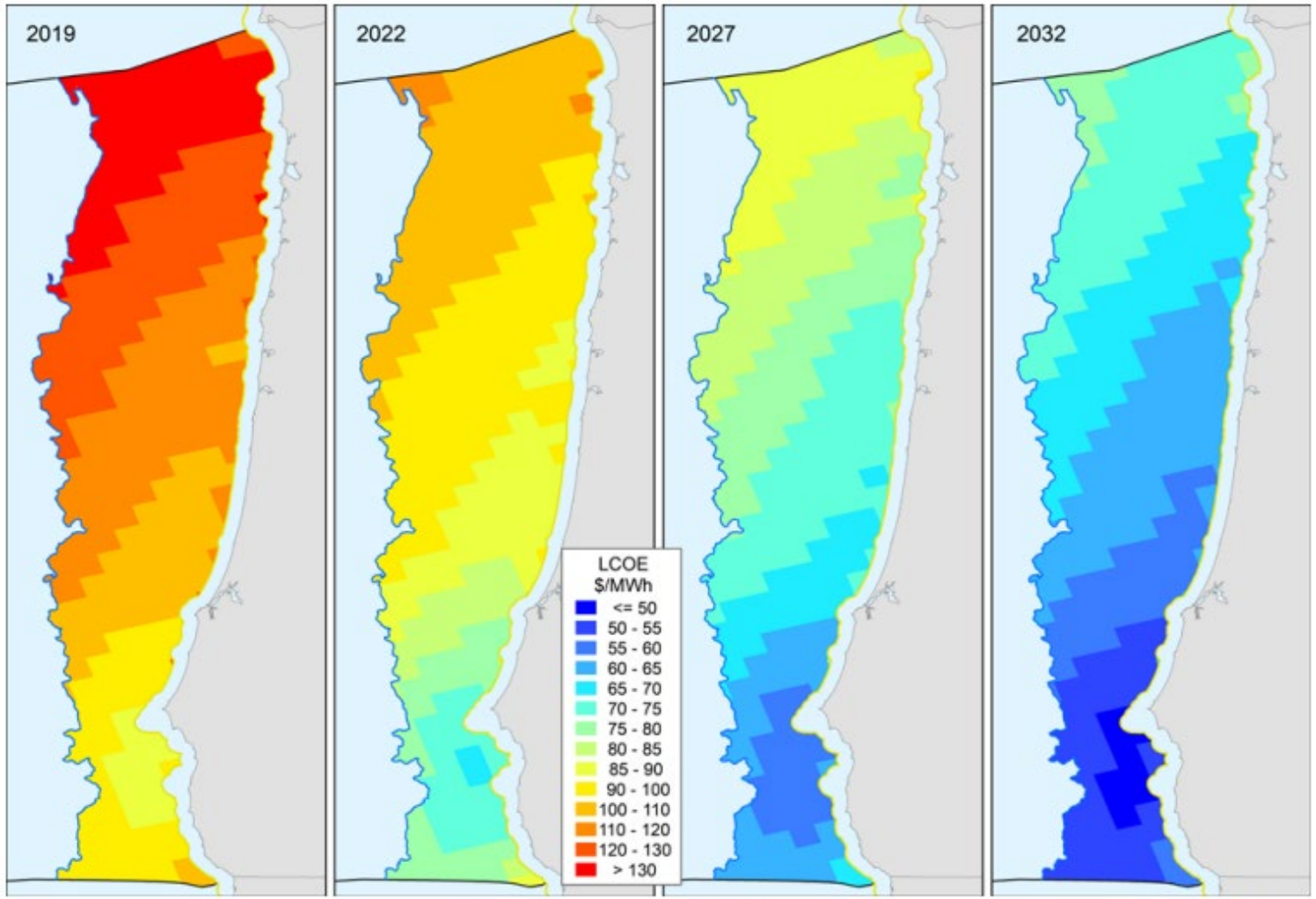


Image source: NREL

What About Costs?

