U.S. DEPARTMENT OF ENERGY

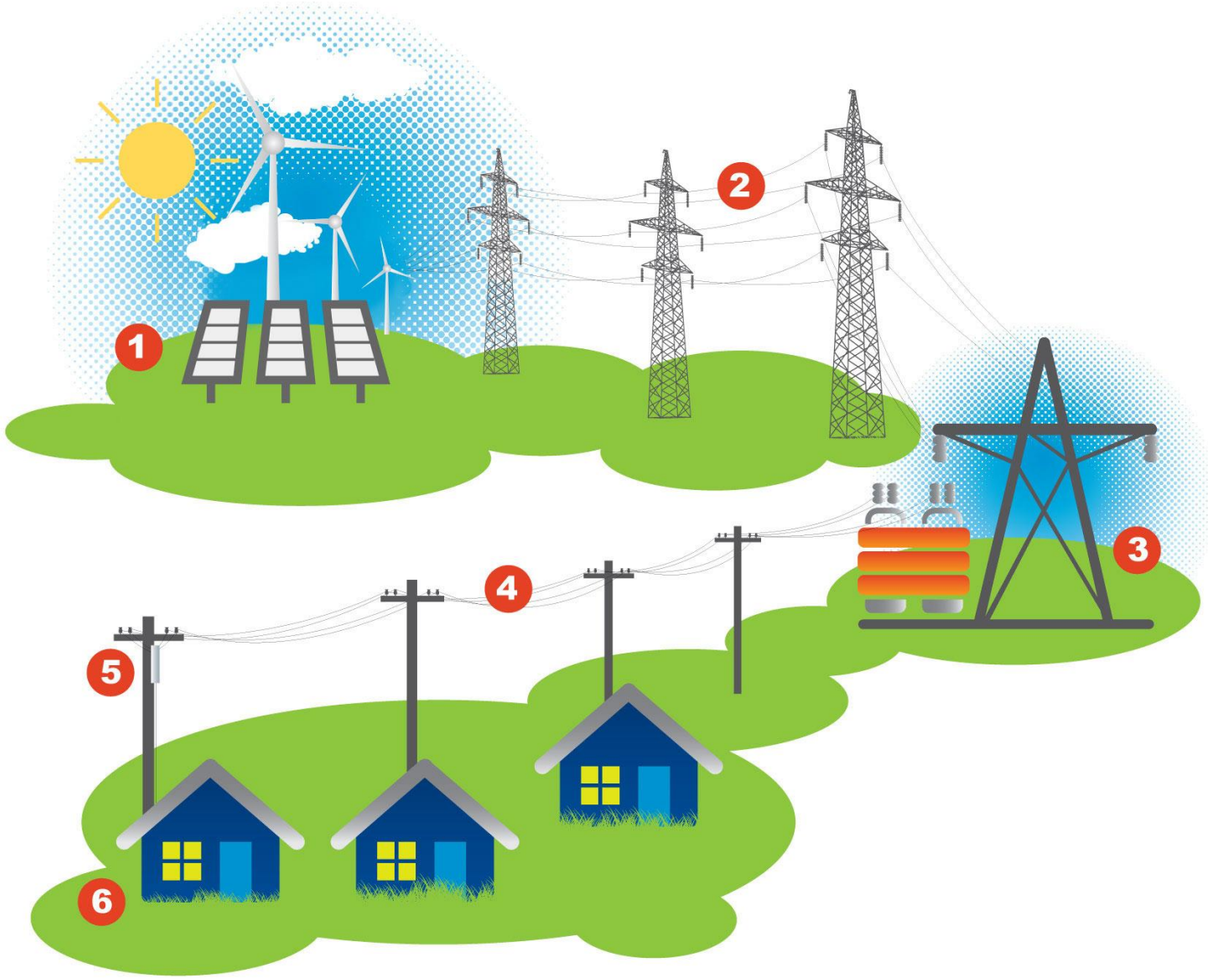
BOEM
BUREAU OF OCEAN ENERGY MANAGEMENT

Pacific Northwest
NATIONAL LABORATORY

West Coast Offshore Wind Transmission

August 12, 2024

Overview of the Grid

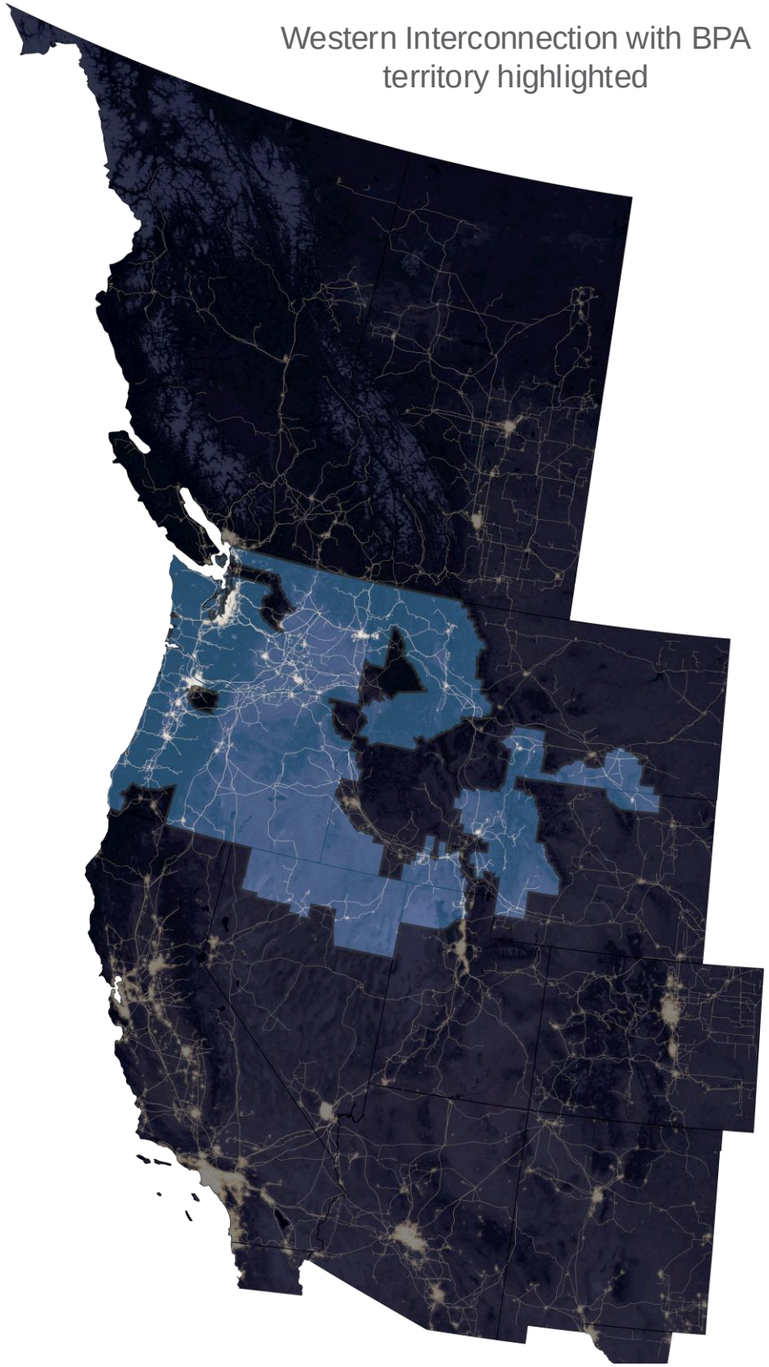


Source: PPL Electric Utilities

1. Electricity is generated at large power plants (hydropower, natural gas, wind, solar, geothermal, coal)
2. Electricity is transported over long distances via high-voltage transmission lines (69, 115, 230, 345, or 500 kilovolts)
3. Substations reduce voltage of electricity for distribution (<69 kilovolts)
4. Lower voltage distribution lines carry the electricity towards loads
5. Overhead or ground-mounted transformers further reduce voltage near point of use
6. Electricity is delivered to a home (110 or 240 volts)

Transmission 101

