California North Coast Offshore Wind Studies

Exploring the Feasibility of Offshore Wind Energy for the California North Coast

A summary report of the 2020 webinar series

This report was prepared by Maia Cheli and Arne Jacobson of the Schatz Energy Research Center and published in December 2020. It is part of the Schatz Center's *California North Coast Offshore Wind Studies* collection, edited by Mark Severy, Zachary Alva, Gregory Chapman, Maia Cheli, Tanya Garcia, Christina Ortega, Nicole Salas, Amin Younes, James Zoellick, & Arne Jacobson.

The series is available online at schatzcenter.org/wind/

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Disclaimer

This project was funded by the California Natural Resources Agency, Ocean Protection Council. The content does not represent the official views of policies of the State of California.

This report was created under agreement #C0304300

About the Schatz Energy Research Center

The Schatz Energy Research Center at Humboldt State University advances clean and renewable energy. Our projects aim to reduce climate change and pollution while increasing energy access and resilience.

Our work is collaborative and multidisciplinary, and we are grateful to the many partners who together make our efforts possible.

Learn more about our work at schatzcenter.org

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1. OVERVIEW

The Schatz Energy Research Center at Humboldt State University (Schatz Center), in partnership with the California Ocean Protection Council, hosted a five-part public webinar series on offshore wind from September 14 through October 19, 2020. Participants were invited to:

- **Learn key findings** on the feasibility of offshore wind energy for the California north coast, and the potential for this development to contribute to the state's clean energy and climate goals.
- **Hear from speakers and panelists** representing a wide breadth of experience and interests.
- **Ask questions and share feedback** on future research and potential development opportunities.

Each webinar featured presentations by the Schatz Center and their research partners, followed by a panel discussion and Q&A. Each event also included a live poll and an invitation for participants to complete an anonymous survey.

The following summary provides a brief overview of the webinar series. Additional information, including key research findings, panelist perspectives, discussion topics, and poll and survey reports can be found in Appendix A. Online resources related to offshore wind can be found in Appendix B.

Video recordings, agendas, and slide presentations are available on the Schatz Center's website at schatzcenter.org/wind. For comments or questions on the webinar series or related reports, or to receive updates on the Schatz Center's offshore wind research, please contact windstudies@schatzcenter.org.

2. CONTEXT

The offshore wind resource along California's north coast is one of the most powerful in North America, and it holds significant potential as a source of renewable energy generation for the state. In 2018, the U.S. Bureau of Ocean Energy Management (BOEM) designated the Humboldt Call Area — located 20-30 miles offshore from Humboldt Bay — as a potential lease site for offshore wind. Due to the deep coastal waters, any wind turbines deployed in this region would be mounted on floating platforms and anchored via mooring lines to the ocean floor. This approach has been demonstrated in European installations, but it remains an emerging technology in an early stage of commercialization.

While offshore wind has great potential to contribute to California's clean energy and climate change mitigation goals while expanding economic and job opportunities, development of the Humboldt Call Area would involve overcoming significant challenges. For the past 18 months, a team led by Arne Jacobson (principal investigator) and Mark Severy (project manager) has conducted a multi-disciplinary study to analyze the feasibility of offshore wind development for the north coast. This research effort has been supported by funds from the Ocean Protection Council of the California Natural Resources Agency, the Governor's Office of Planning and Research, and the US Bureau of Ocean Energy Management. Pacific Gas and Electric also contributed by providing self-funded analysis related to transmission alternatives.

While the Schatz Center seeks to identify and implement best-fit solutions to climate change, these feasibility reports do not represent advocacy for or against offshore wind development in the north coast region. Rather, the goal is to contribute rigorous analyses that improve our shared understanding of the challenges, impacts, and opportunities associated with developing offshore wind on California's north coast.

3. KEY THEMES

Key themes that emerged throughout the webinar series include:

- Collaboration with and between a wide breadth of regional community groups would be critical for successful offshore wind development on the north coast.
- There are technical, engineering, and economic challenges to developing and operating a wind farm offshore from Humboldt Bay. These include the economies of scale needed for wind farm deployment and transmission development; local port constraints; and regional geohazards and storm events.
- Opportunities of interest to the local community include: developing renewable energy and contributing to local and state clean energy goals; reducing emissions associated with climate change; improving electricity grid reliability; regional job and economic development; port redevelopment; and restoration of the Humboldt Bay environment and cultural resources of north coast tribes, including at Tuluwat Island.
- Participant concerns included: reduction in fishery access; bird collision with turbine blades; fishing gear and marine species entanglement with cables and mooring lines; electromagnetic field disturbance from transfer cables; eelgrass regulations; conflicts in Bay channel use; and disturbance of cultural resources of Native American tribes.
- Community members are struggling to track information from different agencies, developers, interest groups, and research labs. A centralized location with updates from state and federal agencies about research, next steps, and community engagement opportunities would facilitate community participation and understanding.
- The public is currently seeking clarity on key concepts including (a) what a Call Area is and how a lease would be awarded, (b) whether any projects are currently under development for the north coast, (c) how federal, state, and local agencies will engage and collaborate on permitting and lease processes, and (d) when and where community members will have opportunities to engage and collaborate.