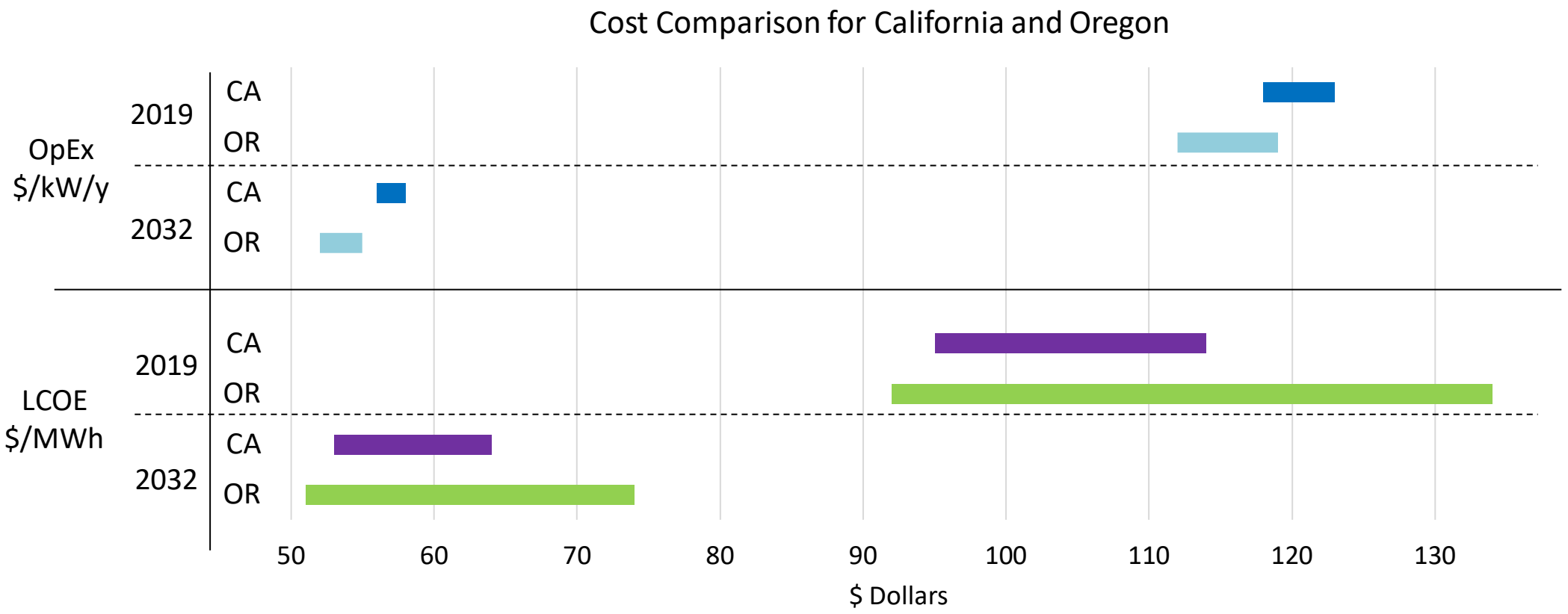
- Costs vary by region
- Licensing and permitting will be expensive
  - Leasing ~25% of capital expenditure
- High uncertainty
  - Unknown cost of infrastructure and interconnection
  - Transmission upgrades ~25-50% of project costs
- Price projections are subject to industry assumptions and development

Current NREL Cost Estimations for OR Wind

- Levelized Cost of Energy (LCOE) $92-$134/MWh
- Capital Expenditure (CAPEX) $~4k/kW
- Operational Expenditure (OpEx) $112-$119 $/kW/yr

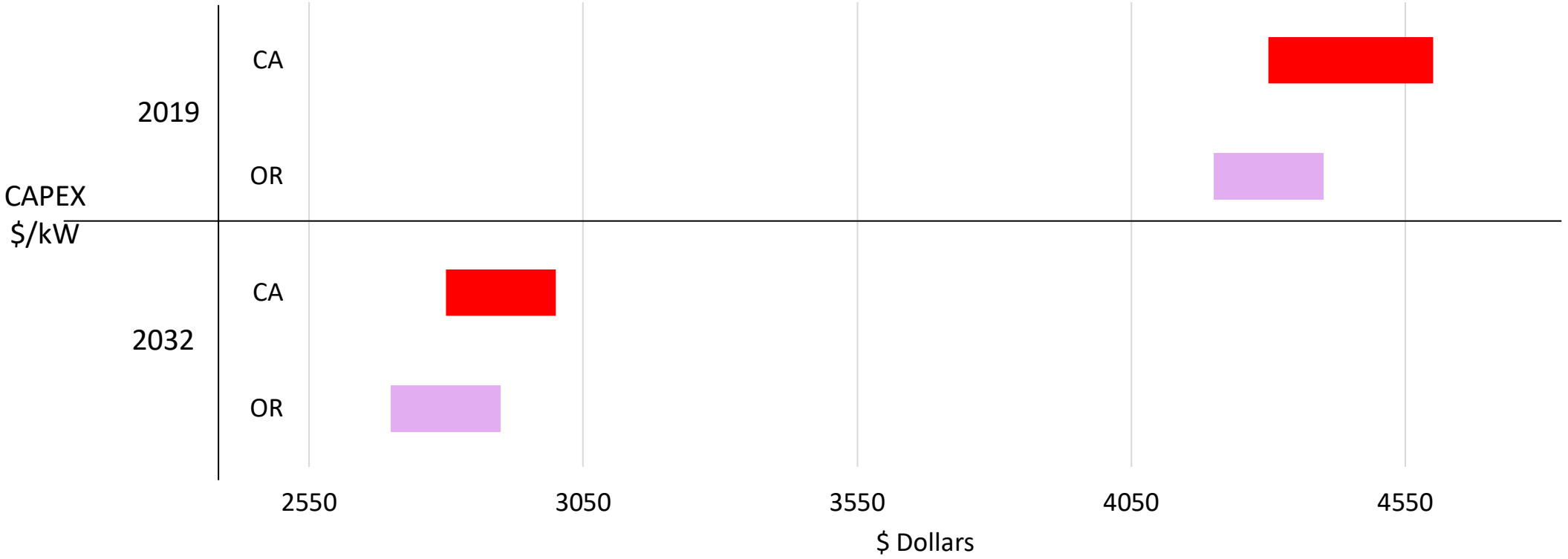
- LCOE:
  - Turbine ($/kW) and balance of system ($/kW) CAPEX
  - Annualized operation and maintenance ($/kW/yr)
  - Annual energy production (MWh)

