North Coast Offshore Wind Feasibility: 
Environmental Conditions 
and Potential Concerns

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Schatz Energy Research Center Webinar Workshop Series
Exploring the Feasibility of Offshore Wind Energy 
for the California North Coast 
September 21, 2020
Topics Covered

• Overview of north coast offshore wind scenarios
• Environmental considerations onshore
  • Transmission line improvements
• Environmental considerations offshore
  • Regulatory setting
  • Project components
  • Environmental stressor-receptor interactions
  • Construction and O&M
  • Seabirds
• Key takeaways
North Coast Offshore Wind Project

Offshore call area
- Location
  - 21 miles off Eureka
  - ~206 square miles

Transmission to shore
- Export cable
- Cable landfall
- Subsea transmission cable

Terrestrial interconnect and transmission

Humboldt Bay port improvements
Our Team’s Study Scenarios

50-MW footprint

150-MW footprint

1,800 MW footprint (full build)
Physical Setting: Onshore
Terrestrial Transmission Line Upgrades

Same route as existing lines with larger towers and more transmission lines

Methods and protocols exist and transmission lines are routinely upgraded making this a monumental but doable task.
Onshore Construction and O&M Effects

Wildlife

• Habitat loss due to vegetation removal
• Noise disturbance from horizontal directional drilling and transmission line improvement activities
• Increased long-term risk of bird collision with transmission lines

Plants, Wetlands, and Watercourses

• Impacts on threatened or endangered plant species or sensitive natural communities from ground-disturbing activities
• Ground disturbance causing hydrological interruption or placement of fill in jurisdictional waters
• Introduction and spread of terrestrial invasive plant species
Regulatory Framework for Offshore Wind: Bureau of Ocean Energy Management (BOEM)

Planning & Analysis
- Intergovernmental Task Force
- Request for Information or Call for Information and Nominations
- Area Identification
- Environmental Reviews

~ 2 YEARS

Leasing
- Publish Leasing Notices
- Conduct Auction or Negotiate Lease Terms
- Issue Lease(s)

~ 1-2 YEARS

Site Assessment
- Site Characterization
- Site Assessment Plan

UP TO 5 YEARS

Construction & Operations
- Construction and Operations Plan
- Facility Design Report and Fabrication and Installation Report
- Decommissioning
- Environmental and Technical Reviews

~ 2 YEARS (+25)

<table>
<thead>
<tr>
<th>Environmental Review Requirement</th>
<th>Approving/Lead Agency</th>
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<tbody>
<tr>
<td>Energy Policy Act of 2005</td>
<td>BOEM</td>
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<tr>
<td>National Environmental Policy Act</td>
<td>BOEM</td>
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<tr>
<td>Section 401 of the Clean Water Act</td>
<td>U.S. Environmental Protection Agency; North Coast Regional Water Quality Control Board; Central Valley Regional Water Quality Control Board</td>
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<td>Section 404 of the Clean Water Act; Section 10 of the Rivers and Harbors Appropriation Act of 1899</td>
<td>U.S. Army Corps of Engineers, San Francisco and Sacramento Districts</td>
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<td>Section 7 of the federal Endangered Species Act</td>
<td>U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS)</td>
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<td>Magnuson-Stevens Fisheries Conservation and Management Act</td>
<td>NMFS</td>
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<td>Marine Mammal Protection Act</td>
<td>NMFS</td>
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<tr>
<td>Migratory Bird Treaty Act</td>
<td>USFWS</td>
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<td>Bald and Golden Eagle Protection Act</td>
<td>USFWS</td>
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| California Environmental Quality Act                                                            | California State Lands Commission (CSLC); California Public Utilities Commission; Humboldt Bay Harbor, Recreation and Conservation District (HBHRC)
| California Endangered Species Act                                                               | California Department of Fish and Wildlife (CDFW)                                      |
| California Fish and Game Code Section 1600 et seq.                                             | CDFW                                                                                 |
| California Coastal Act                                                                         | California Coastal Commission, Humboldt County                                        |
| Section 307 of the Coastal Zone Management Act                                                  | California Coastal Commission                                                       |
| Section 106 of National Historic Preservation Act                                               | California Office of Historic Preservation                                            |
| National Forest Management Act of 1976                                                          | U.S. Forest Service                                                                  |
| Approval for Navigation Aids                                                                     | U.S. Coast Guard                                                                     |
| Obstruction Evaluation/Airport Airspace Analysis                                                | Federal Aviation Administration                                                      |
| California Submerged Lands Act                                                                  | CSLC                                                                                 |
| California Clean Air Act                                                                       | California Air Resources Board                                                       |
| Development Permit                                                                             | HBHRC                                                                               |
Physical Setting: Offshore
Project Components
Project Components
# In-Water Project Phases