4. WEBINAR SUMMARIES

> "If we are going to have a transition, no matter if it is this or anything else, in terms of energy and the way we develop our society, it has to be a just transition. And that transition, the first step in that 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 Board of Supervisors (opening remarks, Session 4, October 5, 2020)

4.1 Session 1: Energy Production and Delivery, and Economic Development

September 14, 2020: Karen Douglas of the California Energy Commission and Necy Sumait of the Bureau of Ocean Energy Management gave opening remarks about the goals and interests of their agencies with respect to offshore wind, and Ms. Sumait announced a funding award for an expanded transmission study to be conducted by the Schatz Center in 2020-21. Arne Jacobson and Mark Severy then provided (a) an orientation to offshore wind, (b) an overview of associated research being conducted by the Schatz Center team and partners, and (c) a presentation of key findings on the wind resource potential, regional transmission constraints, and economic and job analyses for the Humboldt Bay area. Panelists included Matthew Marshall of the Redwood Coast Energy Authority, Jason Ramos of the Blue Lake Rancheria, Neil Raffan of the California Public Utilities Commission, Marco Rios of Pacific Gas and Electric, and Donna Wright of the Eureka Chamber of Commerce. See Appendix A, Session 1 for additional information about the first webinar.

4.2 Session 2: Ecological and Geological Environment

September 21, 2020: Mark Gold of the Ocean Protection Council and Garry George of the National Audubon Society and Power Working Group gave opening remarks, followed by an overview by Arne

Jacobson of the potential environmental benefits associated with offshore wind development. Project partners Sharon Kramer and Scott Terrill of H.T. Harvey and Associates, and Mark Hemphill-Haley of HSU's Geology Department, then shared results from the ecological and geological surveys respectively. Panelists for the community discussion included Tom Wheeler of EPIC, David M. Pereksta of the Bureau of Ocean Energy Management, Brandon Southall of Southall Environmental Associates, Inc., Andrea Copping of the Pacific Northwest National Laboratory, and Aaron Porter of Mott MacDonald. See Appendix A, Session 2 for additional information about the second webinar.

4.3 Session 3: Port and Coastal Infrastructure

September 28, 2020: Jennifer Lucchesi of the California State Lands Commission gave opening remarks on the public trust doctrine, clean energy, and California's blue economy. Aaron Porter and Shane Phillips of Mott MacDonald shared their analysis of the capacity of Humboldt Bay's port and coastal infrastructure to support offshore wind development. Panelists for the community discussion included Adam Canter of the Wiyot Tribe's Natural Resource Department, Tyrone Conner of the US Coast Guard, Sharon Kramer of H.T. Harvey and Associates, Larry Oetker of the Humboldt Bay Harbor and Recreation District, and Antoine Peiffer of Principle Power. See Appendix A, Session 3 for additional information about the third webinar.

4.4 Session 4: Community Perspectives on Regional Impacts and Opportunities

October 5, 2020: Mike Wilson of the Humboldt County Board of Supervisors gave opening remarks. Arne Jacobson introduced the team's research and presented visual simulations related to offshore wind farm development. Laurie Richmond then shared a summary of responses from interviews that her team conducted with north coast community members and other stakeholders between 2018 and 2020. Panelists for the community discussion included Mike Anderson, a commercial fisherman, Jana Ganion of the Blue Lake Rancheria government staff, Jeff Hunerlach of the Operating Engineers Local #3, Harrison Ibach of the Humboldt Fishermen's Marketing Association, and Jennifer Savage of Surfrider Foundation. See Appendix A, Session 4 for additional information about the fourth webinar.

4.5 Session 5: Reflections and Next Steps

October 19: 2020: Congressman Jared Huffman gave opening remarks, which were followed by a synthesis by Arne Jacobson of the webinar discussions to date. Dr. Jacobson also shared a timeline of forthcoming reports and analyses, and a brief introduction to additional offshore wind studies underway at the Schatz Center. Eli Harland of the California Energy Commission, Chris Potter of the Ocean Protection Council, and Necy Sumait of the Bureau of Ocean Energy Management then described next steps for each of their agencies in exploring the feasibility of offshore wind development for the north coast, and discussed opportunities for community members and other interested parties to stay informed and participate in these processes. Lisa Gilbane of the Bureau of Ocean Energy Management and Sharon Kramer of H.T. Harvey also joined the discussion to answer questions about upcoming environmental analyses. See Appendix A, Session 5 for additional information about the fifth webinar.

5. NEXT STEPS

During the webinar series, the following next steps were identified. Please visit the Schatz Center Research Center website schatzcenter.org/wind for updates:

1. Publish the final feasibility reports in this series: schatzcenter.org/publications.
2. Share webinar materials including the video recordings and slide decks, and the questions and comments submitted by participants during the webinars: schatzcenter.org/wind.
3. Develop and share a summary report of the webinar series (i.e. this document).
4. Create a web resource that answers some of the frequently asked questions about north coast offshore wind feasibility.
5. Share a list of online resources with webinar participants.

The Schatz Center is currently conducting two additional feasibility analyses. The first is a seabird distribution risk assessment funded by the California Energy Commission's Electric Program Investment Charge (EPIC). This risk assessment will build a 3D probability map of seabirds in space by integrating existing 2D species distribution models with species-specific seabird flight heights as a function of wind speed, and the latest wind resource data. The Center anticipates sharing results from this analysis in the summer of 2022. The second study is an examination of the transmission cost reduction potential for small to medium commercial-scale offshore wind projects on California's north coast. This research is being funded by BOEM, with study results expected in the fall of 2021.

