

Offshore Wind on California's North Coast



Synthesis and Next Steps
October 19, 2020

Presented by Arne Jacobson
Schatz Energy Research Center



Photo credit: Maia Cheli

Feasibility of offshore wind on California's north coast

- For the past ~18 months, our team has been studying various aspects of the feasibility of offshore wind on the north coast through funding from state and federal agencies.

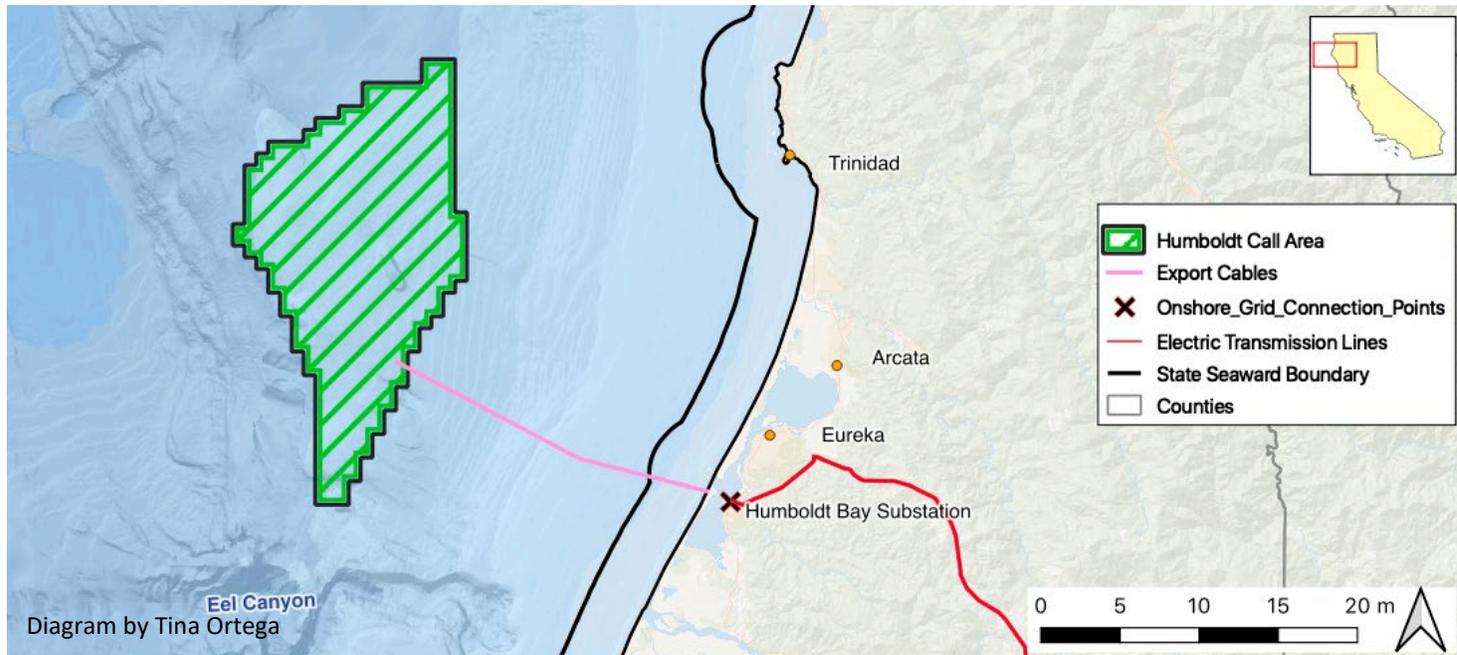


Image source: Wikipedia Commons (https://upload.wikimedia.org/wikipedia/commons/7/76/Agucadoura_WindFloat_Prototype.jpg) →



Acknowledgments

Project Funders



OCEAN
PROTECTION
COUNCIL



Governor's Office of
Planning and Research

Team Members

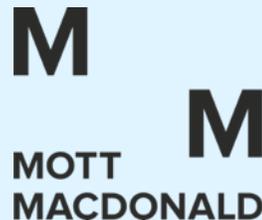
Team lead: Arne Jacobson; **Project manager:** Mark Severy, Jim Zoellick; **Team members:** Peter Alstone, Francisco Alvarez*, Julia Anderson*, Zach Alva*, Max Blasdel, Laura Casali, Charles Chamberlin, Greg Chapman, Maia Cheli, Ciara Emery*, Tanya Garcia, Carisse Geronimo*, Ian Guerrero, Steve Hackett, Andrew Harris, Eileen Hemphill-Haley, Mark Hemphill-Haley, Craig Mitchell*, Christina Ortega*, Laurie Richmond, Nicole Salas*, Sierra Stehman, Wyeth Wunderlich*, Amin Younes*

*participated as student researchers

HUMBOLDT STATE UNIVERSITY



Major Partners



H. T. HARVEY & ASSOCIATES

Ecological Consultants



Navy
Region
Southwest

Off-shore wind feasibility analysis scope

Funded by Bureau of Ocean Energy Management (BOEM)

Resource
assessment

Grid
compatibility /
transmission

Subsea
cable

Economic
analysis

Funded by California Ocean Protection Council (OPC)

Environmental
impact

Port
infrastructure

Community /
stakeholder
perspectives

Policy
analysis

Funded by California Governor's Office of Planning and Research (OPR)

Military
compatibility

Geologic /
seismic

Subsea cable
environmental

Where can the reports from the study be found?

