RENEWABLE ENERGY RESOURCE, TECHNOLOGY, AND ECONOMIC ASSESSMENTS

Appendix J - Task 10: California Offshore Wind Power Forum Summary Report

Prepared for: California Energy Commission
Prepared by: California Wind Energy Collaborative
University of California, Davis

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OVERVIEW

Offshore wind power could tap into a vast, clean, and sustainable energy resource conveniently close to large load centers. Preliminary estimates for California indicate that the winds 3 nmi to 12 nmi offshore could support more than 100 GW of installed capacity. Extending further outward to 50 nmi, the installed potential climbs to more than 575 GW.\(^1\) Currently, more than 5,000 MW of offshore wind power are installed globally, with the majority in Europe and smaller numbers in China and Japan. In the United States, there is only one offshore wind turbine, a reduced-scale prototype.

There are numerous hurdles – technical, regulatory, environmental, and economic – before the large-scale deployment of offshore wind power in the United States. In California, these issues are further complicated by the technology requirements for the extreme water depths of the Outer Continental Shelf; an extensive planning and permitting process well-known for its rigor and lengthiness; and a long coastline that hosts a rich, diverse ecosystem as well as a wide array of commercial, industrial, and recreational users. To initiate the discussion of wind power off of California shores, the California Wind Energy Collaborative and California Energy Commission convened the California Offshore Wind Power Forum. Over two days, state and federal agencies, industry, national labs, consultancies, academics, and others shared and discussed experiences from other efforts, industries, states, and countries. Some of the more salient “takeaways” are presented immediately below. Details are presented further herein.

Background

- Internationally, offshore wind power is growing fast with roughly 5 GW capacity installed, almost all in shallow water.
- The Department of Energy (DOE) and Department of Interior’s National Offshore Wind Strategy includes the following goals:
  - 10 GW deployed by 2020 at $0.10 per kWh
  - 54 GW deployed by 2030 at $0.07 per kWh
- First commercial projects in the United States are moving forward on the East Coast. Cape Wind is approaching construction.
- California contains a sizable offshore wind resource which could provide 661 TWh annually.\(^2\) However, no projects have been demonstrated in California yet.

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Regulatory Issues

- California’s regulatory process is complex and lengthy, involving numerous federal, state, and local agencies and a wide array of stakeholders.
- The Bureau of Ocean Energy Management (BOEM), a federal agency, is the lead for offshore leasing in federal waters (in general, more than three nmi beyond shore).
- At the state level, a number of agencies would be involved including the State Lands Commission, the Ocean Protection Council, and Fish and Wildlife.
- As part of their “Smart from the Start” initiative, BOEM facilitates working with state and local agencies by establishing interagency state task forces.
  - Twelve state task forces have been established so far, including Oregon and Hawaii, but not California.
  - To establish a task force, the state governor’s office must initiate contact with BOEM.
- Experience from past efforts with marine protected areas in California can be applied to marine spatial planning today.
- Regulatory and permitting lessons and best practices can be gleaned from Europe and the East Coast.

Environmental Issues

- Environmental baseline data is needed for potential offshore wind energy development areas, including information on coastal processes, birds, fish, marine mammals, noise, and electromagnetic fields.
- Pacific Northwest National Laboratory maintains TETHYS, a database of potential environmental impacts from offshore wind development.
- Studies are ongoing to address information gaps; many opportunities for collaboration.
- California can leverage experience from the state’s earlier efforts with assessing wave energy³.

Technology Issues

- California’s deep waters will require floating platforms for wind turbines. This technology is still emerging.
- Floating platforms have converged upon three primary configurations.
- Two full-scale wind turbines have been deployed on floating platforms. A number of reduced-scale floating turbines have also been demonstrated.

• Principle Power has received DOE funding toward development of a floating wind power demonstration project off the Oregon coast.
I. INTRODUCTION
The California Offshore Wind Power Forum was held at the Buehler Alumni and Visitor Center at the University of California, Davis on June 11-12, 2013. The event was organized by the California Wind Energy Collaborative and the California Energy Commission. A total of 82 people attended the event, including individuals from state and federal agencies, industry, universities, and environmental and engineering consultancies.

The Forum was organized into four panels to cover a broad range of topics. Each session consisted of four to five presentations by invited speakers, followed by a question and answer period. The session titles were:

- Regulatory Issues for Offshore Wind Power
- Offshore Wind Power and the California Coastal Environment
- Offshore Wind Energy Technologies for the California Coast
- Economic Outlook and Infrastructure Needs

California Energy Commission staff including Commissioner David Hochschild moderated the panels.

Keynote talks provided an introduction to each day of the Forum. On the first day, Joan Barminski of the Bureau of Ocean Energy Management discussed the process by which federal waters are leased for offshore wind energy production. The second keynote was given by Huub den Rooijen of The Crown Estate, who summarized some lessons learned from the United Kingdom’s experience with offshore wind.

A reception was held at the end of the first day to facilitate discussion and networking. The reception was wholly funded by the Warren and Leta Giedt Endowment to the Chair of the Department of Mechanical and Aerospace Engineering of UC Davis. No state funds or attendee registration fees were applied toward the reception.

The Forum proceedings are available at http://cwec.ucdavis.edu/offshore2013. They are open to Forum registrants and include PDFs of the presentations and a contact list of registrants. The presentations will be opened to the public six months after the Forum, on 13 December 2013.

Figure 1. The Forum audience during the first panel. Photo by Walt Musial, NREL.
## II. FORUM PROGRAM/AGENDA

**Tuesday, 11 June 2013**

<table>
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<tr>
<th>Time</th>
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<tr>
<td>8:00 a.m.</td>
<td>Registration and Continental Breakfast</td>
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<tr>
<td>8:30 a.m.</td>
<td><strong>KEYNOTE</strong></td>
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<td></td>
<td>Joan Barminski, <em>Bureau of Ocean Energy Management</em></td>
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<tr>
<td>9:30 a.m.</td>
<td><strong>Regulatory Issues for Offshore Wind Power</strong></td>
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<td><strong>MODERATOR:</strong> David Hochschild, Commissioner, California Energy Commission</td>
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<tr>
<td></td>
<td>Holly Wyer, <em>California State Lands Commission</em></td>
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<td>William Toman, <em>Pacific Marine Renewables</em></td>
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<td>Aviv Goldsmith, <em>Fishermen's Energy</em></td>
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<td>David White, <em>National Marine Fisheries Service, NOAA</em></td>
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<td>Matthew Armsby, <em>Resources Law Group</em></td>
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<td>12:30 p.m.</td>
<td>Lunch</td>
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<tr>
<td>1:30 p.m.</td>
<td><strong>Offshore Wind Power and the California Coastal Environment</strong></td>
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<td><strong>MODERATOR:</strong> David Stoms, California Energy Commission</td>
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<td></td>
<td>Andrea Copping, <em>Pacific Northwest National Laboratory</em></td>
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<td>David Pereksta, <em>Bureau of Ocean Energy Management</em></td>
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<td>Scott Terrill, <em>H.T. Harvey &amp; Associates</em></td>
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<td>Melinda Dorin Bradbury, <em>Independent Consultant</em></td>
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<tr>
<td>5:00 p.m.</td>
<td><strong>RECEPTION</strong></td>
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**Wednesday, 12 June 2013**