5.1 Contact

For questions or concerns related to the north coast wind studies or the webinar series, or to receive updates on the Schatz Center's wind research projects, please contact:

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5.2 Acknowledgements

The Schatz Center's north coast offshore wind energy feasibility research was funded by the Ocean Protection Council of the California Natural Resources Agency, the Office of Planning and Research of the California Governor's Office, and the Federal Bureau of Ocean Energy Management. Pacific Gas & Electric provided in-kind analytical support for the interconnection feasibility study. Research partners for these studies included Mott MacDonald, H.T. Harvey & Associates, Steve Hackett, Mark Hemphill-Haley, Eileen Hemphill-Haley, and Laurie Richmond.

The Schatz Center's webinar production team was led by Maia Cheli, with support from Cassidy Barrientos, Tanya Garcia, Carisse Geronimo, Nicole Salas, and Sierra Stehman. The series was funded by the Ocean Protection Council, and facilitated by Strategic Earth Consulting, a third-party facilitation team. For more about Strategic Earth, visit strategicearth.com or email hello@strategicearth.com.

APPENDIX A – WEBINAR SERIES IN DETAIL

This appendix includes detailed information about the five webinars in the series, including key findings, panelist comments, participant questions, and poll and survey responses. Video recordings and slide decks, as well as agendas and questions submitted during the webinars are available at schatzcenter.org/wind.

A.1 Session 1: Energy Production and Delivery, and Economic Development

Figure 1. A transmission tower near Highway 36 on a line connecting Humboldt County to the rest of the California electrical grid | photo by Arne Jacobson

Presentation

The presentations began with an introduction to offshore wind by Arne Jacobson, followed by an evaluation of energy production, delivery, and economic development given by Mark Severy. Mr. Severy described the study scenarios explored by the Schatz Center to date — including a range of wind farm sizes and transmission routes — and the economic constraints and opportunities associated with each scenario.

Key research findings:

- The north coast offshore wind resource is enormous and could support progress towards meeting California's climate and clean energy goals. An 1,800 MW wind farm in the Humboldt Call Area could produce 3.8% of California's electricity generation.
- Transmission capacity is a major barrier for developing offshore wind on the north coast. Smaller projects face disproportionately high transmission investment costs but may be an important first

step for California offshore wind. Future, large-scale development would require significant investment and coordination at the state planning level.
- Larger wind farms would be required in order to achieve lower costs of energy (i.e., economies of scale). Smaller, initial projects could be used as demonstrations, but developers would likely want to see a pathway to larger projects to achieve economic viability.
- Offshore wind has good potential to create a significant number of jobs in the region and elsewhere in California. For example, a 150 MW wind farm would create approximately 3,000 construction jobs and 2,000 operational jobs.
- The permitting process for offshore wind development is complex, involves multiple permitting agencies, and would take place over several years.
- Offshore wind development on California's north coast can be compatible with the U.S. military mission.

Quotes from panelists and opening speakers

- **Karen Douglas, California Energy Commission**: 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.
- **Necy Sumait, Bureau of Ocean Energy Management:** 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.
- **Matthew Marshall, Redwood Coast Energy Authority:** Our goals are really around developing local renewable resources. And when you look at total capacity, offshore wind is really the largest untapped potential, both locally, and as it was noted, at a state level — I always try to remind myself that California is... the fifth biggest economy in the world. And so, you know, a percentage of California's energy need is no trivial thing.
- **Jason Ramos, Blue Lake Rancheria**: 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.
- **Donna Wright, Eureka Chamber of Commerce:** Renewable energy can support ... positive economic growth by the installation of these projects, creating new jobs during the construction process and the ongoing maintenance. And, surprisingly, tourism. [At the 2018 Climate Action Summit in San Francisco] … it was stated that there was an increase in ecotourism … [in] the surrounding areas of the East Coast Block Island Wind Farm, creating new opportunities. There was also documented growth in communities that have embraced the clean energy movement. … The Chamber does support clean energy and believes there is no better time than now.
- **Marco Rios, Pacific Gas & Electric**: What we know of the system is that whether we develop medium or large-scale generation, it will require significant upgrades to the local transmission system. And that really is because the current grid in this region was not designed to export generation outside of the area… If we add in new 115 kV lines, those would provide additional redundancy and diversity in interconnection to the main electric grid. Not only would we have access to the generation that we're discussing, but also just better access to the grid, especially

during winter storm conditions when transmission could experience more outages, or even during other times if we have more severe events.

- **Neil Raffan, California Public Utilities Commission**: Offshore wind is likely to provide shared benefit and has the opportunity to supply the state broadly, not just the local area. To explore the transmission for that, we've got three particularly relevant activities going on in Integrated Resource Planning right now. One… the National Renewable Energy Laboratory is updating the cost estimate [for offshore wind] specific to California... [Two], on the transmission capacity side, we are seeking to improve the assumptions… [regarding]... what capacities are available in the system already for offshore wind… and what cost assumptions to use to expand that [transmission capacity] if needed. And thirdly, procurement and investment and how to actually have such a large and complex resource come to fruition; that's an activity the CPUC is exploring with stakeholders… to determine how to make that investment occur.