<http://schatzcenter.org/publications/>



Photo Credit: Maia Cheli

California North Coast Offshore Wind Studies (2020)

- 1. [Description of Study Assumptions](#) (2020)
- 2. [Wind Speed Resource and Power Generation Profile Report](#) (2020)
- 3. [Offshore Wind and Regional Load Compatibility Report](#) (2020)
- 4. [Interconnection Feasibility Study Report](#) (2020)
- 5. [Subsea Transmission Cable Conceptual Assessment](#) (2020)
- 6. [Electricity Market Options for Offshore Wind](#) (2020)
- 7. [Electricity Market Revenue Study](#) (2020)
- 8. [Interconnection Constraints and Pathways](#) (2020)
- 9. [Economic Viability of Offshore Wind in Northern California](#) (2020)
- 10. [Economic Development and Impacts](#) (2020)
- 11. [Coastal Infrastructure Co-Benefits Linked to Offshore Wind Development](#) (2020)
- 12. *Electricity transmission policy analysis – coming soon*
- 13. [Existing Conditions and Potential Environmental Effects](#) (2020)
- 14. [Feasibility of Potential Subsea Cable Corridor Scenarios](#) (2020)
- 15. *Environmental permitting policy analysis – coming soon*
- 16. [Overview of geological hazards](#) (2020)
- 17. [Anchoring technology risk assessment](#) (2020)
- 18. [Export cable landfall](#) (2020)
- 19. *Port infrastructure assessment report – coming soon*
- 20. [Social impacts to other communities that experienced offshore wind](#): a literature review (2020)
- 21. [Stakeholder benefits and concerns](#) (2020)
- 22. [Subsea transmission cable stakeholder identification](#) (2020)
- 23. [Military mission compatibility](#) (2020)

Public Webinar Series to Discuss Findings

Sept 14: Energy Production and Delivery and Economic Development

Presenter: Schatz Energy Research Center

Sept 21: Ecological and Geological Environment

Presenters: H.T. Harvey Ecological Consultants
Geology Department, Humboldt State

Recordings of prior sessions
are available at:

<http://schatzcenter.org/wind/>

Sept 28: Port and Coastal Infrastructure

Presenters: Mott MacDonald, Coastal Engineers

Oct 5: Community Perspectives on Regional Impacts and Opportunities

Presenter: Environmental Science & Management, Humboldt State

Oct 19: Reflections and Next Steps

Presenters: Schatz Energy Research Center
State and Federal Agency Representatives

Public Webinar Series to Discuss Findings

“If we are going to have a transition ... in terms of energy and the way we develop our society, it has to be a just transition. And that transition, the first step ... has to be information and really making sure that everybody has an equitable access to the information ... and I think this [webinar series] is a good start.”

- Mike Wilson, Humboldt County 3rd District Supervisor

Feasibility of offshore wind on California's north coast

- At this stage, we know a fair amount about factors that influence offshore wind feasibility and potential, though additional data and analysis are needed in many areas.