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<td>8:30 a.m.</td>
<td><strong>KEYNOTE</strong></td>
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<td>Huub den Rooijen, <em>The Crown Estate</em> (via video conference)</td>
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<tr>
<td>9:30 a.m.</td>
<td><strong>Offshore Wind Energy Technologies for the California Coast</strong></td>
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<td><strong>MODERATOR:</strong> John Hingtgen, California Energy Commission</td>
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<td></td>
<td>Leslie Rosenfeld, <em>Central and Northern California Ocean Observing System</em></td>
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<td></td>
<td>Walt Musial, <em>National Renewable Energy Laboratory</em></td>
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<td></td>
<td>Kevin Banister, <em>Principle Power, Inc.</em></td>
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<td>Time</td>
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<td>12:30 p.m.</td>
<td>Lunch</td>
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<tr>
<td>1:30 p.m.</td>
<td><strong>Economic Outlook and Infrastructure Needs</strong></td>
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<td>MODERATOR: Michael Sokol, California Energy Commission</td>
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<td></td>
<td>Andy Wickless, <em>Navigant Consulting</em></td>
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<td>Chris Elkinton, <em>GL Garrad Hassan</em></td>
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<td>Jim Lanard, <em>Offshore Wind Development Coalition</em></td>
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III. PANEL SUMMARIES

III.1. REGULATORY ISSUES FOR OFFSHORE WIND POWER

The regulatory panel began with Holly Wyer of the State Lands Commission giving an overview of the state agencies that will need to be consulted before an offshore wind project gains approval. William Toman of Pacific Marine Renewables discussed his experience with the regulatory process gained through his involvement with several proposed wave energy and offshore wind projects. Aviv Goldsmith described the progress of the Fishermen’s Atlantic City Wind Farm towards its anticipated construction off the coast of New Jersey beginning in 2014, highlighting the impacts of state and federal policies. David White of the National Marine Fisheries Service provided an introduction to resources for mapping the ocean and marine life, as well as the federal agencies and statutes aimed at protecting marine life. Finally, Matthew Armsby of the Resources Law Group discussed the establishment of Marine Planning Areas in California and their importance for negotiating shared use of the ocean.

III.2. OFFSHORE WIND POWER AND THE CALIFORNIA COASTAL ENVIRONMENT

Andrea Copping began the environmental session by presenting Pacific Northwest National Laboratory’s strategy for studying the interaction of offshore wind energy with marine animals and ecosystems. Impacts to avian life were discussed by the next two speakers: David Pereksta of the Bureau of Ocean Energy Management described some of the possible interactions between birds and offshore turbines and how research is addressing these interactions, while Scott Terrill of H.T. Harvey presented results of a long-term study of wind speed and flight paths. The session was wrapped up by Melinda Dorin Bradbury, who gave an overview of an earlier effort by the California Energy Commission to identify potential environmental impacts of an emerging technology: wave energy.

III.3. OFFSHORE WIND ENERGY TECHNOLOGIES FOR THE CALIFORNIA COAST

The session moderator, John Hingtgen, began with a brief perspective on offshore wind energy off of California. Leslie Rosenfeld then provided an overview of the ocean monitoring conducted by the Central and Northern California Ocean Observing System, including observations and modeling of wind, wave, and current phenomena. Walter Musial from the National Renewable Energy Laboratory provided a survey of the technologies in use and proposed for offshore wind energy. Two presentations discussed specific technologies for offshore wind energy: Kevin Banister described Principle Power’s Wind Float, a semi-submersible floating platform, and Jay Edgar talked about Glosten Associates’ PelaStar tension leg platform. Mirko Previsic of Re Vision completed the panel with a look at his firm’s work on techno-economic optimization and unmanned vessels for wind farm operations.

III.4. ECONOMIC OUTLOOK AND INFRASTRUCTURE NEEDS

Andy Wickless of Navigant Consulting began this panel with an introduction to financing methods for offshore wind projects. Chris Elkinton discussed work at GL-Garrad Hassan that examines the readiness of American ports to support offshore wind construction and operations. Christopher Morris of the Massachusetts Clean Energy Center provided an example of a port that is undertaking
significant work to become a base for Cape Wind and future offshore wind projects in New England. Jim Lanard of the Offshore Wind Development Coalition closed the session with his recommendations for moving forward with offshore wind in California, based on his experiences on the East Coast.
IV. NOTES

The following was compiled from notes taken by various attendees of the Forum. Note that they were not prepared by the presenters. These notes can be used as supplements to the presentations in the Forum proceedings. We thank the note-takers for sharing their efforts.

IV.1. WELCOME

IV.1.a. Enrique Lavernia, Dean, College of Engineering, UC Davis

- Sustainability is important to UC Davis
  - The campus performs well on external metrics of sustainability
- UCD has broad research competence with research funding for diverse areas
- Significant work is being done in the college of engineering
  - Faculty research is recognized with NSF early career grants and other awards
  - UCD engineers conduct research on wind energy and other renewables

IV.2. KEYNOTE


- Recent studies from Stanford and the National Wildlife Federation highlight potential of offshore wind energy on the Atlantic coast – offshore wind could power the entire East Coast (NREL).
- BOEM is a federal agency that controls resources located on the Outer Continental Shelf (OCS), including offshore wind.
  - Outer Continental Shelf (OCS) – 3 nautical miles to approximately 200 miles offshore
  - BOEM is 2 years old
  - Oil and gas – 328 million bbl; 9.8 million bbl off Santa Barbara channel alone
  - BSEE (Bureau of Safety and Environmental Enforcement or “Bessie”) monitors operations
  - Authority is derived from the Energy Policy Act of 2005, which amended the OCS Lands Act –
  - BOEM is the primary agency for offshore wind. Split jurisdiction with FERC for wave/tidal energy is split jurisdiction. NOAA is primary for ocean thermal energy conversion (NOAA)
  - FERC and BOEM have MOU to divide responsibilities regarding licensing (FERC) and leasing (BOEM)