- Transmission planning is regulated by the Federal Energy Regulatory Commission (FERC)
- Three major grids in the U.S.:
  - Eastern Interconnection
  - Electricity Reliability Council of Texas
  - Western Interconnection (WI)
- Bonneville Power Administration, Pacificorp, and California Independent System Operator (CAISO) manage transmission territory needed for West Coast OSW
- These entities participate in annual transmission planning processes which result in the expansion of their systems over time
- State-regulated utilities often build new transmission
- Costs are directly allocated to ratepayers



Western Interconnection with BPA territory highlighted

Source: WECC.org

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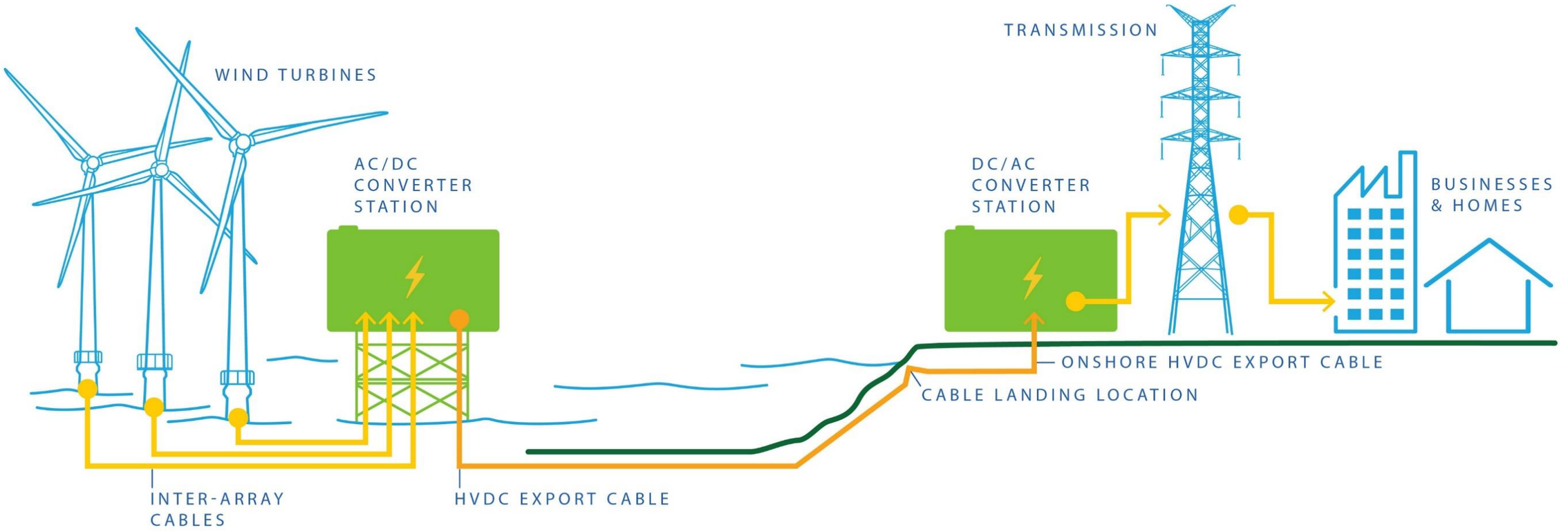
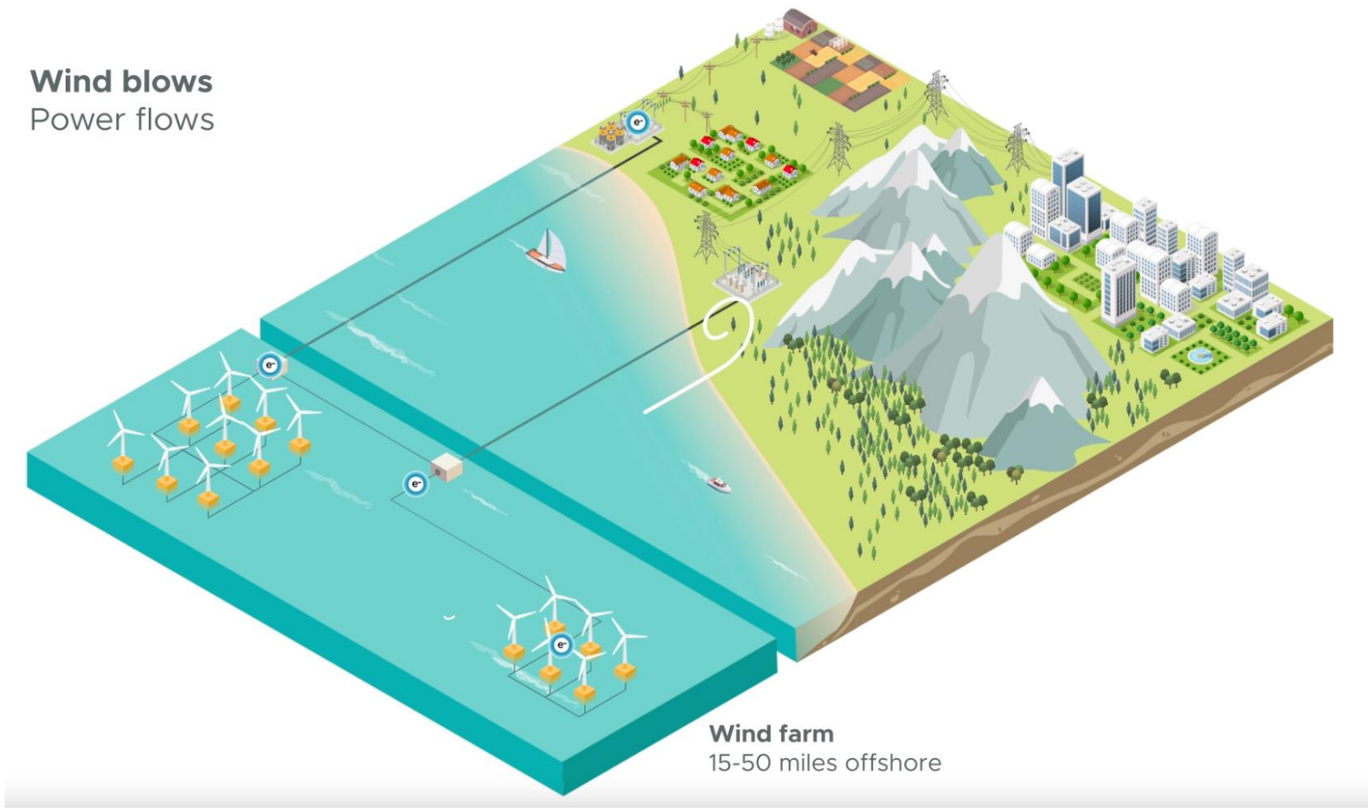
OFFSHORE WIND TRANSMISSION COMPONENTS