Questions submitted

42 questions were submitted by participants on topics including:

- Overland transmission line siting, sizing the undersea transmission cable, and port leasing
- Potential restrictions on fisheries
- North coast power purchase agreements, Eureka gas plant decommissioning, and the potential for offshore wind to support hydrogen electrolysis
- Wind farm site selection, anticipated impacts of climate change on the wind resource, and the potential for collaboration with projects in southern Oregon
- Details about the levelized cost of energy (LCOE), curtailment, line loss, etc. in the scenarios studied
- Bureau of Ocean Energy Management and California Public Utilities Commission timelines and procedures
- Jobs for local residents, and the employment of fishing people for turbine maintenance and troubleshooting
- Local community college training and HSU research opportunities

Participation, poll and survey

255 people registered for the first session, of whom 211 attended live.

Live poll: 168 people responded to a live poll about their location. Of these, 81 participants (48%) identified as being from the north coast (Humboldt or Del Norte counties); 52 (31%) as from California outside the north coast; 34 (20%) as from the US outside California; and 1 (<1%) as international.

Post-event survey: 26 people responded to the survey, representing local and CA residents, researchers and academics, environmental nonprofits, local and tribal governments, and state and federal agencies. Of these survey respondents, 14 identified as being from the north coast; 9 from CA beyond the north coast; and 3 from the US outside CA. A third of the survey respondents described the prospect of north coast offshore wind in positive terms such as optimistic, excited, or promising; half of the respondents (also) expressed concerns about feasibility, especially in regards to transmission constraints.

A.2 Session 2: Ecological and Geological Environment

Figure 2. Orcas swim closely together in Monterey Bay | photo by Scott Terrill

Presentation

The second session of the webinar series focused on the environmental and geological environment of the north coast. Sharon Kramer and Scott Terrill introduced their marine and terrestrial environmental survey and discussed next steps in pelagic seabird research, and Mark Hemphill-Haley reported on his literature review of geohazards in the Humboldt Bay Call Area.

Key research findings:

- Environmental impacts from construction, both on and offshore, will likely be shorter in duration and more localized, while those from operations and maintenance will be long term. Expansion of overland transmission would also create long term, localized impacts to terrestrial and freshwater biota and their habitats.
- Currently, there is a great deal of uncertainty regarding actual effects to seabirds and marine mammals. It is also anticipated that monitoring to assess impacts will be challenging, as events that involve impacts to birds and marine mammals may be relatively rare. To capture events that do occur, 24/7 monitoring technologies may be needed.
- Monitoring, adaptive management, and development of mitigation measures, can be used to minimize environmental impacts of offshore wind development.
- The North Coast region is seismically highly active, and is impacted by shaking from multiple sources, including the Cascadia Subduction Zone, the San Andreas fault, the Gorda plate, the Mendocino fault, and numerous smaller faults on and offshore.

- 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. Among these hazards are strong motion (shaking), surface rupture, gas hydrates, liquefaction, submarine landslides, tsunamis, and coseismic sea level change.

Quotes from panelists and opening speakers

- **Mark Gold, Executive Director, Ocean Protection Council**: We commit the Ocean Protection Council to work with other state agencies toward the development of a commercial-scale offshore wind project that minimizes impacts on marine diversity and habitats, currents and upwelling, fishing, cultural resources, navigation, and aesthetic and visual impacts, as well as military operations. And we want to do it quickly, by 2026 if possible.
- **Garry George, Clean Energy Director, National Audubon Society / Power Working Group**: Our science team revealed in a study released last year that three degrees of warming will likely drive 389 species of North American birds to extinction because they'll lose their wintering and breeding territories due to climate change… So it is exciting to have a new resource, a new technology to add to our quiver of climate arrows here in California, like offshore wind, to get us to 100% clean and net zero emissions. This is critical for birds and it's critical for people. As I've been working on this, it is exciting to see here in California the conservation ethic and the climate politic policies going hand in hand to protect our beloved wildlife of the California Current system.
- **Andrea Copping, Pacific Northwest National Laboratory**: We think, other than the actual footprint — when you put the anchor in and you do some disturbing and so on — there's really relatively little disturbance of the soft bottom habitat and therefore the benthic organisms, and you don't necessarily, depending on what you use on the bottom, create new hard bottom habitat. So we think that the benthic effects can be really very minimal for the floating turbines.
- **David M Pereksta, Bureau of Ocean Energy Management**: Basically, we're trying to get every scientific dataset that's been collected offshore on seabirds and synthesize those into a common database, and then we're now in the process of producing high resolution predictive models of seabird distribution in this area, and it's along the entire Pacific coast from Washington, Oregon and California.
- **Brandon Southall, Southall Environmental Associates, Inc.**: I think we know enough about some of the hearing systems [of marine mammals] to know that most of the [floating wind] operations are unlikely to cause sort of direct physical harm in terms of hearing, and the bigger issues we have to consider are things associated with disturbance and habitat kinds of issues.
- **Tom Wheeler, EPIC**: Things like this really emphasize for me the importance of adaptive management and the inclusion of adaptive management provisions within whatever sort of approval structure for this project. 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 way.
- **Aaron Porter, Mott MacDonald**: We see [seismic hazards for offshore wind] in three different areas, going from the offshore portion, the ocean coast, and then the bayfront as well… On the whole, there is a number of considerations, but we don't see [seismic hazards] fully precluding feasibility going forward, whether we are looking at offshore, on the coast, or on the bayfront – just a little bit more planning, and assessment, and analysis.