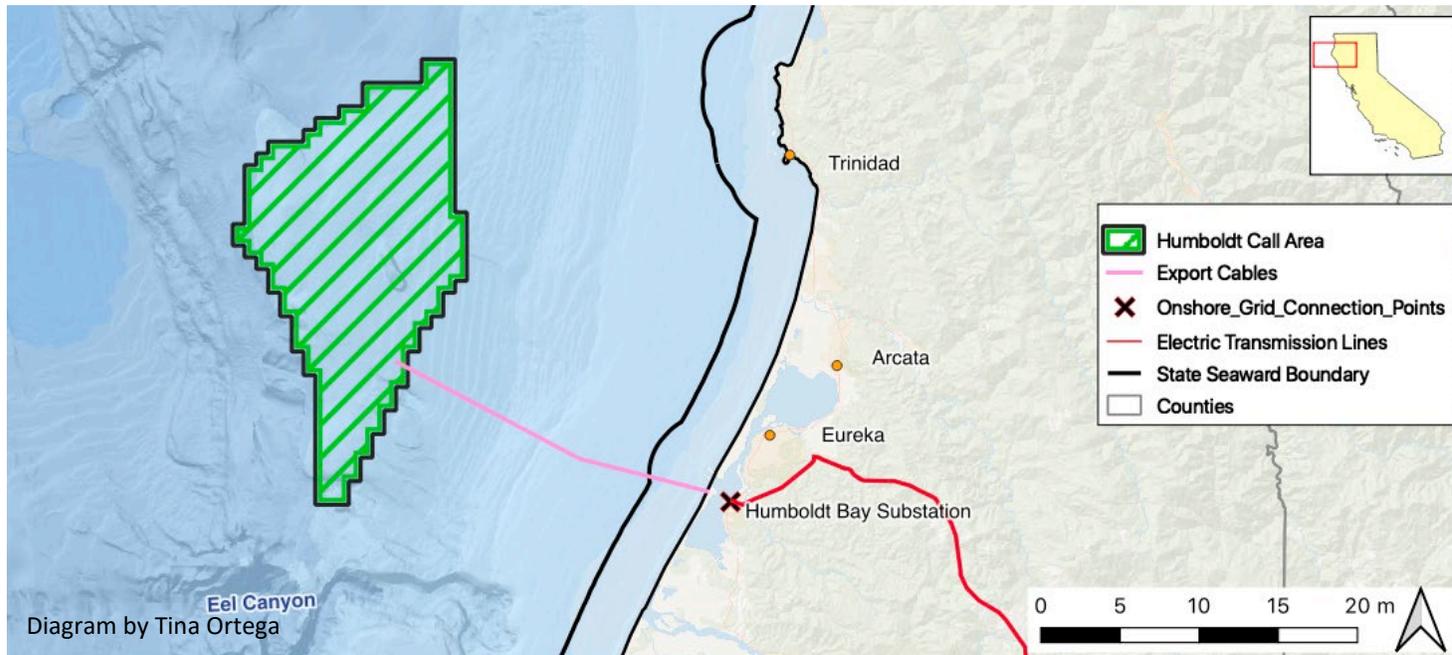


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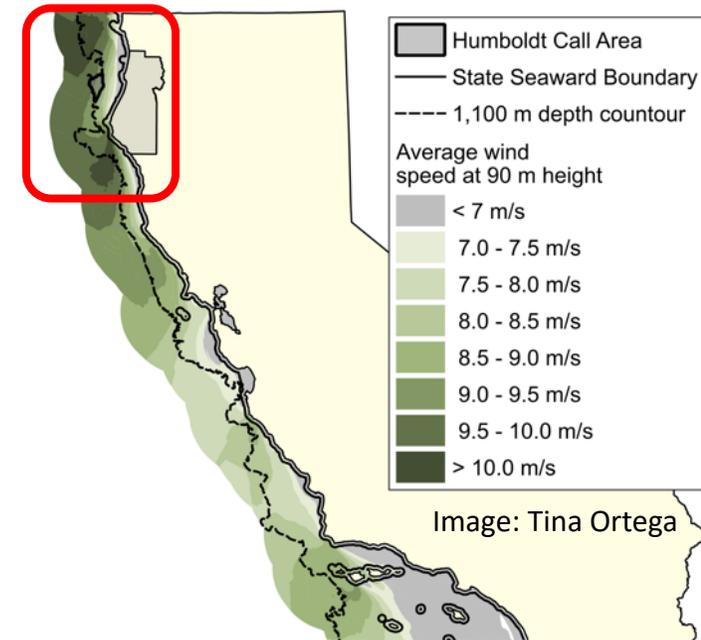
North coast offshore wind feasibility: what do we know?

Topic

The north coast offshore wind resource is world class

Knowledge Status

- The National Renewable Energy Laboratory (NREL) recently updated their offshore wind speed resource model. This can be used to update our analysis (in process).
- On Oct 8, Pacific Northwest National Laboratory deployed a buoy in the Humboldt Call Area that will provide detailed information about the wind resource and other relevant information.



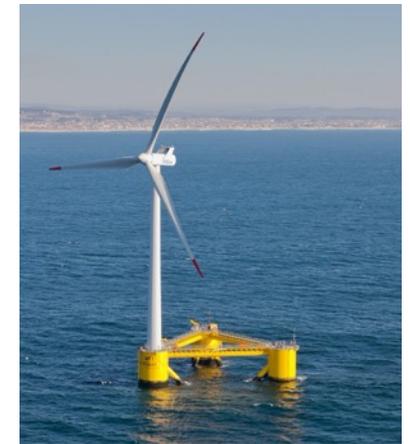
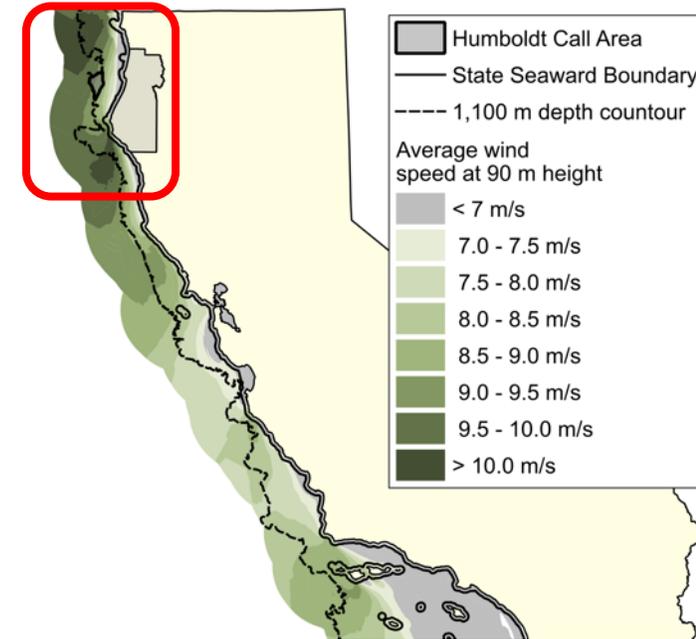
North coast offshore wind feasibility: what do we know?

“I have heard comments such as that there are lots of other places we can put wind projects. I want to firmly correct this. World class wind sites are rare. The one off the Humboldt County coast can provide highly efficient wind power at times of the day and days of the year when we need it to complement solar power and other forms of clean energy.”

- Jana Ganion, Blue Lake Rancheria Tribe

North coast offshore wind feasibility: what do we know?

Topic	Knowledge Status
The north coast offshore wind resource is world class	Confident that resource is enormous, but analysis should be refined.
North coast offshore wind can contribute substantially to California's climate and clean energy goals	



North coast offshore wind feasibility: what do we know?

Topic	Knowledge Status
The north coast offshore wind resource is world class	Confident that resource is enormous, but analysis should be refined.
North coast offshore wind can contribute substantially to California's climate and clean energy goals	Confident that resource could produce substantial renewable energy. Accuracy linked to wind data quality.
Offshore wind is a low carbon energy source	High degree of confidence

Resources

Reports

(<http://schatzcenter.org/publications/>)

Report 2. [Wind Speed Resource and Power Generation Profile Report](#) (2020)

Report 3. [Offshore Wind and Regional Load Compatibility Report](#) (2020)

Webinar 1 (Sept 14) recording (<http://schatzcenter.org/wind/>)

North coast offshore wind feasibility: what do we know?