HVDC EXPORT CABLE

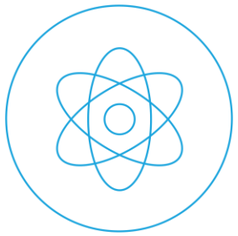


Transmission & OSW

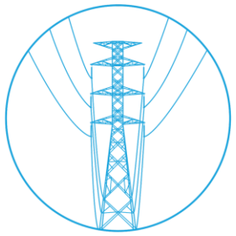
- The U.S. grid we have today emerged over nearly 150 years of innovation
- Never in history, until BOEM auctions in 2013, had bulk power generation from the ocean been seriously considered in the U.S.
- Potential for large scale changes in the direction of energy flows and effects on the benefits that community rely on from ocean and coastal ecosystems.



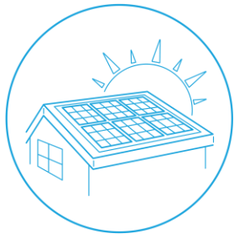
GDO Mission and Goals



Ensure **resource adequacy** by supporting **critical generation sources** and expanding and enhancing **electricity markets**.



Catalyze the development of new and upgraded **high-capacity electric transmission lines** and an improved **distribution system** nationwide.



Prevent **outages** and enhance the **resilience** of the electric grid.

DOE's Role

DOE does NOT:

- **Build, own, or maintain** offshore wind generation or transmission.
- **Pay for** offshore wind generation/transmission
- **Decide locations** for offshore wind generation or transmission

