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What Are The True Impacts of Offshore Wind Energy

Additional submitted attachment is included below.

What are the True Impacts of Offshore Wind Energy? No One Knows.

112 Reasons to Question Offshore Wind Energy.

“Unknown and Potentially Catastrophic Effects on the Ecosystem”

This comment to BOEM is made on behalf of myself, Max Wilbert, as well as the organization Protect the Coast PNW.

In this scoping comment I plan to address some specific and concrete suggestions for analysis that BOEM must complete in order to sufficiently analyze the environmental impacts of proposed offshore wind energy facilities on the Oregon coast.

In regards to these scoping comments, it is a fundamental fact that we do not understand the true impacts of offshore wind energy. This technology is relatively new and has been installed in only a few places around the world. Many of those places are far away and with projects located in government jurisdictions that are not friendly to the United States, and/or in areas where the ecology is fundamentally different to our region. The ecology of the Pacific Rim along the Oregon Coast is unique. In addition, oceanic environments and especially deep ocean areas provide unique challenges for monitoring and data collection.

The ocean is an incredibly complex and interconnected ecosystem. The fact that most ocean organisms begin their life either as plankton or by relying on them for food means that oceanic circulation, currents, and upwelling are critical to the function of marine ecology. The relationships between these factors are poorly understood.

Therefore, any analysis conducted by BOEM to effectively assess the impacts of offshore wind energy should answer the following questions as a minimum starting point.

A. BOEM’s Conflict of Interest

First I must call into question a conflict of interest inherent in this process. According to the BOEM website, your mission is:

> *To manage development of U.S. Outer Continental Shelf (OCS) energy, mineral, and geological resources in an environmentally and economically responsible way.*

Developing offshore wind energy projects requires a permit. BOEM is the organization that grants these permits. Therefore, BOEM is the organization that makes it legal to develop offshore wind energy projects. BOEM is expected to balance competing goals, namely environmental sustainability and energy development.

1. How can members of the public expect BOEM to effectively protect the environment if the development of U.S. outer continental shelf energy resources is fundamentally at odds with that goal? We know that a typical National Environmental Policy Act process involves the creation of a “no-action alternative.” Federal agencies rarely end up selecting this option, largely because their mission statements and directives from political leadership push them towards developing energy projects, mines, etc.
2. What would it take for offshore wind energy projects on the Oregon coast to *not* be approved by your agency?
3. Given your mission statement, how can you ensure that there is not a conflict of interest in this process?
4. How can BOEM's permitting process become more fundamentally democratic? In other words, how can the communities and ecosystems most impacted by decision making have a direct say in the process, rather than being limited to "comment" on decisions being made by professional bureaucrats? For this to be a truly democratic process, the public should be able to vote or otherwise participate in decision-making. Further, ecosystems and non-humans should have a say in these processes, as they are the most directly impacted.

B. Upwelling

According to the textbook *Physical Oceanography* by Robert H. Stewart, “Spatial variability of transports in the open ocean leads to upwelling and downwelling which leads to redistribution of mass in the ocean, which leads to wind-driven geostrophic currents via Ekman pumping… To see how winds lead to upwelling, consider north winds blowing parallel to the California Coast. The winds produce a mass transport away from the shore everywhere along the shore. The water pushed offshore can be replaced only by water from below the Ekman layer. This is upwelling… Upwelled water is colder than water normally found on the surface, and it is richer in nutrients. The nutrients fertilize phytoplankton in the mixed layer, which are eaten by zooplankton, which are eaten by small fish, which are eaten by larger fish and so on to infinity. As a result, upwelling regions are productive waters supporting the world’s major fisheries.”

A 2023 paper by Raghukumar et. al. in the journal *Communications Earth & Environment* states that:

“The development of large-scale offshore wind farms can reduce the wind stress at the sea surface, which could affect wind-driven upwelling, nutrient delivery, and ecosystem dynamics.