Topic	Knowledge Status	Resources
The economic viability of offshore wind is connected to the wind farm scale		<p>Reports (http://schatzcenter.org/publications/)</p> <p>6. Electricity Market Options for Offshore Wind (2020)</p> <p>7. Electricity Market Revenue Study (2020)</p> <p>9. Economic Viability of Offshore Wind in Northern California (2020)</p> <p>10. Economic Development and Impacts (2020)</p> <p>Webinar 1 (Sept 14) recording (http://schatzcenter.org/wind/)</p>

Perspectives on offshore wind: what have we heard?

“We're seeing all the demand for offshore wind energy continue to grow. Technology advances, falling cost, and tremendous economic potential make offshore wind a promising avenue for diversifying and balancing California's energy portfolio.”

- Necy Sumait, Bureau of Ocean Energy Management

“If offshore wind were to take off, it will require skilled labor. ... Long term, these types of projects could create sustainable jobs. ... We would like to see the work done in an environmental and safe manner.”

- Jeff Hunerlach, Operating Engineers Local #3, District Union Representative

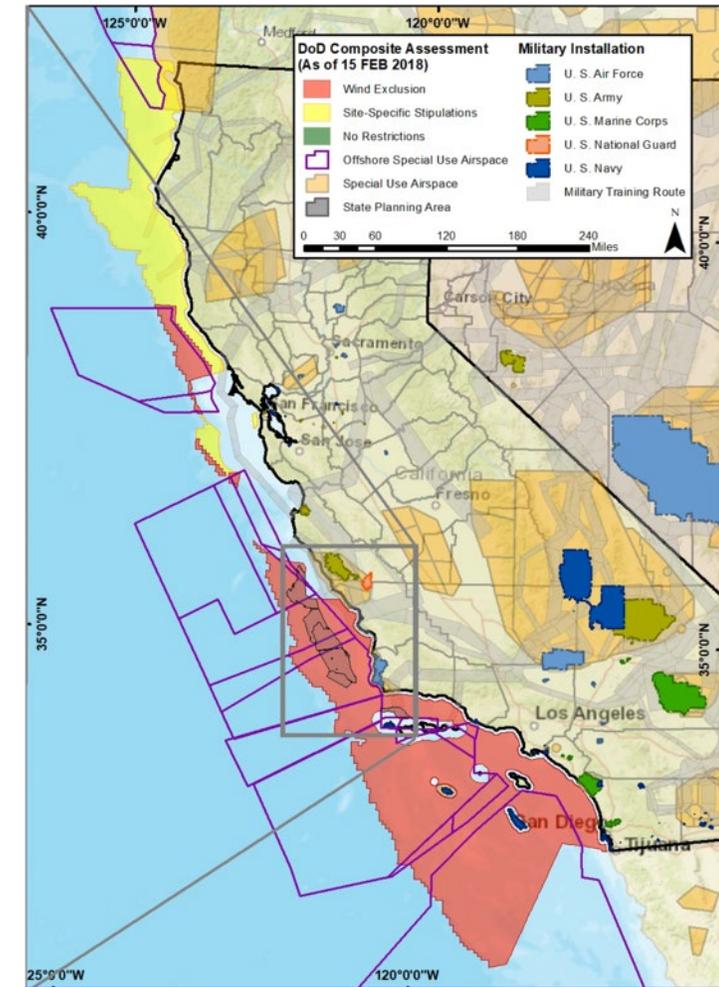
North coast offshore wind feasibility: what do we know?

Topic

Development of offshore wind on the north coast could be compatible with the U.S. military mission.

Knowledge Status

A representative of the U.S. Department of Defense indicated that, “...*DoD Regional Offshore Team ... continue[s] to find that offshore wind development within the Humboldt Call Area can be compatible with DoD’s mission...*”



North coast offshore wind feasibility: what do we know?

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Resources

Reports

(<http://schatzcenter.org/publications/>)

23. [Military mission compatibility](#) (2020)

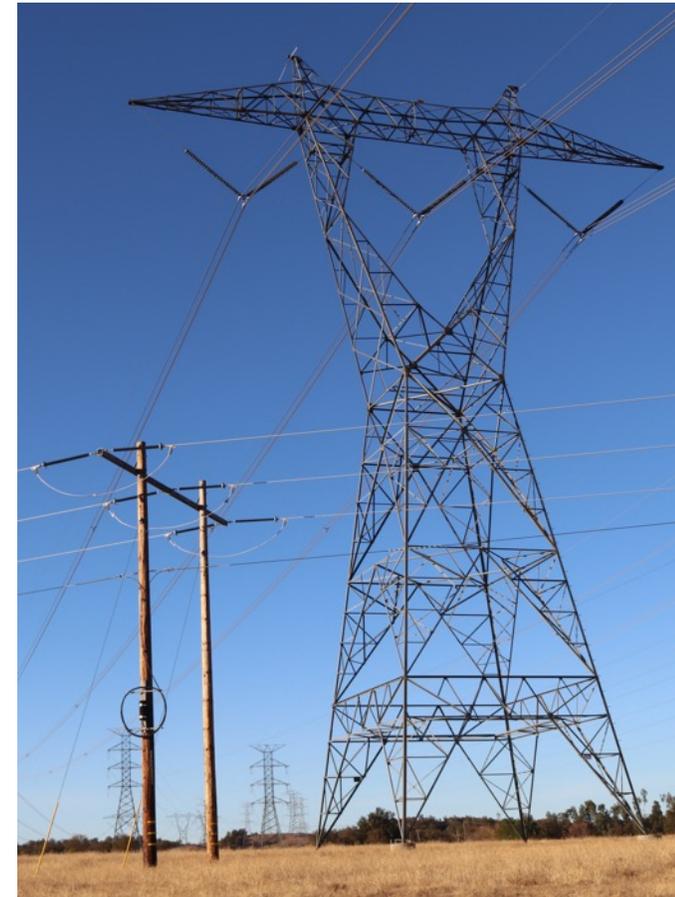
Webinar 1 (Sept 14) recording

(<http://schatzcenter.org/wind/>)

North coast offshore wind feasibility: what do we know?