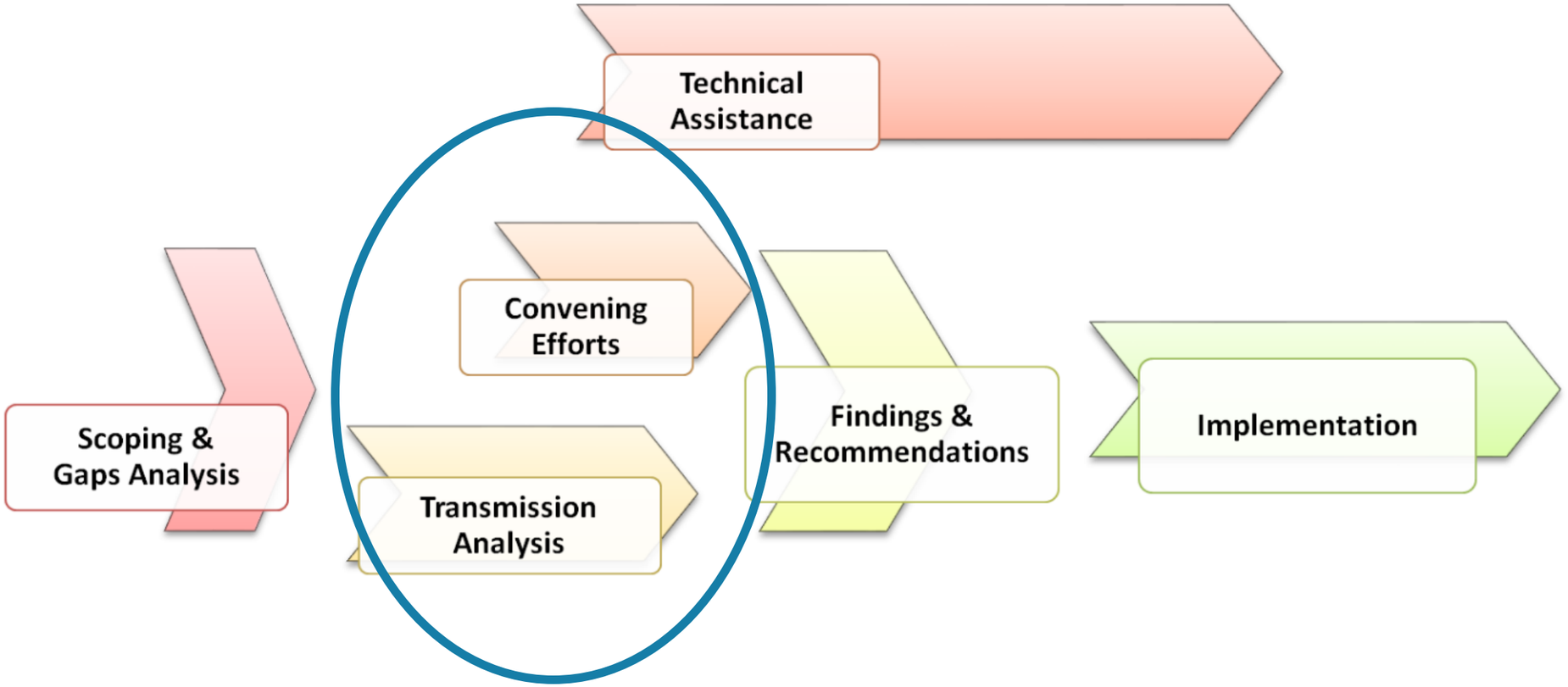
DOE's role is to:

- **Advance research** & conversation
- **Support planning** efforts – creating recommendations that everyone can use
- **Convene** governments (Tribal, federal, state, local), stakeholders, etc.
- **Grant competitive funding** for future transmission projects. Future offshore wind transmission may be eligible to apply for competitive funding.

Convening Series

	What It Is	What It Isn't
Objective	Opportunity to think about and discuss future transmission system for OSW	Not prescribing actions, building consensus, or creating mandates
Methods	Collect input through conversations and Convening Workshops	Not a formal solicitation or government-to-government consultation
Output	Recommendations published in OSW Transmission Action Plan	Not a regulatory action; not a siting decision

West Coast OSW Transmission Planning Workflow



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OSWTransmission@hq.doe.gov

Convening Series Overview

Goal: Develop transmission recommendations

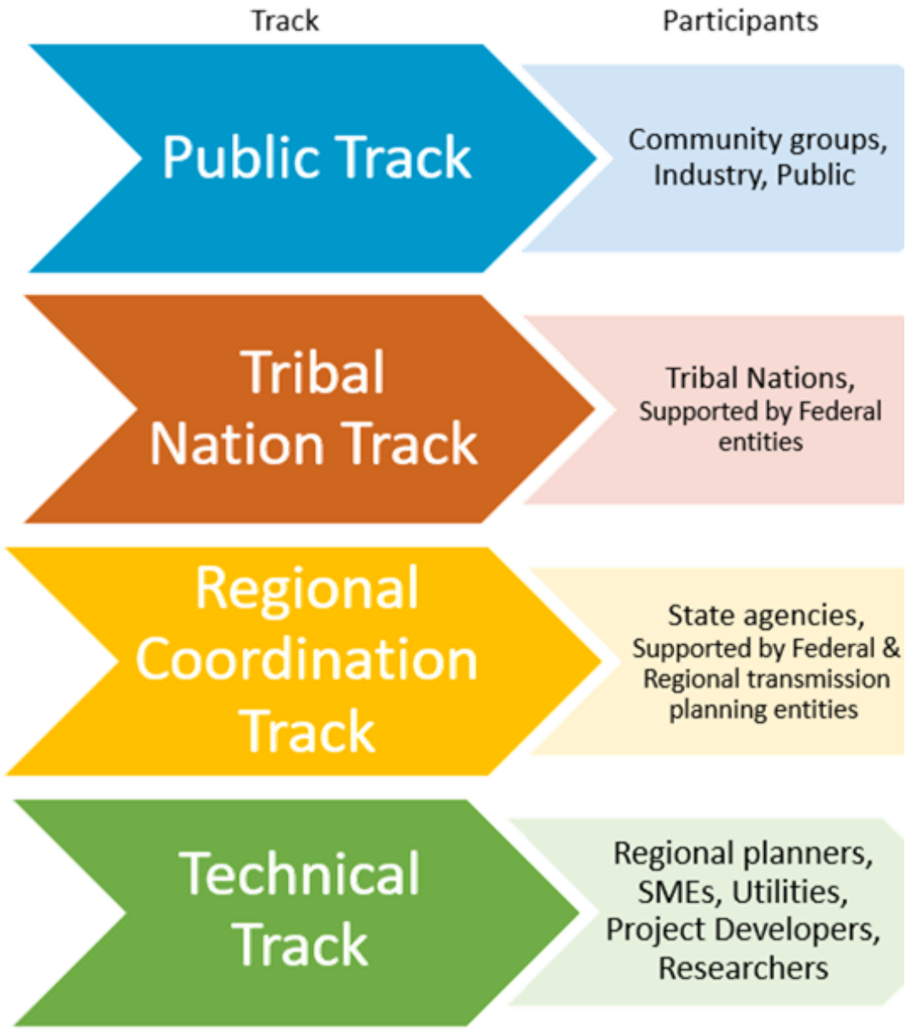
Approach: 1) Hold workshops to hear from wide range of governments, subject matter experts, industry, etc.; 2) Leverage existing meetings/conferences