Here we examine changes to upwelling using atmospheric and ocean circulation numerical models together with a hypothetical upper bound buildout scenario of 877 turbines spread across three areas of interest. Wind speed changes are found to reduce upwelling on the inshore side of windfarms and increase upwelling on the offshore side. These changes, when expressed in terms of widely used metrics for upwelling volume transport and nutrient delivery, show that while the net upwelling in a wide coastal band changes relatively little, the spatial structure of upwelling within this coastal region can be shifted outside the bounds of natural variability."

This brings up serious concerns as upwelling is the foundation of the entire oceanic food web on the Pacific coast.

5. What are the impacts of wind turbines on upwelling and marine currents which circulate nutrients in the region?
6. How does this impact change as the ocean warms?
7. What are the synergistic effects between localized warming effects known to be associated with wind turbines and global warming causing increasing sea surface temperatures? What are the impacts of the cumulative effects of this warming on the areas proposed for wind energy projects?
8. How will changes in upwelling affect fish? What about whales and other marine mammals? What about plankton? What about shellfish and crustaceans? What about birds? What about other species?
9. How will changes in sea surface temperatures affect the same?
10. Upwelling is known to have a significant influence on the distribution of salinity through the ocean. How will changes in regional upwelling due to offshore wind projects affect the salinity of water in various areas, and how will this affect the ecosystem?
11. If you will not answer any of these questions in your analysis, why not?
12. Raghukumar et. al. 2023 modeled wind turbine impacts using 10 MW, 128m hub height turbines and found "changes reported [in wind] were on spatial scales large enough to influence upwelling off the U.S. west coast." Given that the wind turbines that could be installed off the Oregon coast could be substantially larger than those modeled in this study, how can we know the extent of the impact on upwelling?
13. Given that Raghukumar et. al. 2023 is the first significant research done on the topic of offshore wind effects to upwelling, how can we trust that the data in this paper is reliable and the conclusions are trustworthy?
14. Raghukumar et. al. 2023 report that "Wind-stress curl has been suggested to have an important role in eastern boundary ecosystems, and the modifications to the wind-stress curl by the presence of an offshore wind farm will need further consideration in terms of impacts on primary and secondary production, and consequently on higher trophic levels." How will these proposed projects affect wind stress curl and what will be the ramifications on the entire ecosystem?
15. Given that Raghukumar et. al. 2023 conclude that "The consequences of these changes in physical upwelling structure on the ecosystem are currently unknown", How

can BOEM persist and move forward in permitting these projects with unknown and potentially catastrophic ecosystem effects?
16. Will you follow the precautionary principle and refuse to permit projects which may have large-scale unintended consequences? Or will you permit a project and then simply monitor to figure out what the impacts are as they are happening? If the latter, how will you mitigate for unexpected impacts?

C. Fish and Other Oceanic Life

17. How will fish populations respond to the installation of hundreds of floating turbines anchored by cables and chains?
18. What will the impact of these projects be on forage fish and the distribution of fish populations, both vertically in the water column and horizontally across the impacted areas of the ocean?
19. Studies on wind energy projects in the North Sea found that wind turbines reduced wind speed by roughly 10% and affected air temperatures, relative humidity, and solar radiation. How will these impacts affect the ecosystem in this area off the Oregon coast?
20. What about impacts on sharks, tuna, and other large fish?
21. How will the releases of superheated water from project substations affect fish, plankton, marine mammals, and other forms of oceanic life?
22. How will the release of microplastics, peeling paint, and other potentially toxic substances entering the food chain affect wildlife throughout the area?
23. How much oil for lubrication will each turbine hold and how often must this oil be replaced?
24. What is the likelihood of oil spills and leaks from wind turbines given the known leaks and spills at other wind turbine projects around the world?
25. Given oil spills and leaks are likely a certainty, how will this affect marine life throughout the area?
26. How will increased ship traffic affect the likelihood of oil spills from vessels?
27. How will you measure and mitigate for other forms of pollution from wind turbines, including aluminum, zinc, and indium from corrosion from wind turbines?
28. How will you measure and mitigate for “forever chemicals” such as PFOAs and bisphenols (BPA) that will enter the environment from the turbines and infrastructure and that may be resuspended by anchor drops, chain dragging, and cable installations?
29. How will you prevent, mitigate for, and clean up inevitable oil spills from turbine hubs, diesel spills from substations and ships doing installation and maintenance?
30. How will local water quality be impacted by corrosion, spills, and wear and tear?
31. How will increased ship traffic affect marine mammals, especially whales and the likelihood of ship strikes?
32. How will these projects impact pleuston organisms such as velella velella, salps, planksters, sea slugs, jellyfish, Janthina pallida, copepods, and barnacles?