- Offshore wind projects are handled in four stages: planning and analysis; leasing; site assessment, construction and management:
  - Planning: occurs after governor requests task force (combines federal, state, and tribal agencies and stakeholders)
    - Currently, 10 task forces on the Atlantic Coast, 2 on the Pacific (Oregon, Hawaii)
The task force is not a decision making body
- Identify potential lease areas
- Lease may be issued without task force; places planning burden on developer
- Call for information allows stakeholder input before defining wind energy areas (WEAs)
- Some WEAs have been defined on the East Coast, more are planned – North Carolina is currently a “call” area, not yet a WEA.
  - Leasing: can be competitive or noncompetitive, based on interest expressed during area identification
    - Noncompetitive lease occurs when only one entity is interested.
    - Competitive process may include monetary and nonmonetary considerations (see MA/RI leasing process)
    - December 2013 – first ever sale notice for offshore RI/Maine renewable energy
    - Smart from the Start program
      - Site assessment: environmental and resource surveys
      - Construction and operations: construction and operation plan (COP) is key document for NEPA review. Lessee must issue COP within first 5 years of lease.
- Current BOEM activities
  - Most offshore wind activity is concentrated on the East Coast
  - Includes cooperation on environmental monitoring with state agencies such as cost sharing for collection of siting data in Virginia and Massachusetts
  - BSEE – engineering studies by Technology Assessment and Research Program (name will be changed to Emerging Technology Program)
  - Pacific OCS Region: no offshore wind projects but several projects to test MHK devices
  - Formed task forces in Oregon, Hawaii
  - Oregon includes Principle Power project (DoE grant recipient) and the Northwest National Marine Renewable Energy Center (NNMREC), a DoE funded wave energy test center
    - Principle Power’s lease request is now in BOEM – being reviewed by the local task force. Coos Bay, OR: five 6 MW turbines
    - Pacific Marine Energy Center (Oregon State University) – grid connected wave energy devices will be tested (cable to shore). Center may be changing its name
  - Hawaii initial interest is in underwater transmission for inter-island transmission of energy produced onshore, also some proposals for offshore wind energy, especially off Oahu.
  - Dept of Defense (DoD) is important stakeholder, particularly in Hawaii; BOEM is working closely with DoD.
Partnerships on environmental research: BOEM Pacific Region budget in 2008-2014 is ~$18.5 million for environmental studies in Hawaii and the West Coast

- California offshore wind resource (see NREL map online) – floating technology likely to – be most promising on West Coast
- California OCS renewable energy task force could be established if governor requests it
- BOEM can accept unsolicited lease proposals even without a task force in existence.
- California Point Conception area has an existing cable-to-shore connection from an oil platform.

Discussion
- How does BOEM charge for offshore wind leases?
  - A low price is set before production begins ($/acre), during operations a royalty will be charged based on energy production.

IV.3. REGULATORY ISSUES FOR OFFSHORE WIND POWER
Moderator: Commissioner David Hochschild, California Energy Commission

IV.3.a. Holly Wyer, California State Lands Commission
- Regulatory process includes consultation with multiple state agencies; the Marine Renewable Energy Working Group can help coordinate and find the right people in various agencies; first agency to consult is the State Lands Commission
- State Lands Commission is responsible for submerged and subtidal lands, issues leases under public trust doctrine, concerned with environmental impacts (lead agency for CEQA)
- Without existing California projects, assess proposed offshore wind by comparison with other states, other industries
  - Best practices still being developed on a case by case basis
- California: MOU between FERC and State Lands Commission
- Ocean Protection Council permitting guide
- First mover problem: first developer faces highest environmental assessment costs, state wants to avoid (appearance of) favoritism
- CEC’s EPIC will have $130 million for renewables, possibly including offshore wind
- Moving forward: Consultation and coordination are important to regulatory process

IV.3.b. William Toman, Pacific Marine Renewables
- Many wave and tidal projects have been proposed for the Pacific Coast in past 5 years
  - 43 FERC preliminary permits but only one license (in Oregon)
  - 19 wave, tidal and hybrid projects in CA received preliminary permits
  - Preliminary FERC permit is a 3 year permit to study
Permits require 6 month updates to monitor progress and prevent “site banking”

- Permitting requirements make starting projects difficult
- Example - Sonoma County: initial study area was rejected as too large, new application split area into three smaller segments which received preliminary permits; those permits were later revoked due to lack of progress (county no longer had funds available)

- PG&E WaveConnect project (near Humboldt)
  - 3 potential sites evaluated: Humboldt, Point Conception, Mendocino
  - Competing uses included marine life (esp. whales), navigation/commercial fishing, recreation/surfing, and scenic beauty
  - 50 person stakeholder group
  - Site moved twice, primarily because of concerns from fishermen
  - $6 million in grants ($1.2M from DOE, $4.8M from CPUC) for demonstration facility (estimated cost $50 million)
  - Submarine cables are expensive, complex to permit

- Data needs for permitting MHK or offshore wind projects: grey whales; Marine Mammal Act; avian species, endangered species, fish habitat, bathymetry

- CA offshore wind demo proposal:
  - Utilize existing oil platform (Irene) near Vandenberg AFB, with existing submarine cable
    - Almost all CA oil platforms are grid connected because of air quality requirements (cleaner than using diesel generators)
    - New interconnection would cost $18M-$20M and require 1.5 years to permit
    - There are more than 12 existing underwater transmission cables in California
  - Military is interested in local renewable power to increase base energy security
  - PelaStar platform chosen for small footprint; also selected for UK’s first floating turbine demonstration project

IV.3.c. Aviv Goldsmith, Fishermen’s Energy

- Fishermen’s Energy was founded by commercial fishermen concerned about fuel price uncertainty, possible impacts of future wind farms
  - Includes major seafood producers from East Coast (Maine to South Carolina), could include Pacific fishermen in the future – wants to engage the fishing and maritime industry in offshore energy
  - Members have expertise in maritime operations; could provide knowledge, equipment for wind farm O&M

- Initial project in Atlantic City, NJ (demonstration project)
  - Entirely in state waters because NJ regulations were in place, while federal regulations were still developing.
  - State provided consistent support (3 governors’ administrations) for offshore wind
  - 5 5-MW direct drive turbines with 120-meter long blades, subsea cable
The turbines will be visible from Atlantic City, but positive feedback on visual impact of turbines from residents, tourists, casinos.

NJ has few other renewable resources, looking to offshore wind as best option.
- Initial opposition to offshore wind (moratorium 2004-2006)
- Support for initial demonstration project and study of impacts
  - Environmental study found no significant impacts
  - $9 million for meteorological monitoring (floating LIDAR) to three developers including Fishermen’s Energy
  - 3 years of buoy data
- NJ OREC law: Guaranteed purchase price for electricity from offshore wind for 20 years
- No long term PPAs in NJ; Fishermen’s will sell output to PJM energy and capacity markets (OREC sets pricing floor)

Progress on Atlantic City project:
- Carried out surveys of marine life: boat visual surveys, acoustic monitoring, land-based avian radar.
- Geotechnical assessment of site
- Access to transmission system in Atlantic City, cables will be buried using horizontal drilling – 1600 feet of onshore cable
- Permitting started October 2011, now completed
- All NJ permits have been received, also US Army Corps of Engineers
- Received $4 million from DoE, competing for $47 million in second round
- Investment tax credit of 30% available if construction starts before 1/1/14
- Economic benefits due to job creation predicted to be large compared to cost to ratepayers
- Will demonstrate permitting process and economic/environmental impacts
- Operation planned to begin summer 2015