Questions submitted

37 questions were submitted by participants on topics including:

- Bird collisions, avoidance behaviors, and impacts on seabird migration; research on pelagic (versus nearshore) wind farm environments
- Benthic disturbance
- Electromagnetic field impacts on marine species
- Engineering turbines and platform anchoring to withstand earthquakes
- Burying transmission lines in fire prone regions
- Community outreach planning (both general and re: bird species that carry cultural significance and/or are hunted)
- Tribal engagement and participation in planning processes
- Reducing resident energy bills
- California salmon
- Other Pacific coast offshore wind projects
- Timeline of environmental review
- Timelines for external reports (BOEM West Coast Pacific Seabird Synthesis model; Humboldt Mapping Project)
- Details on the Schatz Center's ongoing seabird study

Participation, poll and survey

246 people registered for the second session, of whom 189 attended live.

Live poll: 140 people responded to a live poll about their location. 61 (44% of poll respondents) identified as being from the north coast (Humboldt or Del Norte counties); 48 (34%) as from California outside the north coast; and 31 (22%) as from the US outside California.

Post-event survey: 17 people responded to the survey, representing local residents, researchers, fisheries, environmental nonprofits and professionals, local government, and state and federal agencies. 7 people identified as being from the north coast; 8 from California outside the north coast; and 1 from the US outside California. Half of the survey respondents described the prospect of north coast offshore wind in positive terms such as good, excited, optimistic, and encouraged; 2 people shared a sense of urgency in supporting offshore wind; 3 people described the prospect in negative terms such as dicey, "not as positive," and premature. Responders asked for more (webinar) time for exploring the breadth of environmental concerns, inquired whether consultations regarding migratory species have been held with non-local stakeholders, and recommended that a centralized location be created for offshore wind data and reports.

A.3 Session 3: Port and Coastal Infrastructure

Figure 3. Redwood Marine Terminal 1, Humboldt Bay | photo by Maia Cheli

Presentation

The third session of the webinar series included an analysis of the suitability of Humboldt Bay for offshore wind development; opportunities, challenges, and constraints associated with the port and coast infrastructure; and investments that would be needed to proceed. This analysis was presented by research partners Aaron Porter and Shane Phillips of Mott MacDonald Engineering.

Key research findings:

- The existing navigation channel can likely support floating offshore wind projects. The existing channel geometry could limit the size of offshore wind systems, including the type and geometry of floating platforms. To enable larger systems, channel widening and deepening may be required; yearly installation throughput may also depend on channel modifications.
- A seasonal turbine deployment schedule is likely; however, components could, and may need to be, delivered year-round. Dredging may need to be timed earlier in the season to support the maximum installation window. The Pacific winter wave climate should also be considered when planning turbine deployment.
- Depending on annual offshore wind installation and throughput requirements, wet storage areas may be needed to temporarily store floating foundations.

- A new high-capacity wharf would be required, and berth dredging would likely be necessary. Depending on the location of the wharf and berth, creosote pile removal would likely be required. The existing yard would also likely require upgrades, including site re-grading and ground improvements. The extent and cost of wharf and yard upgrades depends on the scale of expected offshore wind development and the annual installation and component delivery schedules.
- Marine terminal build-out is expected to take approximately 4-7 years, depending on the size of the project.
- An electrical transmission cable landfall on the North or South Spit of Humboldt Bay, and subsequent underwater crossing of the bay, is likely feasible. However, this could be one of the more complex coastal infrastructure elements of the project, and additional studies are required.

Quotes from panelists and opening speakers

- **Jennifer Lucchesi, California State Lands Commission**: We all have a role in advancing a clean energy future. It is critical to promote and practice transparency and understand the current state of the ocean and coastal space, put all the facts on the table so that everyone is aware of the potential benefits and tradeoffs, so that our decision reflects society's values and priorities for our current and future generations.
- **Adam Canter, Wiyot Tribe**: In general, the Wiyot Tribe has long supported renewable energy development that is well sited, and 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.
- **Tyrone Conner, U.S. Coast Guard**: The applicant, once they're awarded the lease, would be required to pre-engage with the Coast Guard when they engage with the Army Corps of Engineers — it's to try reduce the amount of time that it takes to review their navigation safety risk assessment, because we want to look at it to make sure that all waterway users have a safe environment to operate.
- **Sharon Kramer, H.T. Harvey**: One of the major issues with dock construction is going to be the noise. Again, if there's going to be pile driving… different types of piles will be needed to support the piers. The noise effects on mammals, marine mammals, nesting birds, and fish will depend on the amount and type of pile installation that occurs. Long term, the bigger concern is with respect to eelgrass... [For the cable landing] the noise associated with horizontal directional drill will be an important aspect with respect to nesting plovers; plants and other things can also be disturbed through activities on the south spit.
- **Larry Oetker, Humboldt Bay Harbor and Recreation District**: In order to succeed, in my opinion, we need to have a strong community benefits package, so this is a win for the industry, the environment, and the local community. We've got to have local input — within this community benefits package, there needs to be jobs, an apprenticeship program, fisherman's funds to support sea ice, cold storage, life raft inspections, carbon free electricity, and other kinds of things.
- **Antoine Peiffer, Principle Power**: You have average wind speeds of 9-11 meters per second, so it's really a world class wind resource… and having such a very nice and sheltered facility like the port of Humboldt Bay is a key benefits advantage for the local community… we think there is a large potential for this place to become a hub for offshore wind… for the entire West Coast of the US. If the right developments are made, everything can be basically done at this facility — even the assembly of the hub itself.