33. What are the anticipated impacts to habitat and wildlife from Electromagnetic Fields (EMFs) from wind energy areas and the subsea power cables?
34. How will you measure impacts to species particularly sensitive to EMFs including salmon, sea turtles, sharks, and others, whose navigation and prey finding may be disrupted?
35. How will this impact be mitigated?
36. With the dramatic decline of Pacific Northwest salmon species, is it appropriate to introduce ocean infrastructure that may further harm these critical keystone species?

D. Anchoring, Chains, and Undersea Impacts

37. How much chain and anchor cabling will be required for this project? Our understanding is roughly 175 miles for the turbines alone. Is this correct?
38. It is our understanding that each turbine will require at least three very large anchor chains consisting of links perhaps as large around as a human body. It is also our understanding that these anchor chains will drag across the ocean floor as waves and storms move the floating turbines back and forth on the ocean surface. How will this process affect marine life?
39. What will be the impact of establishing anchor point locations on the ocean floor?
40. It is our understanding that establishing anchor point locations requires dumping many tons of stones into the deep sea. Is this correct? If so, where will these stones be sourced and what will the cumulative impacts of that extraction and transportation be?
41. How will many square miles of a maze of chains and cables from the turbines and substations to the ocean floor impact the behavior of marine life?
42. What is the likelihood of whales striking or becoming entangled with cables or undersea chains and suffering impacts or mortality?
43. How will these projects cumulatively affect sediment on the ocean floor? For example, how much sediment will be disturbed and where will that sediment go? What will the impacts of sediment redistribution be on benthic organisms, as well as on fish, plankton, and other swimming organisms?
44. What will be the accumulated habitat loss created by chains and cables dragging on the ocean floor, potentially scouring the ocean floor as the turbine moves, and the suspended sediment this creates in the environment?
45. How will the redistribution of underwater habitat through the introduction of new hard surfaces such as the metal chains and anchors affect the distribution and population abundance of sea life?

E. Impacts to Birds

46. Wind turbine blades are known to kill large numbers of birds, especially larger birds. Given the project's location, any birds which are struck or killed will fall into the water and sink. How will the project measure impacts on bird populations?
47. If only estimates will be possible, why is this considered sufficient?
48. Will there be independent third-party monitoring not financed or associated with the wind turbine companies?
49. How will this project affect large and slow reproducing species such as pelicans and eagles?
50. Over what period of time has monitoring been conducted to determine where bird migrations fall in relation to these project areas? Why is this time considered sufficient?
51. What mitigation will be done for killing birds?

F. Cumulative Effects in Context

The biology of our planet is currently experiencing the sixth mass extinction of life on Earth. This is primarily driven by industrial human activity, including energy generation, transmission, mining, and offshore activities.