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Phase 4</th>
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</thead>
<tbody>
<tr>
<td><strong>Site Assessment and characterization</strong></td>
<td><strong>Construction</strong></td>
<td><strong>Operations and maintenance (O&amp;M)</strong></td>
<td><strong>Decommissioning</strong></td>
</tr>
<tr>
<td>Collecting information needed to design and permit a project</td>
<td>Cable laying, anchoring, mooring, and device deployment</td>
<td>Monitoring and maintenance activities</td>
<td>Project removal</td>
</tr>
<tr>
<td>[weeks]</td>
<td>[months-years]</td>
<td>[years]</td>
<td>[months – years]</td>
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Stressor ➔ Interaction ➙ Receptor

Stressor
(metrics measured: frequency, intensity, duration)

Exposure Regime
(function of environment and stressor)

Receptor
(species/life stage, use of project area, timing, behavior)

Stressor Thresholds
(dose: response)

Potential Effects
Interactions: Offshore Construction

Construction disturbance
  • Disturbance of benthic habitat during cable lay and anchor placement
  • Changes in water quality from sedimentation or contaminants

Increase in underwater acoustic levels
  • Vessels
  • Cable lay

Increase in the risk for vessel collisions with wildlife

Artificial lighting disturbance to wildlife (e.g., on decks or underwater)

Fig. 1. Wheel cutter (left); Plough (centre) and Towed Jetting Vehicle (right) (courtesy: www.ldrovanoean.com).
Interactions: Offshore O&M

Risks:
- Habitat Loss
- Collisions
- Sea Surface Disturbance
- Vibrations
- Underwater Noise
- Turbidity
- Electromagnetic Fields
- Seafloor Disturbance

Opportunities:
- Food Availability Increase
- Roosting
- Increase Reproductive Success
- Nutrients & Organic Matter Increase
- Size & Age Increase
- Refuge Area
- Introduction of Desired Species
- Habitat Gain
- Food Availability Increase
- Biodiversity Increase
- Abundance Increase

Interactions: Offshore O&M

Habitat changes
- Hard structure on seafloor and in the water column
- Noise produced by turbines and maintenance vessels
- Artificial light
- Electromagnetic fields produced by cables and substation
- Resting and foraging opportunities for birds and mammals

Entanglement
- Lost fishing gear on interarray cables and mooring lines

Collision
- Underwater structures and large cetaceans
- Rotor swept areas and seabirds (potentially bats too)
Example: Marine Mammal Interactions

Humpback Whales and Floating Offshore Wind Farms

- Water Depth: 700 m
- Whale: 13 m
- Turbine height: 194 m
- Platform spacing: 820 m

Example: Seabird Interactions
California Current Differs from East Coast and Europe

- Eastern boundary current
  strong upwelling = high production
- Oceanographically and topographically diverse
- Greater abundance of seabirds
- More complex and diverse species composition
- Narrow continental shelf means oceanic species are closer to coast
Many species migrate to the California Current
Many Studies and Monitoring Efforts in the Atlantic

Some of the results with similar species groups in both oceans, especially in the nearshore environment, may be transferred to the Pacific, especially nearshore, but not applicable for many species in the California Current.

Significant differences regarding species in the Pacific, especially pronounced off the outer continental shelf.
Some flight style groups change flight height more readily as wind speed increases (albatrosses, petrels, and shearwaters)

Probability of flying higher than 10 m as function of wind speed

Seabird Behavioral Response to Presence of Wind Turbines

- Risk models are a necessary first step
- Several data-driven probability risk models are currently under development
- But, we have no a priori information on how pelagic birds that fly high under high winds will respond to the presence of turbines
  - May avoid them entirely
  - May be indifferent
  - May collide
Monitoring

- Uncertainty regarding behavioral response of high-flying species to wind turbines necessitates monitoring
- Monitoring will require detecting potential collision encounters
- Remote locations and conditions where floating offshore wind projects will increase monitoring challenges
Unique relative to terrestrial facilities: unable to directly monitor for avian fatalities via search.

Direct observational surveys are difficult and very expensive far offshore:
- boat-based surveys
- aerial surveys

Remote monitoring technologies are being developed to address these difficulties.
Monitoring Technologies

Technologies under development that show promise include

- Radar (horizontal and vertical)
- Optical (visual, thermal imagery)
- Acoustic
- Accelerometers (vibration sensors)

Considerations

- Need for platform stability
- Scale
- Data streams
- Level of detection required (e.g., species identification)
Monitoring Technologies

Thermal Tracker: remote sensing for offshore wind

- Animal temperature contrasts with background temperature
- Records bird and bat activity
  - day and night
  - low visibility conditions
- Automated processing of key metrics
- Passage rates, flight speed and pathway, species ID

Shari Matzner et al. Pacific Northwest National Laboratory
Humboldt Call Area Thermal Tracker Monitoring


Example seabird flight track captured with Thermal Tracker software.
Key Takeaways

Construction impacts on- and off-shore
  • Shorter-term, localized

Operations and maintenance impacts
  • Long-term
  • Uncertainty for seabirds and marine mammals
  • Monitoring challenges

Improvements to overland transmission lines
  • Long-term, localized to stretches of existing transmission lines
  • Impacts to terrestrial and freshwater biota and habitats

Avoid, minimize and mitigate impacts; monitoring and adaptive management
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