Questions submitted

28 questions were submitted by participants on topics including:

- Silting/shoaling and dredging — improvements required to accommodate turbines, what agency would conduct dredging, and who would pay for expansions or increased schedule

- Size of turbine structures and of component delivery vessels
- Underwater and air draft requirements for turbine structures
- Impacts on and communication with other channel traffic
- Dock capacity to support crane loads
- Viability of eelgrass mitigations
- Potential for turbine construction at sea
- Feasibility of Humboldt Bay harbor serving as California turbine deployment hub
- Outreach & communication with Bay users (recreational, fisheries, oyster farms)
- The role of the State Lands Commission in offshore wind development projects
- Potential for development offshore from Del Norte County

Participation, poll and survey

261 people registered for the third session, of whom 179 attended live.

Live poll: 136 people responded to a live poll about their location. 54 (40% of poll respondents) identified as being from the north coast (Humboldt or Del Norte counties); 43 (32%) as from California outside the north coast; 31 (23%) as from the US outside California; and 8 (6%) as international.

Post-event survey: 15 people responded to the survey, representing local residents, researchers, renewable and other energy sectors, nonprofits, developers and engineers, state agencies, local government, and the Harbor District. 7 people identified as being from the north coast; 2 from CA beyond the north coast; 4 from the US outside CA; and 2 as international. 9 of the survey respondents described the prospect of north coast offshore wind in positive terms such as very promising, tremendous opportunity, great, very feasible, and encouraged; 4 people highlighted the importance of community engagement and buy-in.

A.4 Session 4: Community perspectives on Regional Impacts and Opportunities

Figure 4. A turbine is drawn to scale as it might look when traversing the inner channel | compilation by Zachary Alva and Maia Cheli

Presentation

The fourth session of the webinar series focused on community perspectives regarding offshore wind development. After a brief introduction by Arne Jacobson, Laurie Richmond of the Environmental Science and Management Department at Humboldt State University delivered a presentation that summarized findings from interviews with stakeholders and observations of discussions in workshops and meetings related to offshore wind development on the north coast during 2018 to 2020.

Key research findings:

- Transmission infrastructure, turbine deployment, 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.
- During meetings involving ten Native American tribes from the region in February 2020, representatives from tribal governments indicated a strong interest for additional information about the opportunities, challenges, and impacts associated with potential offshore wind development, as well as further government-to-government consultation.

- Interviewees from the 2018-2020 survey included 8 people from government (elected officials and staff), 5 from the energy industry (including developers and consultants), 11 from local and state environmental nonprofits, 13 from fisheries, and 4 from local business and trade associations.
    - The most frequently cited benefits to offshore wind development were climate change and fossil fuel reduction, jobs and the economy, energy independence and local control, and port upgrades.
    - The most frequently cited concerns to offshore wind development were environmental impacts and impacts to fishermen.
    - Concerns were also shared about a lack of clarity in materials (e.g. flowcharts and figures) as well as the Bureau of Ocean Energy Management's leasing process and the Redwood Coast Energy Authority's lease application.
    - Scale and process matter: attitudes might change for larger-scale installations. There is a strong community ethic/value towards a project with local control, as well as a desire for greater transparency and inclusion in the process.
- A literature review of offshore wind projects in other communities found that:
    - Effective stakeholder and public engagement early and often throughout the process is crucial.
    - Fishermen demonstrate a range of concerns regarding offshore wind developments.
    - Native American tribes have unique legal, political, cultural, and historical connections to ocean and coastal spaces for offshore wind.

Quotes from panelists and opening speakers

- **Mike Wilson, Humboldt County Board of Supervisors**: 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 Anderson, commercial fisherman**: The northern California fishing grounds are some of the most productive fishing grounds on the West Coast. It will devastate the trawl industry… in northern California. And if the trawl industry is devastated in northern California, that is what keeps the doors open for Pacific Seafood. And if Pacific Seafood closes their doors, that is a lot of fishermen with nowhere to sell their fish.
- **Jana Ganion, Blue Lake Rancheria**: Each nation and every stakeholder will need to contribute to climate solutions in ways they haven't before. I was at a recent meeting where dozens of leaders of tribal nations across the United States described how fast conditions have changed — extreme weather, unknown before, economies eroded because of climate impacts, die off of species including fisheries — and their traditional ecological knowledge no longer matched what they were experiencing, and they were struggling to teach their children how to live in their environment. The suffering expressed in that room was on an unprecedented scale, but so was the resolve. The leaders' common refrain was to act now to restore some kind of balance.
- **Jeff Hunerlach, Operating Engineers Local #3**: There's just not enough work here in Humboldt and Del Norte county for everyone to earn a living. If offshore wind were to take off, it will require skilled labor. Construction of the wind turbines, the port revitalization, and updating the transmission lines — long term, these types of projects could create sustainable jobs in construction, manufacturing, and installation of the offshore floating wind farms. We would like to see the work done in an environmental and safe manner for the future of our community.
- **Harrison Ibach, Humboldt Fishermen's Marketing Association**: ...[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. So, in reality it is not just an open ocean where we can go fish, and we really can't afford to lose any more fishing grounds.