Topic	Knowledge Status
Transmission infrastructure represents a major barrier	Confident that this is true. There is uncertainty about the costs for both smaller and larger scale offshore wind development options.

- To explore possibilities to reduce the cost of transmission for small to medium commercial-scale projects, BOEM is funding the Schatz Center to carry out additional analysis about this topic. The work will be carried out in partnership with NREL, Quanta Technology, and PG&E.



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Resources

Reports

(<http://schatzcenter.org/publications/>)

4. [Interconnection Feasibility Study Report](#) (2020)

5. [Subsea Transmission Cable Conceptual Assessment](#) (2020)

8. [Interconnection Constraints and Pathways](#) (2020)

12. *Electricity transmission policy analysis – coming soon*

Webinar 1 (Sept 14) recording (<http://schatzcenter.org/wind/>)

North coast offshore wind feasibility: what do we know?

“We appreciate that we have work to do in California, in terms of questions about how we can overcome obstacles that we see, both on the north coast and on the central coast to find the potential or to realize the potential of offshore wind. At the same time, the SB 100 process and the energy work that the state agencies are doing right now are also a really important point in helping us understand the options and choices and tradeoffs confronting us as we move to meet our goals.”

- Karen Douglas, California Energy Commissioner

North coast offshore wind feasibility: what do we know?

Topic

Knowledge Status

Humboldt Bay can provide a staging ground for assembly, deployment, and maintenance of floating offshore wind systems.



North coast offshore wind feasibility: what do we know?

Topic	Knowledge Status
Humboldt Bay can provide a staging ground for assembly, deployment, and maintenance of floating offshore wind systems.	The port has good potential to support offshore wind, but investment is needed.
	Environmental impacts, cultural resources, and residents' concerns must be considered / addressed.
	There will be limits to the size of the systems and the seasonality of deployment.

Resources

Reports

(<http://schatzcenter.org/publications/>)

11. [Coastal Infrastructure Co-Benefits Linked to Offshore Wind Development](#) (2020)

18. [Export cable landfall](#) (2020)

19. *Port infrastructure assessment report – coming soon*

Webinar 3 (Sept 28) recording (<http://schatzcenter.org/wind/>)

Perspectives on offshore wind: what have we heard?

“Our objective is to be the West Coast hub for renewable energy, to be the assembly, fabrication, substructure, anchoring, manufacturing -- to basically start the development [of offshore wind] in Humboldt Bay and then ... also supply the wind turbines for other areas.”

- Larry Oetker, Humboldt Bay Harbor and Recreation District

“How would this all affect peninsula residents, who have already long experienced the negative impacts of industry but have thus far lacked any of the benefits such as robust community services or political influence?”

- Jennifer Savage, Surfrider Foundation and Humboldt Bay Peninsula Resident

“We will be expecting certain industry investments in the region ... which are a part of community benefits models that are now typical of these large industrial buildouts.”

- Jana Ganion, Blue Lake Rancheria Tribe

Humboldt Bay is in Ancestral Wiyot Territory



- Infrastructure and operations related to north coast offshore wind development would cut across the ancestral territories of multiple Native American Tribes.
- Offshore wind development activities in and around Humboldt Bay would take place in the ancestral territory of the Wiyot People

Perspectives on offshore wind: what have we heard?

“The Wiyot Tribe has long supported renewable energy development that is well sited, and [we] are open minded and excited about the potential for offshore wind on the north coast, especially the community-based approach and stakeholder involvement that this group of partners is taking early on during the planning process... we hope that with early engagement with the Tribe and other stakeholders that such a project could avoid and mitigate any negative impacts. And, we're excited to take a deeper look at some of the biological survey work ... and digest more literature on all these subjects.”

- Adam Canter, Wiyot Tribe

North coast offshore wind feasibility: what do we know?

Topic

Knowledge Status

Onshore and offshore environmental impacts associated with offshore wind development must be considered and addressed.



North coast offshore wind feasibility: what do we know?

Topic	Knowledge Status
Onshore and offshore environmental impacts associated with offshore wind development must be considered and addressed.	Confident that this is true.
	Much is known about ecology of region, but uncertainties exist regarding environmental impacts, esp. for seabirds and marine mammals.
	Analysis so far is based on existing data. Extensive monitoring needed.
	Mitigation opportunities are expected.

Resources

Reports

(<http://schatzcenter.org/publications/>)

13. [Existing Conditions and Potential Environmental Effects](#) (2020)

14. [Feasibility of Potential Subsea Cable Corridor Scenarios](#) (2020)

Webinar 2 (Sept 21) recording
(<http://schatzcenter.org/wind/>)

Perspectives on offshore wind: what have we heard?

“The top concerns that were expressed in the [41] interviews we conducted ... related to environmental impacts.”

- Laurie Richmond, Humboldt State University

“We are honestly still in the early stages of wind energy development both onshore and especially here offshore. So we're going to learn a lot in the next couple of years about risks, impacts, and ways to reduce those impacts. So ensuring that adaptive management is part of the project and that we have well defined thresholds of when we need to include an additional mitigation measure is going to be important. I think that that would help to reduce some of the concerns from some of the environmental community that is particularly concerned about impacts on biodiversity -- I think that inclusion of those adaptive management measures is going to go a long ways.”