Timeframe: Throughout 2024, ending early 2025

OSWTransmission@hq.doe.gov

Convening Tracks

The convening series has four distinct tracks that focus the conversation on relevant topics:



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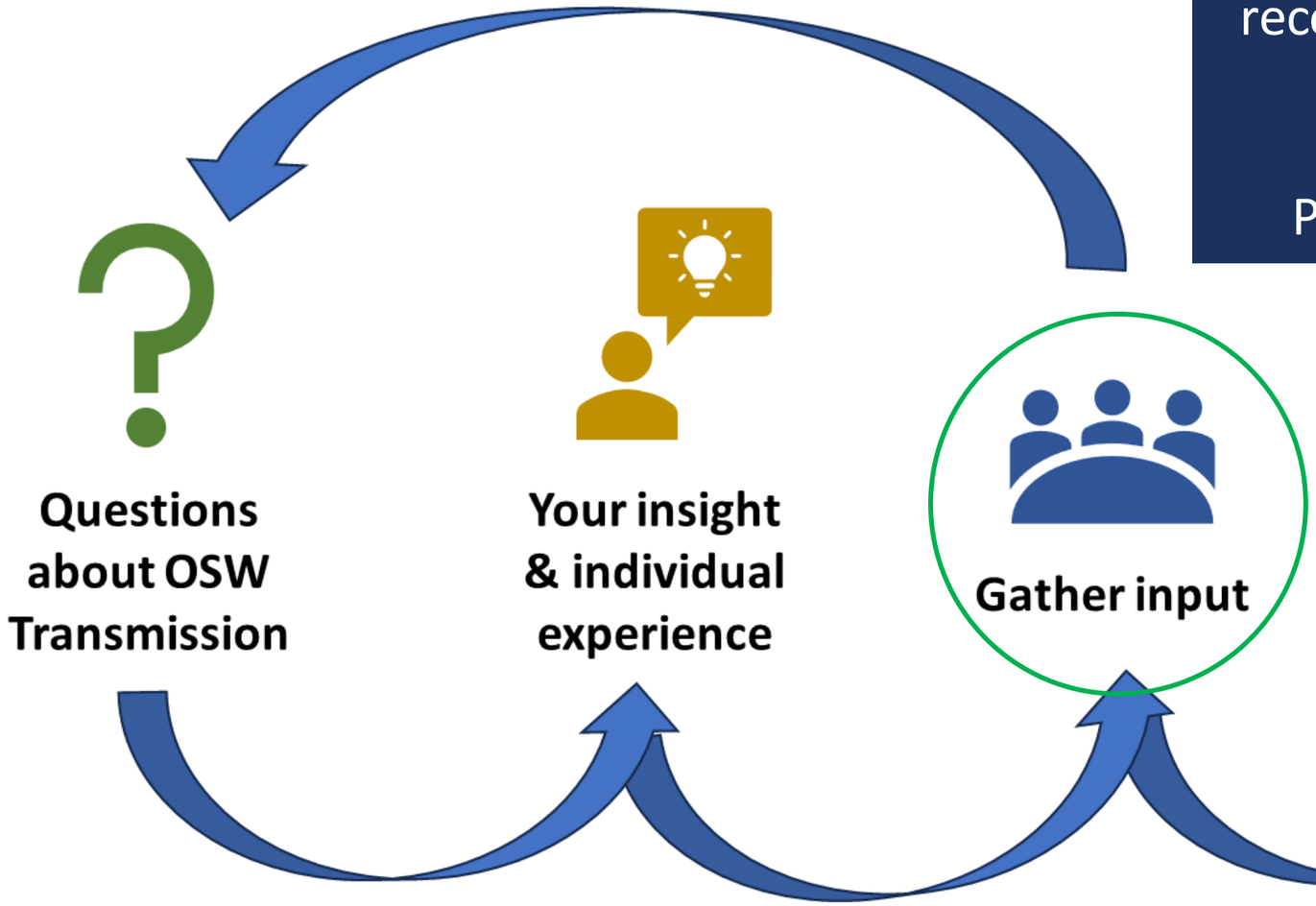
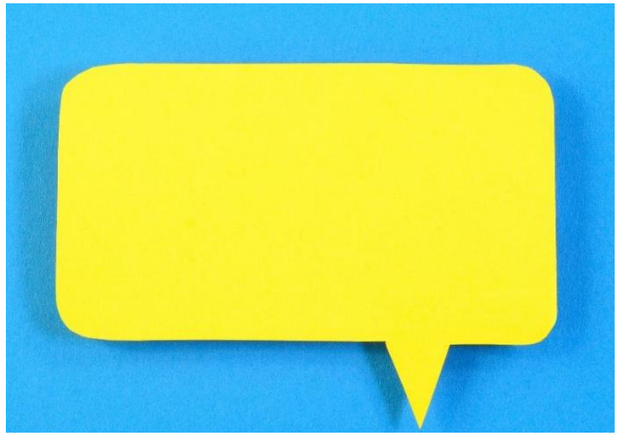
How will input be used?