- **Jennifer Savage, Surfrider Foundation**: 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? This is especially relevant if you consider everything else that's going on out here. There's an exponential expansion of housing in Samoa, there's this big fish farm that's being proposed. This is on a spit filled primarily with low and lower income residents who have no or minimal bus service. There's no bike lanes, there's no Bay trails. These communities will have to absorb more traffic and more industry, and what will that mean and how will the county look out for the residents out here?

Questions submitted

22 questions and comments were submitted by participants on topics including:

- The characteristics of an offshore wind project that would be compatible with the local fishing industry
- The combined effects of offshore wind and Marine Life Protection Act fishing restrictions on fishing, tourism, the tax base, and other economic opportunities in the Humboldt Bay region
- The engagement of Tribal fisherpeople and traditional food practitioners, as well as Native American programs, departments, and students at HSU, in offshore wind discussions
- Local fisheries and their role in food security, and as an economic multiplier
- Determining who owns the fishing grounds
- Cumulative impacts if other wind farms are developed nearby
- Potential impacts on bird migration
- The capacity of wind turbines to withstand adverse weather, and the availability of "fast exit" strategies in the event of an anomalous storm
- Alternative jobs, mitigation funds, and/or buyouts for north coast fishermen
- Traffic restrictions at the harbor entrance, and the impact on crab fisheries
- Differences in community concerns re: onshore and offshore wind development
- Equitable solutions for renewable energy and climate change

Participation, poll and survey

217 people registered for the fourth session, of whom 152 attended live.

Live poll: 122 people responded to a live poll about their location. 71 (58% of poll respondents) identified as being from the north coast (Humboldt or Del Norte counties); 33 (27%) as from California outside the north coast; 17 (14%) as from the US outside California; and 1 (1%) as international.

These 122 people also responded to a live poll regarding their affiliations; respondents could select more than one option, and shared 155 affiliations total. 48 identified as a north coast resident or business; 1 as a Samoa, Manila, King Salmon, or Fields Landing resident or business; and 2 as tribal members or representatives. 24 people identified as being from the energy industry, including developers, consultants, and utilities; 3 from the recreational or fishing industry; 30 with research and/or a university; and 30 from a local, state, or federal agency or government. 13 affiliated with an environmental group, and 4 people identified as other.

Post-event survey: 14 people responded to the survey, representing local residents and businesses, tribal nations, local government and state agencies, energy industry, environmental nonprofits, climate policy and fisheries consultants, and researchers. 10 identified as being from the north coast; 3 from CA beyond the north coast; and 1 from the US outside CA. 11 survey respondents described the prospect of north coast offshore wind in positive terms such as optimistic, supportive, essential, positive, and convinced. A

respondent expressed concerns about support from the fishing community, while another wondered if the lease site was optimal.

A.5 Session 5: Reflections and Next Steps

Figure 5. Signage on the Waterfront Trail along Humboldt Bay in Eureka, California | photo by Arne Jacobson

Presentation

The final session included a presentation by Arne Jacobson that summarized the key findings shared by the research team to date, and synthesized questions, comments, and reflections from panelists and speakers throughout the webinar series.

Key research findings:

- The Schatz Center and partners have initiated two new research efforts related to offshore wind energy.
    - One focuses on exploring possibilities to reduce the cost of transmission for small to medium commercial-scale offshore wind projects on the north coast. This effort is funded by BOEM and involves partnership with the National Renewable Energy Laboratory (NREL), Quanta Technology, and Pacific Gas & Electric.
    - The second involves developing a three-dimensional seabird distribution model for the California Current, evaluating the relative risk of offshore wind impacts to seabirds for different locations and turbine heights, and comparing tradeoffs between seabird risk and power generation for offshore wind farms on the California coast.

Quotes from panelists and opening speakers

- **Jared Huffman, US Congress**: As I think everyone knows, the north coast has some of the best wind resources in the nation. A potential offshore wind project in this area, we have learned, could provide clean, renewable energy for our local community, but it could also create jobs and other economic benefits while helping our state and our nation hit greenhouse gas emission reduction goals. So there are lots of reasons to try to make this happen if we can, but that doesn't mean you don't have to be thoughtful and do it right. We know any proposed project on the north coast needs to meet robust standards to prevent negative impacts for marine mammals, birds, habitat and of course our local fishing community. We need to ensure the local tribes, fisherman and other community members continue to be engaged in the development process. And if we do that, I think this can be a win-win all around — that, at least, is my hope for this.
- **Chris Potter, Ocean Protection Council**: ...not only are we concerned about the environmental issues, but socioeconomic [issues] — especially when you're talking about development of what we call the blue ocean economy.
- **Eli Harland, California Energy Commission**: Engagement from local communities in the state processes is challenging for communities, too, especially if there's not a great platform for the state to communicate. And it's one thing I've noticed just looking at other states, especially East Coast states, is everyone does it a bit differently on not just their planning process and their stakeholder engagement, but also the way that they communicate using websites and report processes. I think there's a space where the CEC and the Ocean Protection Council, State Lands Commission and other state agencies can probably improve over the next five years, on the communication that comes from the state and is available for local communities…
- **Necy Sumait, Bureau of Ocean Energy Management**: I think the thing that's most exciting is just the level of collaboration that we see in the area of research, data gathering, and information sharing that is going on throughout the state. I think working together we can ensure that we will have the best available science to help guide future decision making with regards to offshore wind development.