- Tom Wheeler, Environmental Protection Information Center (EPIC)

Seabird 3D Distribution & Relative Risk from California Offshore Wind

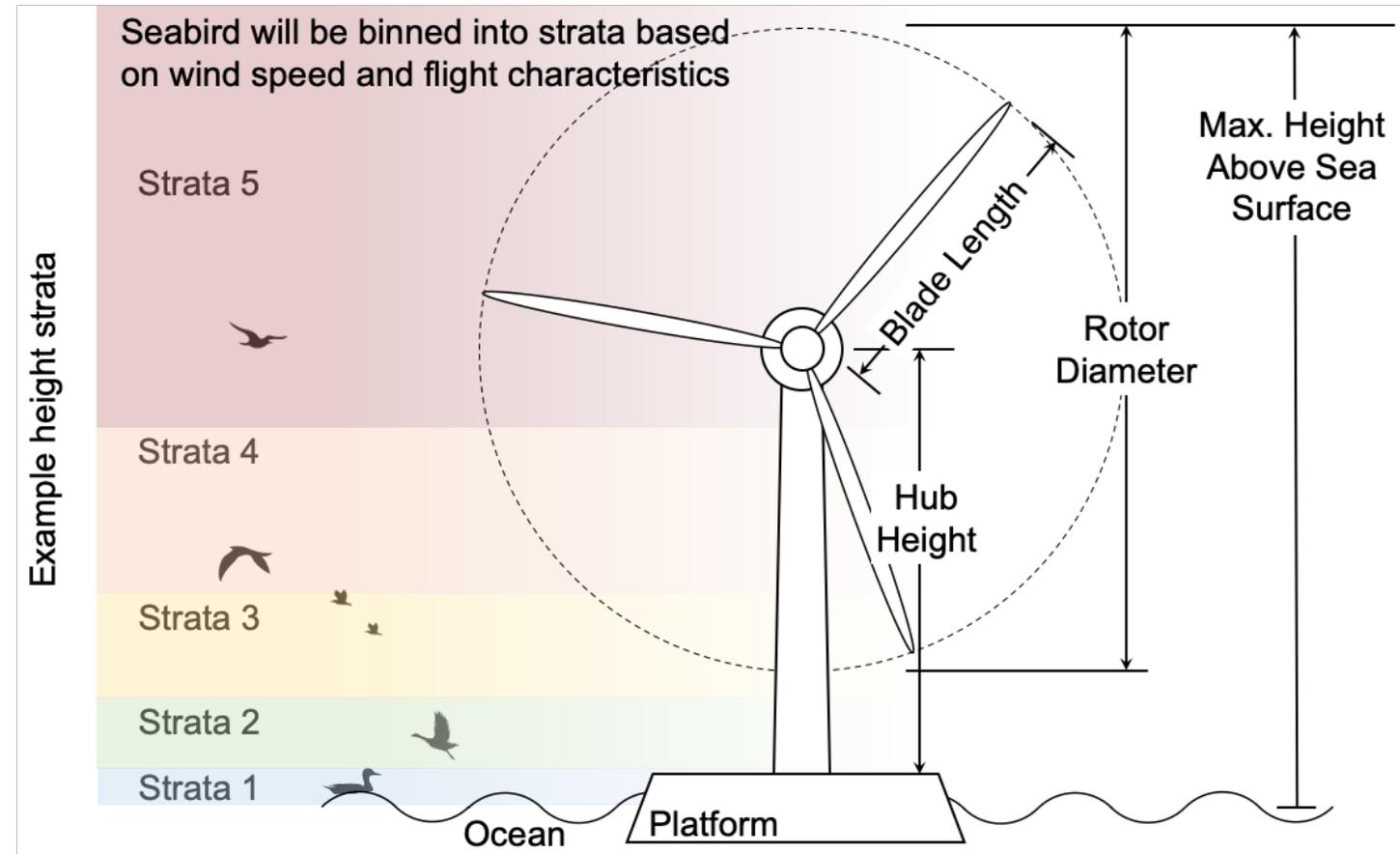


H. T. HARVEY & ASSOCIATES

Ecological Consultants

This CEC-funded project will:

- Develop a three-dimensional seabird distribution model for the California Current
- Evaluate the relative risk of offshore wind impacts to seabirds for different locations and turbine heights
- Compare tradeoffs between seabird risk and power generation