IV.3.d. David White, NOAA National Marine Fisheries Service

- NOAA NMFS is concerned with marine life (except birds, see USFWS), including mammals, fish, turtles, abalone, habitats. NMFS does research as well as enforcement
- Magnuson-Stevens Act: regulates projects that impact commercial marine species. Protects essential fish habitat – “effects analysis” with conservation recommendations for mitigations.
- Federal Power Act – NMFS prescribes fish ladders on terrestrial dams – nexus to marine wind is unclear
  - Responsibilities derive from species protection and commercial fishing statutes
  - Requirements cover endangered species (special requirement for marine mammals), fish of commercial interest, and marine sanctuaries
- Endangered Species Act (ESA): NMFS uses best data available to produce Biological Opinion which includes incidental take statement and mandatory reasonable and prudent measures.
• Marine Mammal Protection Act: guides “take” or “harassment” of marine mammals. NMFS does a NEPA review and issues a permit.
• National Marine Sanctuaries Act: Licenses within “reservations” might include National Marine Sanctuaries under Sec 4(e) of Federal Power Act.
  o In California: Channel Islands, Cordell Bank, Monterey, Farallones
• Likely recommendations (in CA) – baseline studies, site inspections; marine mammal entanglement, impacts of electromagnetic surveys, etc. www.marinecadastre.gov provides summary of marine information in GIS format
• David White is contact person in Pacific region to find best NOAA contacts for marine renewables (707) 575-6810

IV.3.e. Matthew Armsby, Resources Law Group

• Marine Life Protection Act – 1999
• Marine Life Protection Act Initiative 2004
• Marine planning areas provide example of state process for addressing shared ocean uses
• Public-private partnership: MOU between CA Natural Resources Agency, CA Dept Fish and Wildlife, and Resources Legacy Trust Fund
• Initiative Planning Bodies
  o Blue ribbon Task Force
  o Science Advisory Team
  o Regional Stakeholder Group
  o Support staff
• Eight year process ended 12/2012
• 16% of State waters now in Protected Areas
• Comment letter 2010 to federal Interagency Ocean Policy Task Force from California
• Marine planning on West Coast has strong environmental protection
• Why no new process here?
  o lack of projects to drive
  o lack of comprehensive information
  o little push for Feds to proceed
  o need understand how offshore RE would play into conservation values
  o complex permitting and regulatory process
• Ocean Protection Council has a “geoportal”, listed below
  • Engaged diverse stakeholders
  • Conducted mapping/research efforts
    ▪ www.marinemap.org
    ▪ http://portal.gis.ca.gov/geoportal/catalog/main/home.page
IV.3.f. Panel Discussion

- Q: Regarding CARB: how does monitoring differ for offshore wind from oil and gas – especially air?
  - A: Everyone is responsible for safety and environmental management on oil and gas rigs. BSEE would probably be the safety implementing agency
- Q: What is the reason for government success in Oregon and Washington?
  - A: The governors have taken strong positions for marine energy. California has tremendous other resources with alternative RE sources compared to many other states, NJ for example is relatively resource-poor.
  - UK has a 2-stop shop approach compared to “many stop shops” – big burden on developers
- Q: Regarding state lands – submerged lands plus school lands (in California). Huge disconnect in CA between the current government administration and conservation lands – cf. DRECP, very little similar effort expended for off-coast resources – Why does this disparity exist between land and ocean emphasis in California?
  - A: It takes a concerted long term effort. The public sector is needed to take a role. The quantity of this resource far outweighs all the other REs
  - A: (from M. Armsby): the burden should not be just on government.
- Q: Are any efforts underway to streamline CA permitting?
  - A: A new scoping effort – needs mandate from executive branch of state, federal govt
- Q: Could the Fisherman’s Group interest its members in a project in California?
  - A: Yes, but would need certain criteria (reference Aviv’s talk) in California EPIC is an exciting program and could lead to the kind of revenue that developers would need
  - Considering size of leasing area (<500 MW) – only so many turbines can be installed in a season; need utility scale buildout; vessels to do it

IV.4. OFFSHORE WIND POWER AND THE CALIFORNIA COASTAL ENVIRONMENT

Moderator: David Stoms, California Energy Commission

- David spoke about Natural Resources Council conceptual framework:
  - Theoretical resource
  - Technical resource
  - Practical resource, as filtered through:
    - Social filter
    - Economic filter
    - Regulatory filter
    - Environmental filter
  - Multiple environments: air, water column, sea floor, coast
- Species
- Project life cycle
- Effects: noise, sea bed disturbance, electromagnetic frequencies, collision, entanglement
- Other issues: fisheries, shipping, military, climate change

IV.4.a. Andrea Copping, Pacific Northwest National Laboratory

- DoE tasked PNNL to investigate environmental effects of offshore wind deployment
  - PNNL has DoE’s only marine lab
  - DoE provided funds to 7 offshore wind projects in development
- Offshore wind turbines and marine life
  - Floating turbines (made on land and towed out) avoid pile driving noise of fixed-bottom platforms
  - What monitoring is needed to recognize marine species effects? Not much actual hard data on effects, so have to mine existing literature
  - Identify priority environmental interactions: sensitive species + specific stressors
  - Will interact with existing regulations and ocean uses
  - Stressor-receptor interactions:
    - stressor is any part of the offshore wind installation that may cause stress anywhere in the ecosystem; location and technology both are important
  - Receptors
    - for birds, floating turbines are a special risk, e.g., albatrosses and other birds that frequent large distances offshore.
    - Migratory whales can travel 5 miles or more offshore, are at risk from floating turbines.
    - Pinnipeds less at risk because the structures don’t provide good places to “haul out”
    - Bats – not a huge offshore issue except where there are islands; Farallones e.g., have a hoary bats colony
    - Habitats – most turbines will be on soft bottoms; avoid hard bottom habitats
- Use existing studies and identify research gaps
- Highest research priorities for interactions: birds, bats, marine mammals
- Renewables ocean mapping
  - Identify suitable sites for ocean renewables, starting in Oregon and Northern California
  - Combines site quality information, grid connection, shore resources, but not environmental constraints.
  - Aims to highlight resources, does not exclude areas with existing uses
- Tethys database and online management system for MHK – and offshore wind research: http://mhk.pnnl.gov/wiki/index.php/Tethys_Home

- California OCS has high diversity of bird species – 50+ species, both pelagic and near-shore and shoreline – 35 special status species on west coast US

- Changing status of pelagic birds: some migrate long distances, e.g., short tailed albatross, Hawaiian petrel – ESA listed.