52. Please analyze how the development of these offshore wind energy projects will facilitate continued growth in energy demand and consumption, as well as material consumption, and how this will impact the climate and the ongoing ecological collapse. These analyses must incorporate a discussion of what the energy from these projects will be used to power, and, given that these are public waters, whether providing additional power to these users is in the public benefit. For example, energy projects are often discussed in terms of the number of households they would provide energy for, but the largest consumers of electricity remain industrial users, and increasingly data centers and AI are projected as driving massive demand increases.
53. How will the ecological effects of offshore wind energy projects, substations, transmission lines, subsea cables, maintenance trips, and the mining related to the above affect regional ecology and wildlife species in the context of the ongoing mass extermination of life on Earth? In other words, how will these projects contribute another “nail in the coffin” to species which are already facing catastrophic declines, including common species such as the California Gull?
54. According to the International Energy Agency, “Mineral demand from low-carbon power generation grows rapidly [in their projections], doubling in the STEPS [model] and nearly tripling in the SDS [model] over the period to 2040. Wind power plays a leading role in driving demand growth due to a combination of large-scale capacity additions and higher mineral intensity (especially with growing contributions from mineral-intensive offshore wind).” Additionally, they note that “Demand for rare earth elements (REEs) – primarily for EV motors and wind turbines – grows threefold in the STEPS and more than

sevenfold in the SDS by 2040." The report continues, "As countries step up their climate ambitions, clean energy technologies are set to become the fastest-growing segment of demand for most minerals. Their share of total demand edges up to over 40% for copper and REEs, 60-70% for nickel and cobalt and almost 90% for lithium by 2040 in the SDS" and notes that "Wind turbines require concrete, steel, iron, fibreglass, polymers, aluminium, copper, zinc and REEs. Mineral intensities not only depend on the turbine size, but also on the turbine type. For example, turbines based on permanent-magnet synchronous generators – which dominate the offshore market due to their lighter and more efficient attributes as well as lower maintenance costs – require REEs. In the SDS, demand for REEs in wind – neodymium and praseodymium in particular – is set to more than triple by 2040, driven by the doubling of annual capacity additions and a shift towards turbines with permanent magnets. Copper demand reaches 600 kt per year in 2040, propelled by offshore wind requiring greater cabling. Offshore wind accounts for nearly 40% of copper demand from wind despite accounting for only 20% of total wind capacity additions." Therefore, cumulative analysis for these projects should include the supply-chain impacts associated with greater demand for copper and rare-earth elements (REEs). Will BOEM take responsibility for permitting projects which increase global demand for these materials?

55. According to Rees and Seibert's 2022 paper *Through the Eye of a Needle: An Eco-Heterodox Perspective on the Renewable Energy Transition*, "Rare earth metal processing for wind turbines already generates as much radioactive waste as the nuclear industry". How much radioactive waste will be associated with the mining to construct these wind turbine projects?

56. If you will not answer any of these questions in your analysis, why not?

G. Global Warming

57. Currently, fossil fuels are being burned at a greater rate than ever before in history. This is occurring despite continued record-breaking growth in renewable energy generation, and is well documented in scientific literature. This project is being promoted primarily to address the climate crisis; without subsidies from the federal government, these projects would be financially infeasible. But due to demand growth, it appears that renewable energy is not sufficient to address the global warming crisis. How will the federal government guarantee that this project will result in fossil fuel emissions being reduced?

58. If you cannot guarantee this, why not?

59. This project will involve the creation of significant greenhouse gas emissions. For example, these sources include mining and smelting steel and copper, fabricating metal pieces, cutting balsa wood for the production of the turbines, producing the lubrication oils used in turbine nacelles, burning diesel fuel and other forms of fossil fuels in the ships which will carry the materials and install the wind turbines offshore, as well as trucks and various forms of terrestrial transportation to bring the materials to their