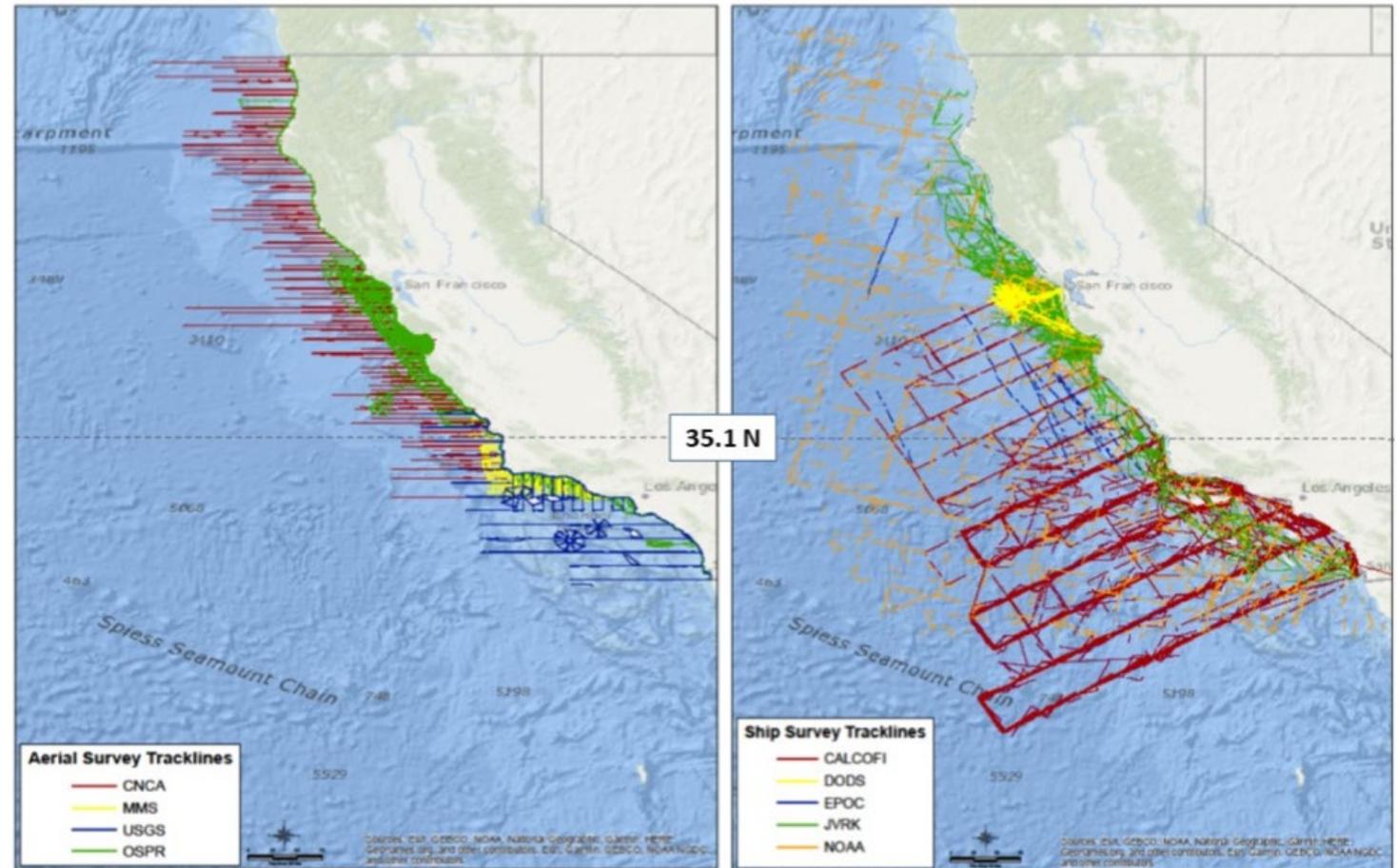


Seabird 3D Distribution & Relative Risk from California Offshore Wind

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- Develop a three-dimensional seabird distribution model for the California Current
- Evaluate the relative risk of offshore wind impacts to seabirds for different locations and turbine heights
- Compare tradeoffs between seabird risk and power generation

Ship and aerial survey data from 114 surveys spanning 1976 - 2006 in the California Current to be included in this project (from Ford et al. unpublished data).

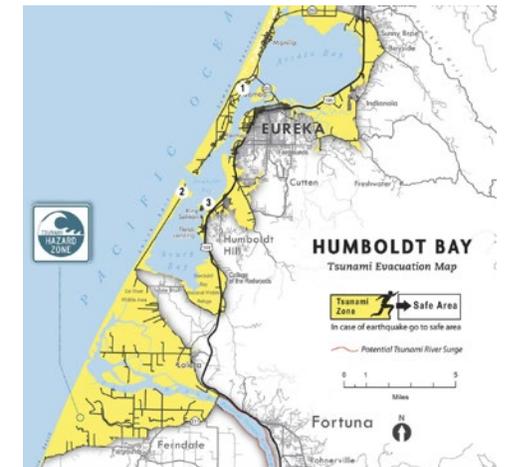
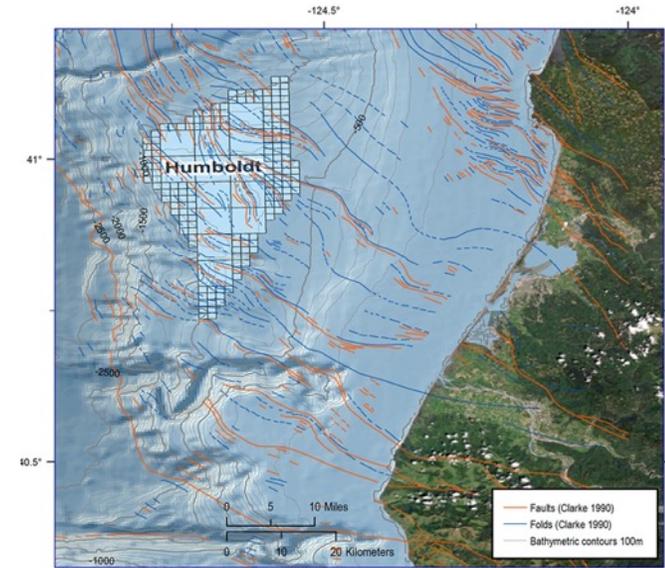


North coast offshore wind feasibility: what do we know?

Topic

There are significant potential geological hazards within the region that will need to be investigated and addressed for possible development of an offshore wind farm.

Knowledge Status



North coast offshore wind feasibility: what do we know?