- Impacts to birds can be categorized as: collision, avoidance, attraction; cumulative impacts are a concern
  - Collision: 100,000 to 400,000 birds killed/year now
  - Avoidance: Some avoid wind farms; this could restrict feeding space; barriers to movement (migration and feeding)
  - Attraction: may affect prey base; perching; light attraction; disorientation; e.g. peregrine falcons perching increased prey base – they can predate smaller birds at the platforms

- Little data available from European offshore wind farms re: bird effects: they aren’t doing bird monitoring there (for collisions)
  - BOEM/European interagency cooperation
    - Workshop in Feb 2013
  - More stringent monitoring anticipated to be required in US
  - No collision monitoring in Europe
  - Differences in geography, climate, species of concern limit the usefulness of European studies for California.

- BOEM engaged in environmental/avian monitoring studies
  - USA: drone surveys for birds

- Avian concerns in California:
  - Collisions due to large crowded colony flights, some birds (e.g., sooty shearwater) may be above normal flight height, unable to maneuver as freely as lone birds
  - Poor understanding of some species’ migratory/foraging patterns (recent evidence of travel in loop from Hawaiī to Japan, US west coast)
  - Predatory birds using turbine platforms to perch beyond normal habitat
    - How do turbines extend range of terrestrial predators?
  - Several rare and endemic species on West Coast sooty shearwater population is in global decline but there can be very large flocks in Ca offshore
  - Lighting: strobing colored lights may be less disruptive than constant white lights
  - Oil and gas lessons learned?
  - California diverse stakeholders: bird organizations; interested public; NIMBYs

- Baseline studies to determine present abundance and flight paths
  - Develop vulnerability index
  - Collaboration with other agencies and universities
• Mitigation approaches:
  o Siting is critical
  o Other mitigations:
    ▪ Construction timing
    ▪ Turbine design – fewer larger ones, minimize perching opportunities
    ▪ Layout of array: wider spacing of turbines
    ▪ Turbine operations: slower speeds, shutdowns at certain critical times

• Spanish mitigation example
  o 18 million bird and bat deaths due to onshore wind turbines
  o Perimeter monitoring network used to shut down turbines when sensitive species (vultures) are nearby
  o Study found 50% reduction in vulture deaths with mitigation, 0.07% reduction in power [de Lucas et al, Biological Conservation 147:184-9 (2012)]

• Environmental Studies Branch at BOEM-- produces peer-reviewed papers

• Hot spot analyses in California currents:
  o 20 year comparison from earlier studies
  o Associated with weather frontal systems
  o Western US: vulnerability index for scaling possible adverse effects of RE projects on Pacific OCS birds, ongoing, will be published
  o Nocturnal studies for ashy storm petrels and Xantress murrelets – on offshore oil platforms in So Cal – lighting effects
  o Habitat affinities and far-ranging behaviors of some Hawaiian seabirds that may fly over near to mainland west coast foraging for young and then fly back

• NOAA biogeography branch –David Perekstra david.perekstra@boem.gov

IV.4.c. Scott Terrill, H.T. Harvey and Associates

• 4.2 GW capacity for offshore wind – European wind farms average 29 km and 22 meters depth
• Current knowledge of offshore turbine bird impact based on European experiences
• Main risks: collision, habitat loss, migration barrier. Collision is bottom of list of how much we know; but top of list of concerns
• Europe versus California: similar nearshore birds, deep water in CA means pelagic species closer to turbines – closer to the continent here because west coast shelf break is so close.
• California Current environment is very different oceanographically from Europe or East Coast US – submarine heterogeneity off west coast promotes very rich environment and high species diversity
  o Boobies and frigate birds attracted to high perch areas
  o Foraging trips may span large area (Hawaii, Japan, California)
  o California songbirds typically don’t migrate over open ocean
• Flight height is affected by wind conditions
• 30-year data study in Pacific Ocean now being analyzed for BOEM
• Height tends to increase with wind speed, varies by species – pelagic, cold water birds are flight-adapted to wind energy; headwind vs tailwind vs crosswind
• Flights are categorized by height, highest bin is >10m

- Collision risks: lighting, bad weather (hard to monitor). Lights may impact night foragers that feed on bioluminescent organisms. Green/blue lights seem to be less disruptive to birds; strobes less disruptive than steady lights
- Passerines migrate at night; have a high percentage of wind turbine strikes but this not thought to be a big problem in Ca because of the migration routes.
- Intensive studies with data collection by David ____? et al from Southern Ocean, Peru Current, Antarctica as well as California current – huge dataset

### IV.4.d. Melinda Dorin Bradbury, Environmental Consultant

- CEC wave energy study is an example of a collaborative process for research gap analysis
  - Identified potential environmental effects of wave energy as a research gap and opportunity for interagency collaboration
  - Wave energy seen as an imminently arriving technology
  - Defined scope, identified researchers, required project management
  - Examined possible social environmental, economic effects, or identified gaps for future research
  - IBIS – online service
  - Report is available online CEC website

### IV.4.e. Panel Discussion

- Q (to David Perekstra): Will BOEM have the staff to evaluate information submitted by developers over 2 years of migratory and other studies? How will BOEM balance the benefit of RE against traditional activities…?
  - A: Yes; we will be issuing guidelines to relieve guesswork (as to what is needed) and we will be comparing and looking at cumulative effects
- Q (to David Perekstra): Are prey species increasing in European windfarms where predatory birds are avoiding the farms?
  - A: Possibly
- Q (to David Perekstra): Working with US Coast Guard on lighting?
  - A: We will be; Coast Guard requirements for oil and gas platform lights are complex and prescriptive
- Q (to Melinda): Re: LIDAR
  - Not being used now
  - SCADA data – wouldn’t show bird strikes
  - Infrared – might show splashdown after strike
  - We don’t understand fundamental issues of animal behavior around installations
• Comment (from Dr. Rick Zimmerman) – we will be starting UC Davis Coastal and Marine Sciences Institute

IV.5. KEYNOTE

IV.5.a. Huub den Rooijen, The Crown Estate (via videoconference)

• 1341 = current number of turbines operating or under construction in UK waters
• The Crown Estate is a public, non-governmental body accountable to Parliament
• In UK, transmission and generation owned separately by law
• A “proactive landlord” promoting offshore renewable energy development
  o Permitting (“consenting”) is handled by a separate agency (DECC)
    ▪ Not a regulator
  o Organizes selected areas into leasing rounds for wind, wave and tidal energy production
  o Assists developers with site identification, surveying, consenting
    ▪ Sometimes acts as a developer, co-investing in origination, consenting
  o Aims to avoid land banking
  o UK goals: increase energy security, stimulate economy, reduce greenhouse gas emissions, reduce electricity bills
• Health and safety is principal driver of good organizational culture in offshore industry
• The Crown Estate addressing sector-wide challenges summed up in cost of energy
• Leasing driven by national energy policy, marine spatial planning, and market
• Costs of decommissioning are included in lease, reducing risk to taxpayers in case of bankruptcy
• Engagement with stakeholders: fishing industry (FLOWW) engagement with site selection process led to mutual benefits
• Round 3 is an example of The Crown Estate priming market by performing initial selection work
• Dedicated test sites: new round for floating technology demonstrations
• Building larger farms is best opportunity for learning curve to reduce costs

Discussion

• Q: (Aviv Goldsmith, Fishermen’s Energy): Is fishing permitted within the wind farm? Are there minimum distances established for how close fishing vessels can be to the wind turbines?
  o A: Yes fishing is allowed in wind farms in the UK. There are minimum distances, but I don’t have the exact distances. It depends on the type of fishing.
• Q: (Bill Toman, Pacific Maritime Renewables): One of the things we’ve run into in California is a labyrinth of regulators and regulations that seem cumbersome compared to what you have in the UK. Did your consenting process evolve from something fragmented and complicated, or was it streamlined from the start?
A: At an early stage the government made an effort to channel the process. However, a lot of work has been done over the years to make the process more streamlined.