Questions submitted

10 questions and comments were submitted by participants on topics including:

- Details on the Schatz Center's 3D seabird study
- Details on the BOEM lease process, including the number of developers and type of industries that will be considered, and whether community benefit criteria can be included in the BOEM auction scoring framework
- The roles of California agencies within offshore wind processes (e.g. CEQA), and advantages to appointing a statewide offshore wind energy czar
- Whether a shift in the balance of power in Washington will change policies on renewable energy, including offshore wind
- How north coast wind development would compare with Danish wind farms
- Mitigation and minimization of impacts to seafood providing fisheries and associated industries
- The capacity of a small wind farm to meet Humboldt Bay's energy demands alongside fishing, navigation, and commerce needs
- Whether future research will include a review of operating wind farms to see how they have performed in terms of economic and other community benefits

Participation, poll and survey

141 people registered for the fifth session, of whom 108 attended live.

Live poll: 82 people responded to a live poll about their location. 40 (49% of poll respondents) identified as being from the north coast (Humboldt or Del Norte counties); 25 (30%) as from California outside the north coast; 16 (20%) as from the US outside California; and 1 (1%) as international.

These 82 people also responded to a live poll regarding their affiliations; respondents could select more than one option, and shared 103 affiliations total. 26 identified as a north coast resident or business; 1 as a Samoa, Manila, King Salmon, or Fields Landing resident or business; and 3 as tribal members or representatives. 26 people identified as being from the energy industry, including developers, consultants, and utilities; 1 from the recreational or fishing industry; 9 with research and/or a university; and 24 from a local, state, or federal agency or government. 9 affiliated with an environmental group, 1 with labor/unions, and 3 people identified as other.

Post-event survey: 16 people responded to the survey, representing local residents and business, local government, tribes, environmental nonprofits, senior citizens, researchers, wind developers and consultants, state and federal agencies, workforce development and STEAM education, and municipal and regional utilities and community choice aggregators. 9 identified as being from the north coast; 4 from CA beyond the north coast; and 3 from the US outside CA. 11 of the survey respondents described the prospect of north coast offshore wind in positive terms such as excellent, very good, encouraging, inevitable, positive, and optimistic; 7 people mentioned the value/necessity of collaboration, in both research and throughout the community.

Areas of research that participants would like to see explored next included: a careful mapping of the actual fishing resource in the affected areas; a complete list of data collected to date, with links; a comprehensive summary of data required to complete the environmental impact study; integrated environmental studies that capture the entire California current; information on employment opportunities; and real world case studies of economic benefit or impacts for communities where offshore wind has been implemented.

APPENDIX B – RESOURCES

Figure 6. Entrance to Humboldt Bay | photo by Maia Cheli

Additional information on offshore wind energy is available via these sites:

- Bureau of Ocean Energy Management — California activities: boem.gov/california
- Bureau of Ocean Energy Management — Central California Call Area (map): boem.gov/sites/default/files/renewable-energy-program/State-Activities/CA/Central-California-Call-Areas-Map-NOAA.pdf
- Bureau of Ocean Energy Management — A Citizen's Guide to the Renewable Energy Authorization Process: boem.gov/sites/default/files/renewable-energy-program/KW-CG-Broch.pdf
- Bureau of Ocean Energy Management — Intergovernmental Renewable Energy Task Force Meetings: boem.gov/node/14455
- Bureau of Ocean Energy Management — Office of Renewable Energy Programs: boem.gov/renewable-energy
- Bureau of Ocean Energy Management — Northern California Call Area (map): boem.gov/sites/default/files/renewable-energy-program/State-Activities/CA/Humboldt-Call-Area-Map.pdf

- Bureau of Ocean Energy Management — Regulatory Framework and Guidelines: boem.gov/renewable-energy/regulatory-framework-and-guidelines
- Bureau of Ocean Energy Management — Outreach Summary Report on California Offshore Wind Energy Planning (9/18): boem.gov/sites/default/files/renewable-energy-program/State-Activities/CA/Outreach-Summary-Report-September-2018.pdf
- Bureau of Ocean Energy Management — Selected BOEM-Funded Research Informing Renewable Energy Offshore California (12/19): boem.gov/sites/default/files/documents/renewable-energy/Selected-BOEM-Research-Renewable-CA.pdf.pdf
- Bureau of Ocean Energy Management — sign up for email updates: data.boem.gov/Other/EmailSubscriptions/Default.aspx
- California Energy Commission — Offshore Renewable Energy Program: energy.ca.gov/programs-and-topics/topics/renewable-energy/offshore-renewable-energy
- California Ocean Protection Council: opc.ca.gov
- California Ocean Protection Council — 2020-2025 Strategic Plan (see Target 4.4.1) : opc.ca.gov/webmaster/ftp/pdf/agenda_items/20200226/OPC-2020-2025-Strategic-Plan-FINAL-20200228.pdf
- California Public Utility Commission — Integrated Resource Planning (The IRP process coordinates the planning and procurement efforts of CPUC-jurisdictional load serving entities to meet the state's long term goals, including consideration of the role of new resource types such as offshore wind): cpuc.ca.gov/irp/
- National Renewable Energy Lab — The Cost of Floating Offshore Wind Energy in California Between 2019 and 2032 (report): nrel.gov/docs/fy21osti/77384.pdf
- Offshore Wind Energy Gateway (DataBasin): caoffshorewind.databasin.org
- Schatz Energy Research Center — wind studies: schatzcenter.org/wind
- Surfrider — Renewable Ocean Energy: beachapedia.org/Renewable_Ocean_Energy