destination and so on. What will the cumulative greenhouse gas emissions of this project be, including ongoing maintenance and decommissioning?
60. How will you measure and account for the significant greenhouse gas emissions from the infrastructure associated with the wind turbines, including turbine bases, anchors, chains, offshore substations, electrical cables, onshore substations, new grid lines, port expansions, specialized ships and equipment for transporting, installing, and maintaining the turbines, substations, bases, and cables, and the equipment, installation, and maintenance of all onshore infrastructure?
61. Of particular concern whenever new electrical substations are built is the potential for sulfur hexafluoride (SF6) leaks. SF6, used as an insulator in electrical equipment, is a greenhouse gas with 23,500 times the warming potential of CO2 and remains in the atmosphere for 3,200 years. All substations leak SF6. How will you account for such leaks in your estimates for the global warming impacts of these projects?
62. Are the greenhouse gas emissions involved in this project consistent with a 1.5 degree Celsius global warming limit?
63. Will additional LNG power plants be required to provide backup energy (“baseload generation”) for these energy projects in the event power generation from these wind energy areas drops during times of peak demand?
64. If so, how many will be built, and where? What will be the impacts of these facilities?

H. Impacts to Native American Sites and Cultural Resources

63. Native American tribes have expressed serious concerns about the development of offshore wind energy projects along the Pacific Coast. We share these concerns. What are the impacts of these proposed projects to traditional cultural sites on the land areas that may be impacted?
64. What are the offshore impacts to submerged cultural sites?
65. What are the impacts to sacred and traditional-use areas in terms of noise or visual impact?
66. What are the impacts to culturally important species, including salmon and whales, as well as all the creatures lower in the food chain which support their continued existence and flourishing?
67. What will be the impact to culturally important bald eagles?
68. How will these impacts be mitigated?
69. If these impacts cannot be mitigated, will the projects be rejected?

I. Noise and Light Pollution

70. Many marine species are heavily impacted by noise, including whales and dolphins such as humpbacks, orcas, North Pacific right whales, and others who migrate, live, and breed on the West Coast. Noise from seismic ocean floor testing during project exploration phases, increased ship noise for installation and maintenance, pile driving, anchor dragging, chain dragging, wind turbine vibrations, and more will all dramatically increase the anthropogenic noise levels for these projects. How will this noise be measured?
71. Will there be independent third-party monitoring? If not, why not?
72. How will the increased noise level impact marine life, particularly endangered species such as North Pacific right whales?
73. How will the impact of this noise be mitigated?
74. Many oceanic species rely on light from the night sky for orientation in the water column. Birds are also sensitive to light pollution. What lighting will be installed at these offshore projects?
75. How will this light pollution affect wildlife, including birds, bats, and marine species down to the size of plankton?
76. Will this light pollution attract additional bats out to sea? This is a concern given that bats are especially vulnerable to wind turbine blades.

J. Mining and Extraction Impacts Globally

79. The construction of offshore wind turbines requires materials such as concrete, steel, nickel, iron, fiberglass, various polymers, aluminum, copper, zinc, manganese, chromium, rare earth metals, and balsa wood. What is the cumulative environmental impact of the mining and extraction process for these materials in terms of greenhouse gas emissions, pollution, water quality reduction, and habitat destruction?
80. Logging for balsa wood to be used in wind turbine blades has been shown to be increasing deforestation in the Ecuadorian Amazon with significant impact on indigenous communities and ecosystems. Where will the materials used in the turbine blades for these projects come from? What will the impacts be of the extraction, processing, and transportation of these materials?
81. Will there be economic and material links between Oregon's offshore wind energy projects and mining and extraction in locations known for human rights abuses and serious violations of environmental protection?
82. Will there be slave labor implicated in the supply chains for these wind turbines?
83. Will there be species extinctions and extirpations related to the material and energy supply chains for these wind turbine projects?
84. Is abuse of indigenous people implicated in the supply chains for these projects? For example, one of the world's largest nickel-producing countries is Indonesia, and the nickel mine on Halmahara Island is known to be encroaching on the territory of the uncontacted tribe called the Hongana Manyawa. This is not an isolated incident in mining supply chains globally.