Q: (Andrea Copping, Pacific Northwest National Laboratory): We have used the work out of COWRIE to really good advantage. It’s been absolutely wonderful in moving forward some of the environmental studies in this country. Do you anticipate more of these large environmental impact studies?

A: In the early days of the industry there was a major focus on gathering data. What we see now is that data gathering is part of the consenting process for wind development projects. The focus of COWRIE has shifted as we’ve come to realize that other big cumulative impacts require focus and attention. They may go back to doing the data gathering they’ve done in the past after the current work is over.

IV.6. OFFSHORE WIND ENERGY TECHNOLOGIES FOR THE CALIFORNIA COAST

Moderator: John Hingtgen, California Energy Commission

- California has RPS goals of 33% by 2020, and the Governor has expressed interest in going to higher goals. The RPS energy targets provide an opportunity for all renewables, including wind generation, to expand in the state.
- Wind has been a major part of the renewable resource mix to date, and wind and solar are forecast to be major parts of the mix through at least 2020.
- Development of offshore wind in California will most likely occur in waters that are deeper than those in other regions of the US.
- The offshore wind energy resource in the state is larger than the 2012 generation from all sources, larger than the 2020 RPS energy requirement, and larger than the on-shore wind energy resource.
- Only 2% of California’s wind energy resource was tapped in 2012, offering lots of opportunity for wind to contribute more to the state’s energy goals.

IV.6.a. Leslie Rosenfeld, CeNCOOS

- CeNCOOS is the Central and Northern California Ocean Observing System
  - Part of the US Integrated Ocean Observing System
    - 17 members
  - Data interoperability with other members of IOOS
  - Shares responsibility for California with SCCOOS (Southern California Coastal Ocean Observing System)
    - Only state with two regional organizations under IOOS
    - Dividing line at Point Conception
    - Many cooperative efforts
  - Offshore wind would fall under the marine operations category
- CeNCOOS data collection and observations
• Try to understand and characterize ocean and marine atmosphere: predictions and forecasts, high frequency radars for measurement of surface currents, shore stations measure temperature, salinity, currents, etc.
• Website (www.cencoos.org) offers gateway to data including other sources.

• Wind observations and modeling
  • Navy model: COAMPS
    ▪ 3 km resolution is finer than weather service models until recently
      • NWS was 12 km
    ▪ Optimized for modeling ocean/atmosphere interaction
  • Data available from 2003 - present
  • Wind phenomena
    ▪ Spring transition: winter has more variability of speed and direction, spring and summer have predominant northwest wind patterns
    ▪ Winter storms – strong winds and low pressure
    ▪ Southerly Surge – low level wind from south
      • Reversal at low heights
      • Directional shear within height of turbine
    ▪ Seabreeze – coastal mountains block cross shore flow in many areas
    ▪ Cape enhancement – highest winds and largest variability occur at capes

• Wave data sources
  • Coastal Data Information Program (CDIP) includes measurements such as wave buoy observation along coast and a swell height and direction nowcast – cdip.ucsd.edu DART – deep water tsunami pressure sensors and tidal measurements

• Ocean current measurements and models
  • High frequency radar – covers coast with resolution ranging from 0.5 km to 6 km
  • Data is fed into ocean models, could be used to predict animals known to congregate at certain weather features
  • Upper and lower currents travel in opposite directions along California coast (vertical shear)
  • Turbidity flows: isolated but damaging (hard to model - usually lose equipment), associated with steep topography

Discussion

• Q: Is there an effort to reconstruct long-term (20-30 year) historical data?
  • A: Yes, UC Santa Cruz is working on it using CDIP

• Q: Shallow water model parameters?
  • A: Difficult to implement due to need of high resolution and variable nature

• Q: Plans to incorporate hydrophones into data collection?
o A: Possible on underwater gliders - leads to lots of data that can be difficult to manage. Would like to make a baseline noise map of coast.

• Q: Why non-hydrostatic assumption in COAMPS?
  o A: Allows better modeling of vertical flows.

IV.6.b. Walt Musial, National Renewable Energy Laboratory

• Population & wind energy – need multiple strategies to get wind energy to people, most people near coasts

• Over 4000 GW of gross offshore wind potential USDOE offshore wind target 20% wind energy by 2030, Department of Energy report (soon to be updated) 54 GW from offshore by 2030. Land based above trend, no offshore yet

• Onshore/offshore turbine technologies beginning to diverge
  o Shorter towers needed offshore due to reduced wind shear – but bigger in MW than onshore
    ▪ Tip clearance of ~75”; minimum requirement from Coast Guard and for wave clearance
  o Larger rotors than onshore
  o Direct drive generators are coming.
  o Operation & maintenance: higher cost, different challenges due to remote location. More costly to install.. Lessons and technology from oil/gas

• Offshore market mostly Europe and China now; very large growth expected in offshore wind deployment

• Although each region of the U.S. provides different conditions, offshore wind has several distinct challenges: deep water, ice (fresh water), and tropical storms; these should have engineering solutions to expand resource and reduce cost.