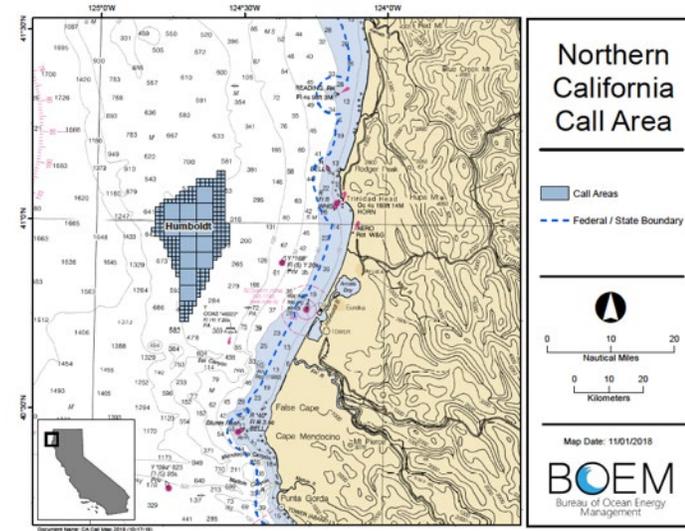
Topic	Knowledge Status	Resources
There are significant potential geological hazards within the region that will need to be investigated and addressed for possible development of an offshore wind farm.	Confident that significant geologic hazards exist.	Reports (http://schatzcenter.org/publications/)
	Analysis to date is based on existing data. Additional data collection is needed, including geologic studies specific to the Humboldt Call Area.	16. Overview of geological hazards (2020) 17. Anchoring technology risk assessment (2020)
	Additional analysis regarding the impact of geologic hazards on offshore wind systems, including onshore infrastructure, is needed.	Webinar 2 (Sept 21) recording (http://schatzcenter.org/wind/)

North coast offshore wind feasibility: what do we know?

Topic

Knowledge Status

The permitting process is complex, involves multiple permitting agencies, and would take place over several years.



North coast offshore wind feasibility: what do we know?

Topic	Knowledge Status
The permitting process is complex, involves multiple permitting agencies, and would take place over several years.	The permitting process is definitely complex.
	Permitting will include opportunities for public input.
	The BOEM lease auction is a key next step.
	Development of a wind farm could take 5-7 years (or more) after the auction.

Resources

Reports

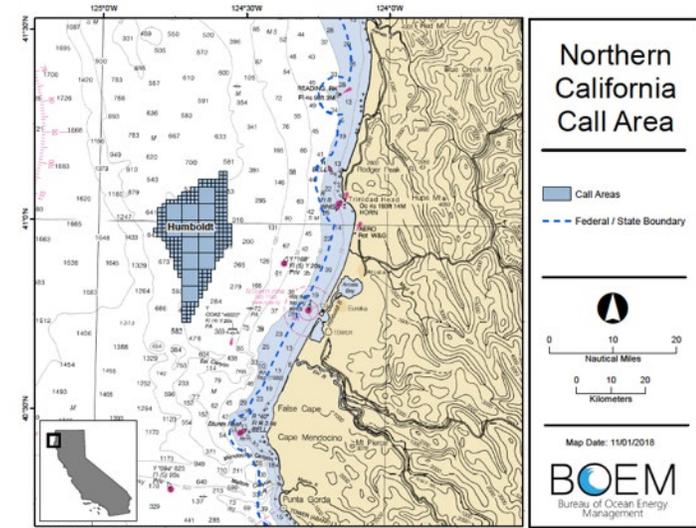
<http://schatzcenter.org/publications/>

15. *Environmental permitting policy analysis – coming soon*

Perspectives on offshore wind: what have we heard?

“If you were to ask fishermen what they really think about [offshore wind], I think you might find that most fishermen will oppose [it]. ... The most definitive impact would be a loss of fishing grounds a lot of people think we can go fishing everywhere in the ocean, but that really is not the case. If you were to draw a map of the ocean and carve out the rockfish conservation areas where we can't fish and the essential fish habitats that we can't fish, the marine protected areas that we can't fish, and there is a laundry list of other areas. ... We really can't afford to lose any more fishing grounds.”

- Harrison Ibach, Humboldt Fishermen's Marketing Association



Perspectives on offshore wind: what have we heard?

Our team gathered information about the perspectives of community members and other interested parties during 2018-2020 through numerous interviews and meetings.

Topic	Knowledge Status
There are a variety of perspectives related to offshore wind development on the north coast.	



Perspectives on offshore wind: what have we heard?

Our team gathered information about the perspectives of community members and other interested parties during 2018-2020 through numerous interviews and meetings.

Resources

Reports

(<http://schatzcenter.org/publications/>)

20. [Social impacts to other communities that experienced offshore wind](#): a literature review (2020)

21. [Stakeholder benefits and concerns](#) (2020)

22. [Subsea transmission cable stakeholder identification](#) (2020)

Webinar 4 (Oct 5) recording (<http://schatzcenter.org/wind/>)

Topic	Knowledge Status
There are a variety of perspectives related to offshore wind development on the north coast.	It is clear and unsurprising that many perspectives exist.
	Many people/groups are in learning mode. There is a strong interest to learn more about the various dimensions of offshore wind.

Perspectives on offshore wind: what have we heard?

“Climate change is a driver for why we are here, why we are discussing these issues today ... The status quo of energy and the status quo of our existence on the planet is not going in the right direction, and we are having these conversations because we have a need from a global perspective to address that.”

- Mike Wilson, Humboldt County 3rd District Supervisor

“There's a long history in Humboldt County of boom and bust cycles with industries. We saw it first with gold. We saw it with timber, we saw it most recently with cannabis. And so what we see in these industries is that there's an impact on the environment during the course of resource extraction, and then the citizens of Humboldt County and the tribes are left with the environmental impacts when people leave. So we're concerned that this isn't another one of those scenarios -- that it's just not an investment in wind infrastructure or electrical infrastructure, but it's an investment in people and human capital. That there's some long-lasting prospect for job opportunities for the citizens of Humboldt County.”

- Jason Ramos, Tribal Council Member, Blue Lake Rancheria

Contact Information



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Photo credit: Maia Cheli