K. Terrestrial Impacts

85. What will be the cumulative environmental, cultural, and social impacts of onshore transmission project expansions?
86. What will be the cumulative environmental, cultural, and social impacts of onshore port expansions related to these projects?
87. What will be the cumulative environmental, cultural, and social impact of onshore man camps or other expansions of worker housing in areas related to these projects? This is particularly relevant as it is known that large industrial projects tend to increase the rates of drug use, petty crimes, and violence, including sexual violence in communities. This has especially affected indigenous communities (see “MMIW”). How will these impacts be mitigated?
88. The Oregon Coast is a place of unique beauty. In 1967, the legislature protected Oregon's beaches permanently under the Beach Bill. The unique natural beauty of this coastline is world-renowned and millions of people visit each year. It is well known that spending time in nature has positive health benefits. How will the development of these offshore wind energy projects affect the aesthetics of the Oregon coast?
89. What will be the cumulative impact on coastal tourism and visitation?
90. What will the economic ramifications be for communities located directly in the viewshed of these projects?
91. How will local communities be affected by the increased traffic, pollution, trucking, and influx of workers related to these projects?
92. How will local air quality be affected?
93. How will local potable water quality and quantity be affected?
94. If you will not consider transmission projects and other terrestrial impacts as part of this process, why not? Developing offshore wind energy projects necessarily involves these onshore impacts and they are significant. It is impossible to separate the two. Why attempt to do so other than to bypass community understanding of the extent of cumulative impacts?
How will housing prices be affected?
How will electricity rates be affected?
How will onshore road maintenance costs be affected?

L. Monitoring, Maintenance, and Decommissioning

95. What monitoring measures will be used to ensure project compliance with environmental laws and regulations?
96. What is the worst case scenario possible if one or multiple turbines and or substations break free from their mooring anchors during a storm?

97. Given the project's remoteness and the difficulty of access to the offshore surface area, let alone the subsurface, how will the government provide assurance to the public that the data we are receiving is legitimate?
98. Will there be independent third-party monitoring not conducted by BOEM or other agencies that could be politically penalized for reporting negative results?
99. What is the projected lifespan of these projects?
100. During that time, how many turbines are expected to fail?
101. What dangers and risks to oceanic life and ecosystems will these failures pose?
102. What is the projected cost of decommissioning and completely removing all turbine components as well as anchors and chains from the project sites?
103. We believe that such decommissioning costs are usually set at 50% of installation costs somewhat arbitrarily. Why are these costs set at 50%?
104. Will the company be required to post this full amount as a bond?
105. What sort of habitat restoration requirements will be placed on the offshore wind energy corporations at end of project life?
106. Will BOEM make assumptions regarding the carbon footprint associated with future maintenance trips and decommissioning, or will it use carbon intensity for current technologies? Why or why not?
107. How will turbine hub fires and substation fires be put out?
108. What are the impacts expected from turbine hub and substation fires?
109. How will turbines that “flop” (fall at the base) be retrieved and/or fixed?
110. What are the impacts to the environment from “flopped” turbines, and associated pollution?
111. What will happen to turbines that fail, and to those which are retired at the end of their operational usefulness?
112. What will happen to blades that fail, and to those which are retired at the end of their operational usefulness?

Conclusion

The potential ecological impacts associated with offshore wind turbine project construction off the Oregon coast are immense and severely under-studied. It is essential that BOEM conduct extremely thorough and wide reaching studies of the impacts of these projects, including the cumulative impacts. These studies should also assess the cradle-to-grave impacts of producing wind turbines and operating these offshore wind energy facilities.

When accounting for greenhouse gas emissions, impacts to wildlife species, and perhaps most especially the impacts of mining the materials and fuels necessary to build and operate these wind turbine facilities, the harms of these offshore wind energy projects are significant and global.

We oppose these projects, and alongside local community members, Tribes, fishermen, and environmentalists, we will oppose them. Global warming is a serious crisis, but further

investment and government subsidy of massive industrial projects which are extremely destructive to the natural environment is not the proper path forward. Instead, communities and government should be working to re-localize and scale down our consumption of natural resources and build a way of life that does not require endless growth. This is the only true path to sustainability. Anything less is self-delusion.