• Majority of US offshore resource is in deep water (>60 m), especially in California

• Current installations are mainly shallow water, moving into transitional water with new installations, different foundation styles
  o Tripods and jackets exhibit better structural dynamics than monopile

• Floating platforms make economic sense in deeper water
  o Various methods for primary stability of floating platforms, each method has primary hydrostatic restoring force
  o Construction is more expensive in deeper water – may be able to make up costs with mass production of platforms and ability to assemble on land and float to location
  o Two existing demonstration projects adapt land based technology to floating
  o Substations out at sea? (German model) instead of cable for each farm

• Dept of Energy funding demonstration projects to help jumpstart industry

• Offshore technology may need different optimizations than onshore turbines

• Policy can support reduction in cost of energy
Discussion

- Q: Earthquake risk of offshore?
  - A: Earthquake risk is design parameter, not dissimilar from land based turbines
- Q: Current cost of energy?
  - A: $0.18/kWh-$0.29/kWh in Europe, $0.27 Statoil project in Maine

IV.6.c. Kevin Banister, Principle Power

- Engineering team out of Berkeley
- Wind Float platform
  - Uses any manufacturer’s turbine “off the shelf”, modifications to control system
  - 3 or 4 mooring lines
- Portugal project
  - Windplus, S.A. - many partners
  - Able to use existing power cable to reduce costs
  - Turbine and float constructed on land in dry dock in port, then floated to site and attached to moorings
  - Portside construction decreases risk:
    - Towing vessel to tow turbines more available, cheaper than crane ships to construct at sea
    - Avoids jack-up barges, which have been responsible for damaging many submarine cables in European wind farms
      - Most offshore insurance claim requests have been for cable strikes
    - Turbines can be returned to shore for maintenance if necessary
  - Power curve of floating turbine correlates well with the published curve for onshore machine
- Oregon project
  - Oregon moving to 25% RPS
  - Construction site is chosen to avoid going under bridges when floating turbine out to sea
  - Lots of partners for the demonstration, need to implement by 2017 for DOE grant, quick lead time for the project
  - DOE milestones:
    - Permitting (BOEM)
    - Engineering design review
    - Project management (power purchase agreement)
  - 25 year life

Discussion

- Q: Draft and motion of demonstration turbine?
A: Operational draft 20 m, towing draft 7 m; pitch and roll of turbine less than 2.5 degrees


- Marine consulting firm with wide variety of projects
- Tension leg platform currently 1000 ton weight, could reduce for final design
- Quayside assembly
- Specialized barge for installation avoids crane operations offshore
- TLP has less impact than catenary moorings – minimizes floor disruptions
- Regular predictable turbine maintenance important to keep costs down, maximize total system reliability
- Reducing costs by increasing turbine size (biggest driver), then reducing financial risk.
- Demonstration project in UK (ETI)
  - Bigger turbine reduces installation costs, longer blades access better wind
  - 1st design review done, FEED study currently underway
- Need to make sure there is real demand – commercially viable (site conditions, political process, demand).

**Discussion**

- Steel mass 1100 tons for 6MW unit, >1000 tons for production
- Processing of steel has as much cost impact as volume of steel
- Can multi-purpose installation vessel- have it provide O & M also.
- Anchor technology is site specific depending on ocean floor.

**IV.6.e. Mirko Previsic, Re Vision**

- Techno-economic optimization – optimize all factors simultaneously
- Cost & design drivers for offshore turbine are different than for land-based turbines – offshore wind may look very different in 20 years than today, re: turbine design
- Simulation toolbox developed – couples turbine dynamics and hydrodynamics for total system simulation
  - Important to look at the coupled system for analysis
- Marine construction vessels $50-100 thousand per day
  - Looking into unmanned ships to reduce costs
  - Develop new unmanned vessel which operate in more extreme conditions than manned vessels
- Example – assumptions can dictate results
- Lots of different cost drivers can be site specific, difficult to generalize
IV.6.f. Panel Discussion

Q1: There has been some discussion around the ideas that different design concepts will have different footprints in the ocean and that the footprint will affect environmental impacts. How much flexibility in the design is there to change the size of the footprint?

- Too soon to worry about footprint specifically
- Government should do site preselection to manage stakeholders & environmental concerns. It would allow developers more certainty in arranging financing and that they could actually build projects.

Q2: Government bodies seek to maximize the effectiveness of their investments in R&D. Where are the gaps to be filled in current research that the state might fund?

- Demonstration projects should be used because they will fill in many of the gaps that we don’t know exist
- Consistent and predictable regulation is needed
- Discussion of offshore wind environmental impacts should include cross comparison of all impacts from the various energy sources

Audience questions and panel responses:

- Cabling is expensive – balance of plant cost
  - 80% of European insurance claims are for cables
- Being closer to shore provides many benefits for operations and maintenance, access, balance of plant, etc.

IV.7. ECONOMIC OUTLOOK AND INFRASTRUCTURE NEEDS

Moderator: Michael Sokol, California Energy Commission

IV.7.a. Andy Wickless, Navigant Consulting

- Offshore wind projects require lots of capital, which is typically financed in one of two ways:
  - Balance sheet financing: company uses its own money
    - Cheaper, simpler to set up and control
    - Requires deep pockets (e.g. utility companies - may have conflicting priorities), may impact credit rating
  - Project financing: stand-alone entity seeks financing from various sources
    - More expensive, more difficult to coordinate multiple contributors
- Less risk to principal backers
- Initial European projects used balance sheet financing, but are shifting to project financing
- Main risks are delays, cost overruns, weather, technology (breakdowns)
- PPA essential to obtain financing
- Public sources can assist with loans or loan guarantees to establish industry
- OEMs may finance to build market, but not a long-term solution
Discussion

- Q: What do you see as the best near-term opportunity to improve the economics of offshore wind?
  - A: Policy. Without production tax credit, feed in tariff, investment tax credit, or some other mechanism to bring down cost I think we’re going to have a hard time growing the industry in the US. In my mind progress will be state driven in the near term. For example, the policies adopted in New Jersey and Maryland.

- Q: What is the average cost devoted to permitting and environmental mitigation?
  - A: For large-scale projects, permitting is a tiny portion of the cost of the project. Less than 1%.

- Q: With more US projects in the works, do you think US or European banks will finance them?
  - A: European, at least for the first couple of years. They have the expertise and experience in the industry. Most of these banks are really global. It doesn’t matter much if the projects are on US soil. US banks may get involved eventually as the US offshore wind industry grows.

- Q: Do you see any environmental drivers that would facilitate carbon intensive projects funding these renewable projects?
  - A: Can you give an example?
- Q: The California carbon market that allows carbon intensive projects to buy credits to meet greenhouse gas limits.
  - A: In Europe we see some large oil and gas companies financing a building wind farms. They have the capital to do that and they may be more likely to do it than US based utilities.
  - A (from the audience): We see a lot of onshore projects where oil and gas companies buy credits from wind farm operators without financing the projects.

IV.7.b. Chris Elkinton, GL-Garrad Hassan

- GL-GH offshore team: 100 people
- Predicting 28 GW offshore by 2030, will need 16 projects on West Coast to meet this; need 2 manufacturing ports, 2 staging ports
- Study of offshore wind port readiness sponsored by DoE
  - Assumptions about turbine deployment based on “20% by 2030” moderate growth model
- Vessels constrained by Jones Act: must be US built/flagged or use US feeder ships
- Characterized typical weights and dimensions of wind farm components, based on capacity
  - Bearing pressure is key limitation in many US ports
    - Too low at 10 t/m²
  - Choice of installation methods may require unobstructed height clearance between port and ocean
• Online tool: www.OffshoreWindPortReadiness.com
  o Intended to inform decisions by developers and port operators
  o Now publicly available, still needs more complete information from port operators
    ▪ Will allow for operators to enter information about their own port
• Floating turbine considerations: height clearance, wide channel for tug spread

Discussion

• Q: Will there be outreach to the ports to populate this tool?
  o A: Yes. We’ve reached out to the ports. Now that we have the tool to show them I think they will be even more responsive.
• Q: Can the infrastructure improvements we need for sea level rise be combined w/the improvements needed for offshore wind?
  o A: Yes. That would be great.
• Q: Are any ports in California ready?
  o A: Yes. Technically, some ports in California could be ready with minor improvements. However, finding space in the queue for offshore wind projects will also be an obstacle.
• Q: Atlantic ports are going through huge changes over the coming years. How can we (the offshore wind industry) be involved in those changes?
  o A: We’re a small industry. It’s up to us to make them aware and to be part of the discussion.