California Comparison



NREL-OR NREL-CA

California Comparison



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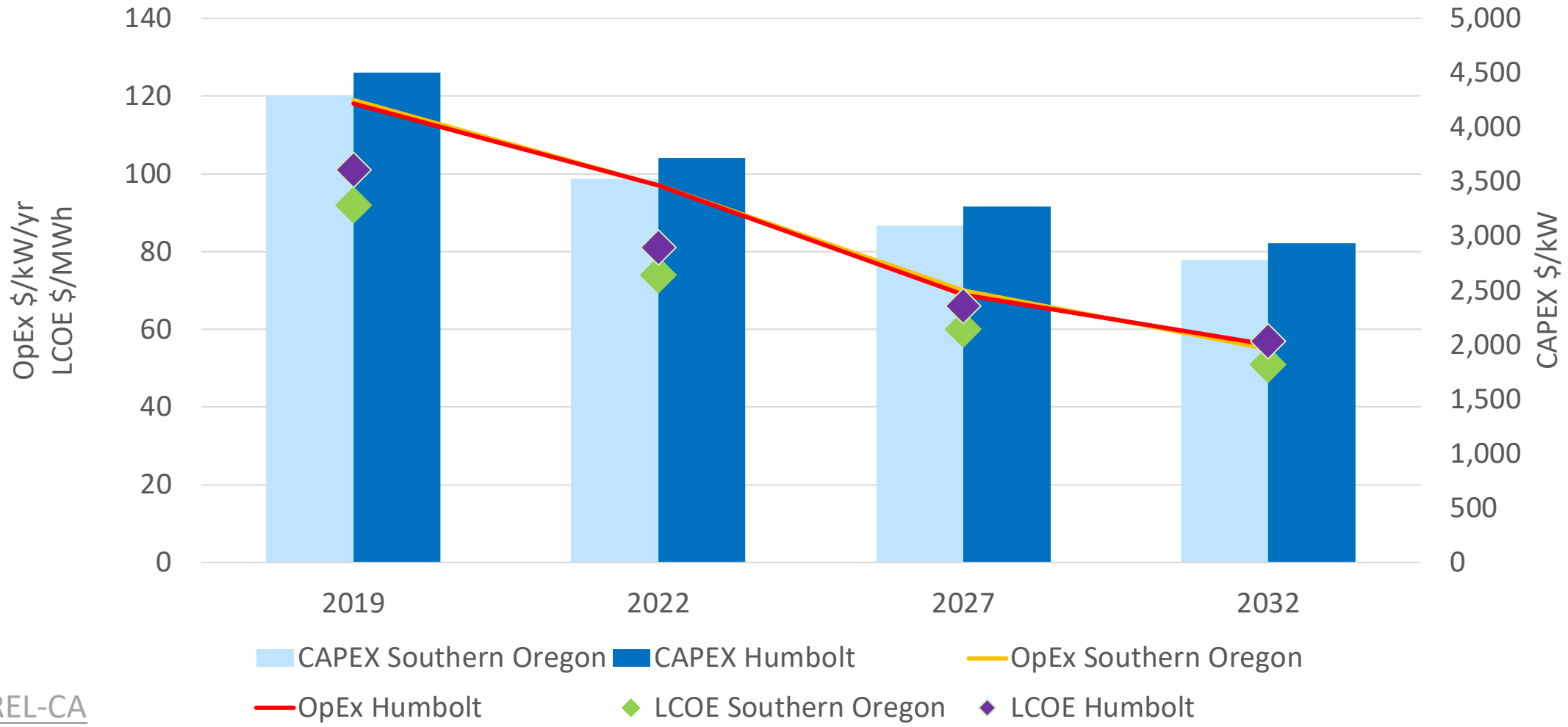
Southern Oregon and Northern California