Convening series and any input gathered will inform eventual Action Plan recommendations made by DOE and BOEM

Publication: Early 2025



Ways to Provide Input



- **Email us input anytime at** OSWTransmission@hq.doe.gov
- Request for Information
  - Submit a response via email by Oct. 3

Background videos:

- **Transmission 101:** https://youtu.be/J4lCBobenSA
- **Siting and Permitting of Offshore Wind Transmission:** https://youtu.be/JazUaxferF4

Immediate Recommendations

Immediate Actions Before 2025		Reference Section
★ ★ ★	Multi-State Offshore Wind Transmission Collaborative	1.1.1
★ ★ ★	Regional Transmission Planning Collaborative	1.1.2
★ ★ ★	Tribal Nation Engagement	1.1.3
★ ★ ★	Systematic Evaluation of POI Capacities	2.1.2
★ ★ ★	NERC Reliability Standards Around Offshore Transmission	2.3.1
★ ★ ★	Voluntary Cost Allocation Assignments	4.1.1
★ ★ ★	Offshore Transmission Investment Tax Credits	4.2.1
★ ★	"Network-Ready" Equipment Standards	3.1.1
★ ★	Equipment Rating Standardization for Transmission Components	3.1.2
★ ★	R&D for Offshore Transmission Technology Commercialization	3.3.1
★ ★	Expansion of Domestic Supply Chain and Manufacturing	3.4.2
★ ★	Skilled U.S. Workforce Development	3.4.2
★ ★	Federal-State Aligned Offshore Wind Transmission Siting	5.1.3
★ ★	Guidance for Federal Environmental Review and Permitting Requirements and Procedures	5.2.1
★ ★	Permitting Agency Resources and Staffing	5.2.3
★	Environmental R&D for Offshore Wind Transmission	3.3.2
★	Relevant Federal Funding, Financing, and Technical Support	4.2.2

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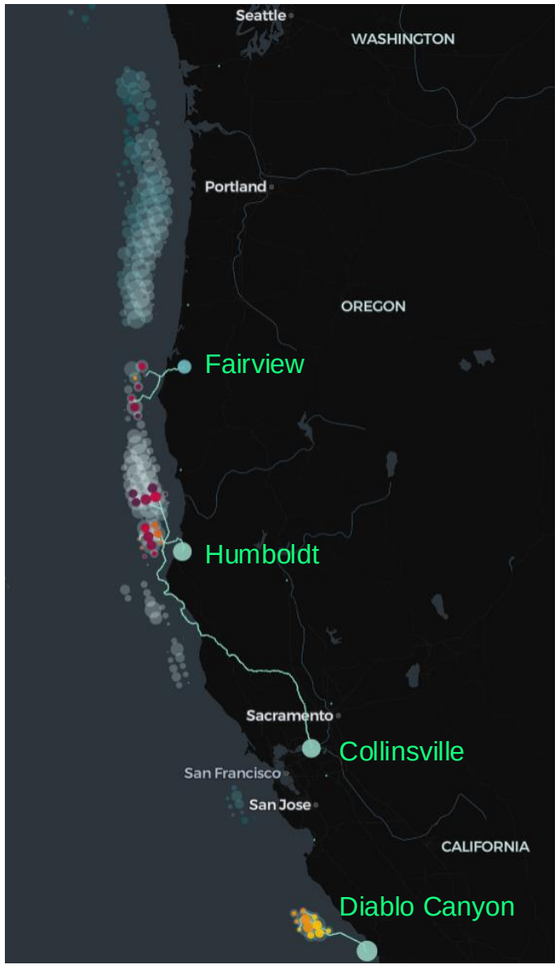
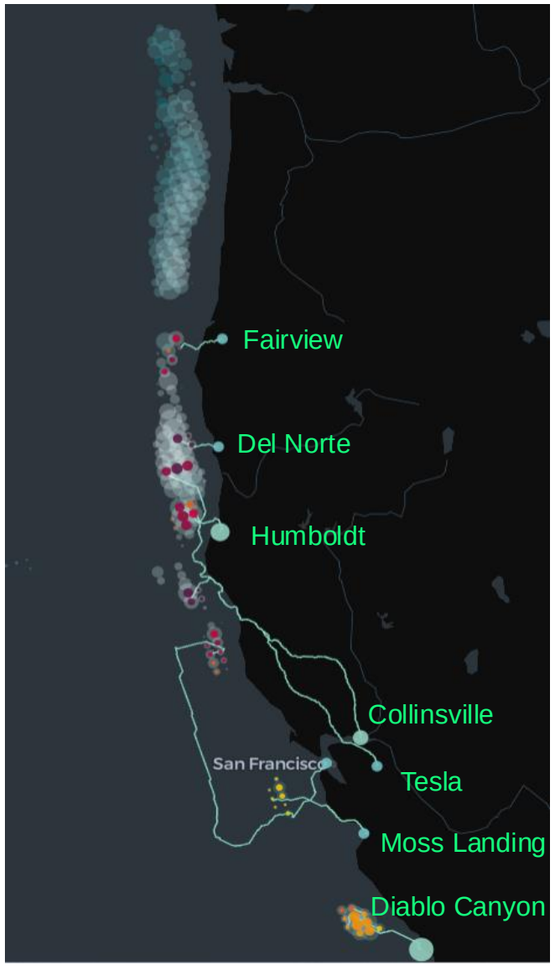
WOW-TS Overview

- Model power plants and transmission lines across the Western Interconnection with 15 and 33 gigawatts (GWs) offshore wind by 2035 and 2050, respectively
- Compare four realistic scenarios (topologies A – D) across key metrics:
  - reductions in costs to produce power and associated emissions,
  - congestion on power lines and & curtailment of renewable generation when it otherwise could be used,
  - adequacy of power generation at all hours to meet needs across the system,
  - reliability under single and multiple plant, substation, or line failures,
  - resilience under West Coast extreme weather events such as heat waves and wildfires
- Inform policymakers, planners, the industry, and the public of the opportunities and challenges for OSW transmission on the West Coast

Transmission Topologies (or scenarios)