IV.7.c. Christopher Morris, Massachusetts Clean Energy Center

• Commonwealth of Massachusetts is interested in offshore wind for resource potential, jobs, environmental benefits
  o Clean Energy Center provides investment, job training, infrastructure
  o Utilities required to purchase fixed minimum of clean energy, including offshore wind
  o Mass. Spends $22 billion/year on energy; $18 billion/year goes out of state
  o Massachusetts is #2 in clean energy development leadership: California is #1
• MassCEC supporting Cape Wind as a first mover
  o Stakeholder engagement
  o Maps of fishing vessel traces used to eliminate regions from wind energy area
  o Cape Wind 15 meters depth water, very shallow. Scallop fishing grounds: restricted wind energy area
  o Cape Wind could supply 77% Massachusetts energy needs
• Large blade testing facility supports technology development
• New Bedford Marine Commerce Terminal: restore port economy, supply MA offshore wind farms including Cape Wind
Comparable to European ports, esp. Cuxhaven and Bremerhaven: historic fishing ports, economic decline, high unemployment

- Suitable depth, no overhead obstructions, skilled workforce, close to resource areas, protected harbor
- Superfund site complicates dredging
- Constructing new bulkhead with high bearing pressure

**Discussion**

- **Q:** How do you keep offshore wind developers from moving to other facilities?
  - **A:** There really isn’t another alternative.

- **Q:** Is the Massachusetts Maritime Academy involved in development or training?
  - **A:** Yes. And there are other training programs. The Pathways Out of Poverty grant looks for people who, with a little bit of training, can get into apprentice programs with the trade unions, who then put those people to work. With that they can develop skills that can be translated to the offshore wind industry. We’re also in the process of doing a planning grant with Cape Cod Renewable Trust to put together a program to send people to Germany to be fully trained to be professors so they can bring that knowledge back to Massachusetts and train people to work in offshore wind operation and maintenance. The closest current facility is in Kalamazoo, Michigan, but they are more geared towards onshore wind.

- **Q:** Did you look at other ports in addition to the ones included in the presentation?
  - **A:** We looked at more ports, but I think those two are the best corollaries to New Bedford. New Bedford has an unemployment rate of 12.5%, which is twice as much as Massachusetts overall, so they have a high unemployment rate and they really do have similar circumstances (to the example in the presentation). New Bedford is heavily dependent on fishing. Most fishermen work a couple months a year to make their living, then there’s really not a mechanism for them to continue to make a living wage for the rest of the year.

**IV.7.d. Jim Lanard, Offshore Wind Development Coalition**

- Note: no slides
- The goal of this talk is to point out lessons learned from east coast development.
- This talk is focused towards policy makers.
- Court decision on constitutionality of state preferences for in-state renewables
- Our coalition
  - Represents virtually all of the active offshore wind developers in the US and 4 or 5 European developers, as well as most of the supply chain.
  - Our mission is to advocate for federal and state policies to move the offshore wind industry forward.
- Cape Wind
  - Operating for 12 years
Over $60 million spent over 12 years
$0 revenue for 2-3 more years

- Deep Water Wind
  - $30 million spent
  - Power purchase agreement for 30 MW
- Statoil
  - Power purchase agreement for 12 MW
- Maryland and NJ have passed laws to encourage offshore wind
  - Maryland: revenue stream for 200MW if developers meet certain criteria.
  - New Jersey: 1100 MW revenue stream for offshore wind.
- Some states, like California, require a certain amount of installations sources for renewable energy—this has been declared unconstitutional in Court of Appeals
- In California, you’re not going to see a clamoring of developers to spend millions of dollars with very little likelihood of return if there aren’t policies in place and regulations and procedures to move forward. You have an opportunity right now to figure out the best way to move forward, so when the time is right the developers will be willing to make investments here.
- 1st challenge: Federal government issues leases on the outer continental shelf. It goes to the highest bidder without any consideration to if the bidder is qualified or able to develop the resource. The state controls the revenue stream and can consider the qualifications of the developer and might pick a developer who doesn’t own the lease. This is a problem.
  - Maryland asked for their federal footprint to be divided into two pieces, then only allows leaseholders to bid for state revenue stream.
- We’ve had many advancements in this industry in the last 5-7 years
  - 3 MW turbines to 6 MW
  - $8 million met tower to floating LIDAR measurements ($2 million)
- We don’t have commercialized floating foundations yet, but don’t worry about floating platform technology. This technology will be proven long before offshore wind will be up and running in California.
- European energy policy
  - They believe in climate change
  - They want to reduce consumption, so they price energy and petrol high.
  - The subsidies on offshore wind don’t have to be as big.
  - They are striving for energy independence
- US Energy Policy
  - US energy policy is really a geographic policy
  - If you’re from coal country you advocate coal mining, if you’re from gas country you advocate for gas.
  - We’ll never get a consensus
• In California the offshore wind conversation is about CO2 reduction and RPS standards. I haven’t heard a lot of talk about portfolio diversity, energy independence or job creation as drivers for renewable energy. As we move forward we should try to extend our conversation.

• I don’t think offshore wind is really part of the 33% by 2020, because it seems like you’re already close without it.

• California policy considerations
  - There is a real public benefit to support first movers in any industry.
  - Learn from what is being done on the east coast.
  - Find a way for the first movers to share the risk and reward with the state.

• My biggest concern with BOEM is that they won’t have enough resources when this industry gets going.

• Another worry is the permitting process.
  - 5-7 years for just permitting is too long.

• Other concerns are: the coast guard (increasingly possessive of open water for navigation) and tower lighting

• We’re driving down the cost of technology. We also need to drive down the cost of capital.
  - Financing offshore wind is expensive
  - Maybe a California backed or California obligated fund could be used to provide affordable loans.

• Marine life and avian issues
  - We will do at least 2 years of study.
  - We should be doing a lot of post construction monitoring of the first projects then plan mitigation for subsequent projects.
  - Let’s not get caught up in not being able to build anything until we know everything.

• When it comes to state coastal regulations, I think we’re going to see an extra level of scrutiny in California compared to the east coast. Make sure CA coastal regulations are clear and make sure it’s a parallel process that can occur at the same time as the federal process.