NREL-OR NREL-CA

Offshore Wind Grid Value Potential

- Hourly generation complementarity with:
  - Southern Oregon solar
  - Columbia Gorge wind
  - Hydro

- Load complementarity
  - Moderate correlation in winter, spring and summer
  - Better load match than onshore wind

PNNL, NREL

Load Balancing Benefits

- Potential to deliver energy during peak hours
- Smoother ramp rates relative to onshore wind
- Improve local power quality for coastal communities
- Deployment of offshore wind may reduce East-West power flow

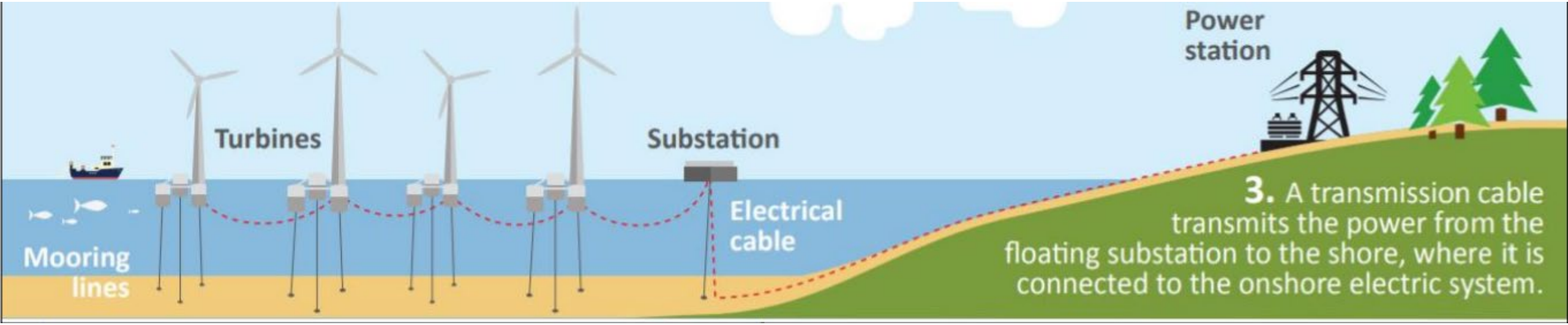
PNNL, NREL

Limitations & Challenges

- Technical feasibility
- Coastal infrastructure
- Transmission
- Supply chains

Technical Feasibility

- Designs for very deep ocean floor are not fully developed
- Uncertain call areas for development:
  - design of grid connection and cables to the coast
- Lack of greater transmission infrastructure



ODOE OSW public meeting 1 cropped

Coastal Infrastructure

- No existing west coast port can support offshore wind logistics
  - Wharf
  - Yards
  - Cranes
  - Storage
  - In addition, no direct coordination between ports
- No major multi terminal hub
  - Limited points of interconnection
- Societal considerations:
  - Material impact on coastal communities

Transmission Limitations

Oregon

- 2.6 GW nameplate capacity
- But on southern coast, 1.1 GW

Washington

- Limited rural coast load infrastructure

California

- Developed coastal load infrastructure
- Diablo Canyon decommissioning opportunity

Supply Chain and Risks

- Supply chain issues is main risk to acknowledge
  - Steel supply is the primary weakness
- Manufacturing bottlenecks
- Policy Driven space
  - 10-year development cycle but shorter political cycles

Adequacy and Resilience

- Local (coast) benefits:
  - Reliable supply of energy for coastal communities

- With transmission improvements:
  - May provide adequacy benefits for the region
  - Depending on extreme events and wildfires, offer resiliency measures

WECC Market Dynamics

- Dynamics of offshore wind export/local use will be influenced by transmission limitations and market cooperation
- Depends on state priorities for decarbonization transitions and clean energy policies
- Market coordination will set the stage for broader utilization
  - Regional Transmission Organization (RTO)
  - Energy Imbalance Market (EIM)

Future Directions

- Evaluate offshore wind from a system-wide perspective:
  - Focus on overall complementary renewable fleet to match load profile and capacity
  - Determine potential hybrid storage integration
- Roles of RTO and EIM
- Focus on adequacy and resiliency benefits

Acknowledgment

We appreciate everyone who shared information and suggested resources.

Thank you!

Any Questions?