A - 2035 Radial
- 15 GW
- Concentrated
- 5 POI's



B - 2035 Radial
- 15 GW
- Distributed
- 9 POI's

C - 2050 Intraregional
- 33 GW
- Within system operators

D - 2050 Interregional
- 33 GW
- Between system operators

Carbon sequestration

Cultural identity

Food

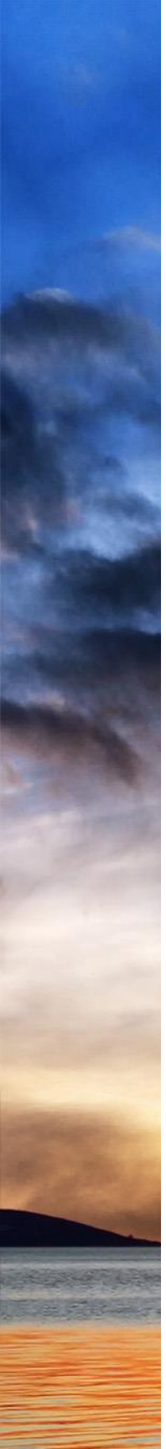
Livelihoods

Coastal protection

Energy

Clean water

Recreation



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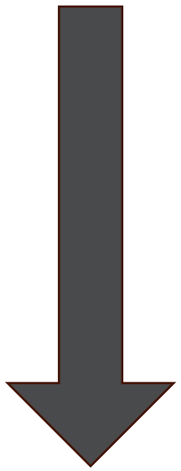
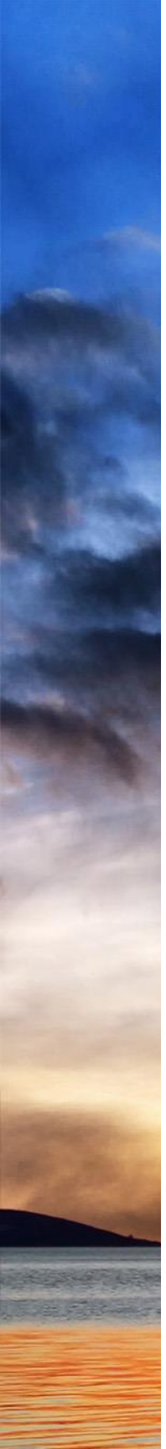
People



Environment



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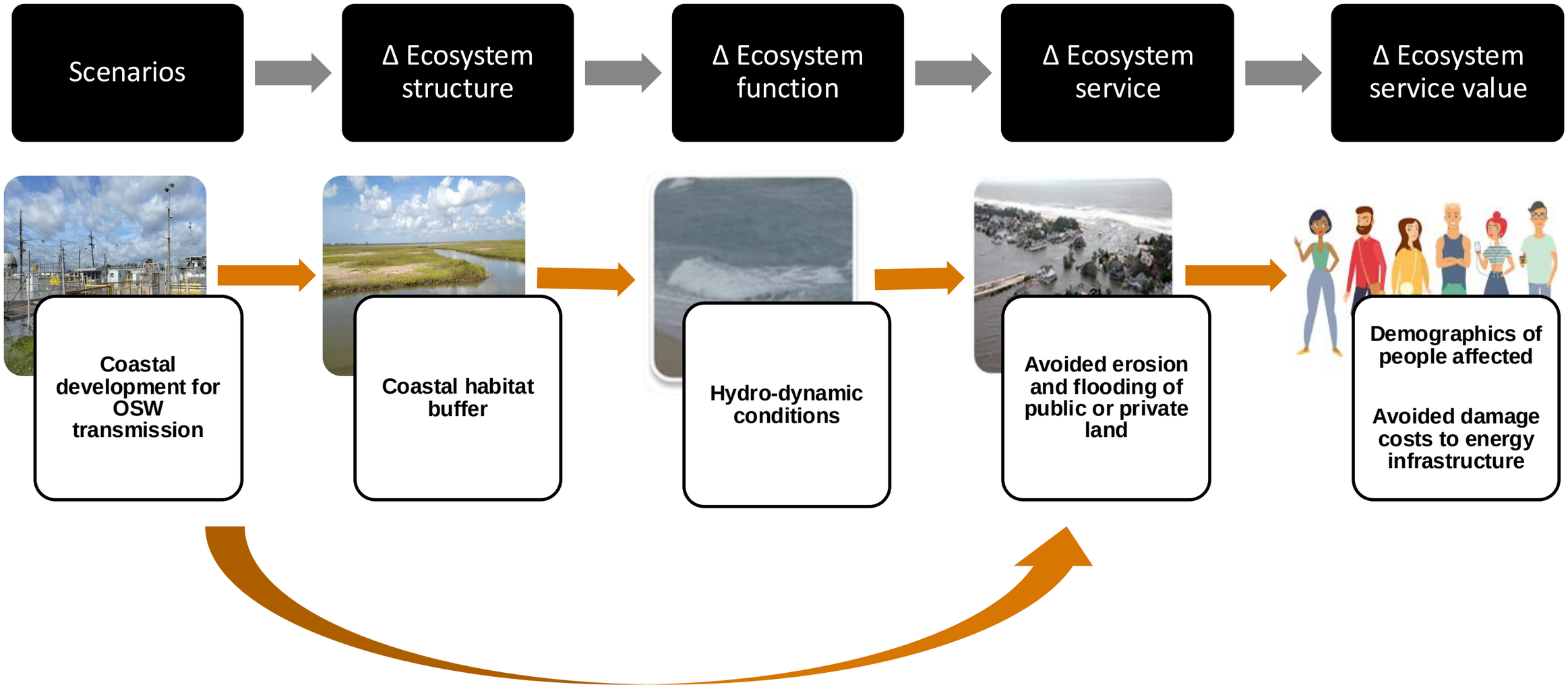
People

Environment

Social-ecological modeling – Coastal risk

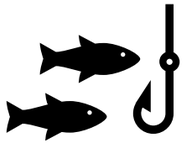
Ecosystem service assessment



DRAFT conceptual model - adapted from Arkema et al. 2017

Community Benefits and Costs Analysis

How do different transmission options for offshore wind influence:



Fisheries

Energy resilience

Viewshed and cultural landscapes

Coastal risk to people and energy infrastructure

Thank You

www.energy.gov/gdo/offshore-wind-transmission-federal-planning-support

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GDO GRID DEPLOYMENT OFFICE

LPO LOAN PROGRAMS OFFICE

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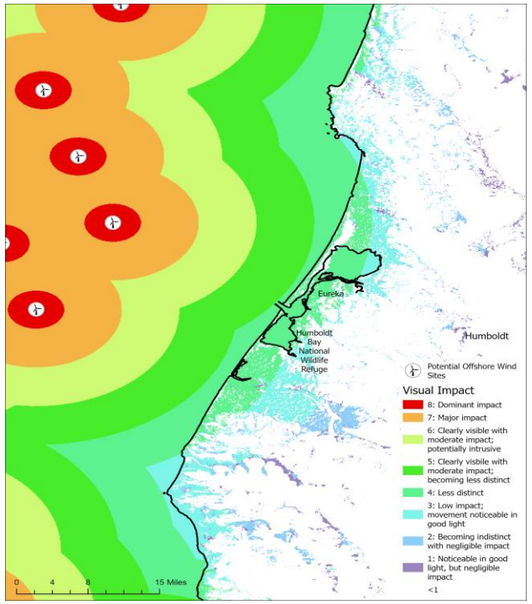
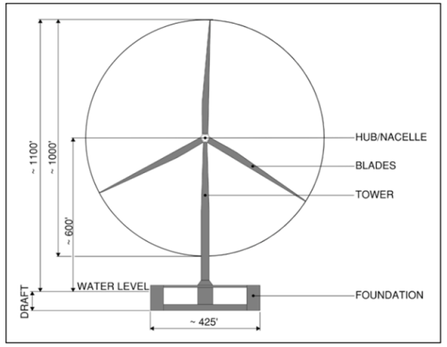
Viewsheds

- Where are the turbines visible?
- How dominant in the viewshed are visible turbines?
- Where are people that may have an affected viewshed?

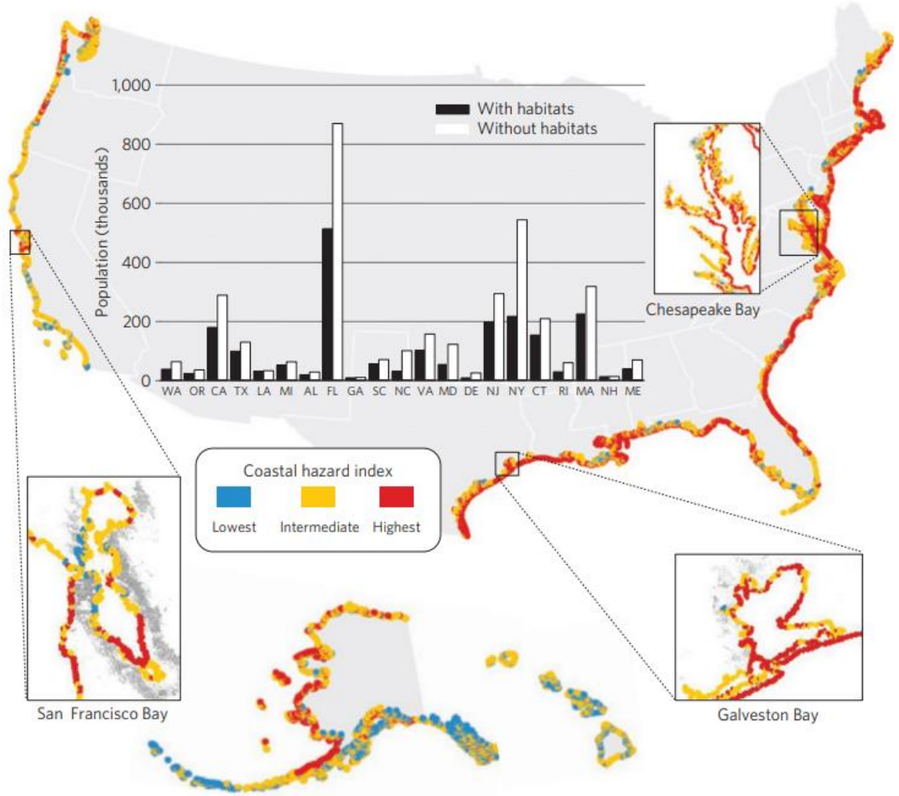




Coastal Risk

- What is the relative risk to people and energy infrastructure along the coastline from storm-induced erosion and flooding?

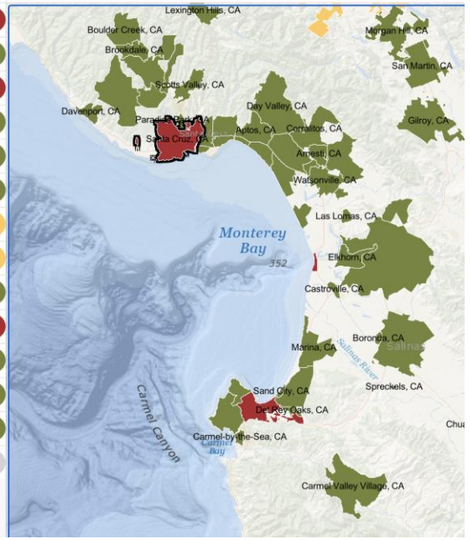
- How might modification of the natural environment - that could happen with OSW transmission development - affect exposure?



Fisheries

- Where do fishing grounds and habitat overlap with OSW infrastructure, such as cables, turbines, and substations?
- How does OSW infrastructure influence fishing opportunities, vessel transit, and coastal communities?
- If a port is closed due to OSW development, how does that affect fishermen and landings seasonally?

Santa Cruz, CA	2020
Commercial Fishing Engagement	High
Commercial Fishing Reliance	Low
Recreational Fishing Engagement	High
Recreational Fishing Reliance	Low
Poverty	Low
Population Composition	Low
Personal Disruption	Medium
Housing Disruption	Medium
Retiree Migration	Low
Urban Sprawl	High
Labor Force Structure	Low
Housing Characteristics	Low
Sea Level Rise Risk*	Low
Storm Surge Risk*	N/A



Energy Resilience

- What are the power outages experienced by coastal counties and how does this relate to extreme weather events?

- Which coastal counties are particularly vulnerable to power outages and would benefit from resilience interventions?