

ATLANTIC WIND ENERGY WORKSHOP

Summary Report

FINAL
28 September 2011



Prepared for:

U.S. Department of the Interior
Bureau of Ocean Energy Management,
Regulation and Enforcement



Prepared by:

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Suggested Citation:

Cahill, M., K. Olsen, D. Blaha, J. Tims, A. Finio, M. Todorov, J. Ewald, J. Primo, L. Medley, D. Bigger, K. Skrupky, B. Hooker, B. Jordan and A. Dhanju. Atlantic Wind Energy Workshop Summary Report. U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement. Herndon, VA. OCS Study BOEMRE 049-2011. 78 pp. + apps.

**Prepared under BOEMRE Contract
GS-07F-0591W**

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1.0 INTRODUCTION

On November 23, 2010, Secretary of the Interior Ken Salazar launched a “Smart from the Start” wind energy initiative for the Atlantic OCS to facilitate siting, leasing and construction of new projects, spurring the rapid and responsible development of this abundant renewable resource. In January 2011, the Department of the Interior’s (DOI) Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) initiated the National Environmental Policy Act (NEPA) environmental assessment (EA) to evaluate the potential impacts associated with site assessment activities on the Atlantic OCS. BOEMRE published the draft EA in July 2011 for review and public comment (to be submitted by August 11, 2011). All comments on the draft EA will be considered in the preparation of the final EA and determination of whether a Finding of No Significant Impact (FONSI) would be appropriate, or whether an Environmental Impact Statement (EIS) would need to be prepared. The draft EA can be accessed online at: [U<http://www.boemre.gov/offshore/RenewableEnergy/SmartFromTheStart.htm>](http://www.boemre.gov/offshore/RenewableEnergy/SmartFromTheStart.htm).

On October 1, 2011, BOEMRE was reorganized into the Bureau of Ocean Energy Management (BOEM) and Bureau of Safety and Environmental Enforcement (BSEE). For more information on the reorganization: <http://www.boemre.gov/reorganization.htm>

As part of the Secretary of the Interior’s “Smart from the Start” wind energy initiative to spur renewable energy development on the Outer Continental Shelf (OCS), this workshop will assist BOEMRE and its federal partners in environmental and technical reviews of wind energy areas and in the evaluation of new projects. Additionally, this workshop was part of the DOI-Department of Energy (DOE), Memorandum of Understanding (MOU) process to coordinate environmental monitoring and baseline studies in support of environmental assessment and consultations for siting and leasing in the mid-Atlantic wind energy areas. The Atlantic Wind Energy Workshop was held 12 through 14 July 2011 at the Hyatt Dulles Hotel in Herndon, Virginia. The three day workshop had 180 participants, representing Federal, State, tribal, NGO, academia, developers and public interest.

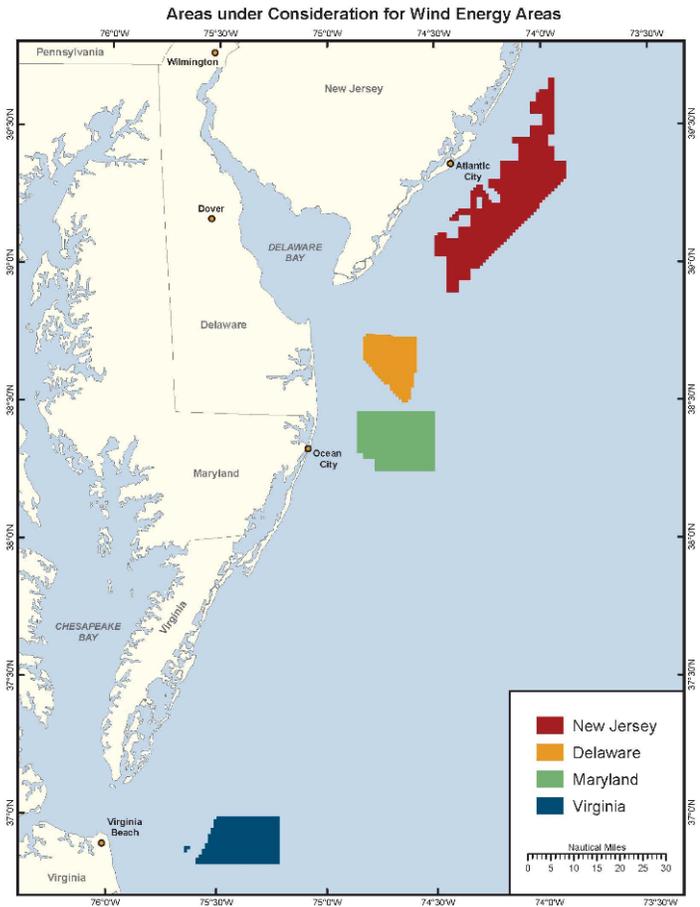
Director Bromwich opened the Workshop with a speech that touched on the role of offshore renewable energy development in the Administration’s Blueprint for a Secure Energy Future, and explained how the bureau’s Offshore Renewable Energy Program is being elevated through the overall reorganization of the former Minerals Management Service. The Director also highlighted steps the bureau is taking internally and with other federal agencies and state partners to streamline the leasing process while ensuring environmental protection as projects move forward. He concluded his opening speech, “We all have a role to play in building a secure energy future for America. Here today, we are moving forward collectively in support of the Administration’s ambitious clean energy goals. Success is achievable. How and when we attain that success is, in part, dependent upon the active communication and coordination among our respective agencies and organizations. I encourage you to fully engage in discussions over the next three days to help define and advance our collective scientific knowledge, identify critical data gaps, and outline strategies for enhancing collaboration in future environmental studies and research. As BOEMRE continues with its comprehensive regulatory reforms and reorganization, I assure you that we will remain focused and dedicated to leading the nation toward a renewable energy future.” The full address may be found at: <http://www.boemre.gov/ooc/press/2011/press0714.htm>

1.1 WORKSHOP GOALS

Goals for the workshop included 1) providing a summary and synthesis of recent and ongoing technical, environmental and social sciences research; 2) identifying key data needs and prioritize research gaps; and 3) developing partnerships and identifying potential synergies for future studies. In addition, the Workshop provided a technical document updating the research conducted since the Worldwide Synthesis and Analysis of Existing Information Regarding Environmental Effects of Alternative Energy Uses on the Outer Continental Shelf workshop in 2007, related to offshore wind development in the Atlantic Wind Energy Areas (Map 1).

1.2 WORKSHOP FORMAT

The Workshop was structured so that the specific goals could be achieved and information sharing could occur within small breakout groups. This was accomplished by beginning the workshop with a Plenary Session with all attendees present to set the stage for subsequent breakout sessions. The presentations provided updated information relevant to the regulatory program, market barriers, maritime infrastructure, energy infrastructure, and some aspects of energy markets as they relate to offshore wind power on the Atlantic Outer Continental Shelf (OCS).



Map 1. Areas under Consideration for Wind Energy Areas

1.3 AGENDA

Day One (July 12, 2011) Plenary Session

8:00-8:45 **CIRRUS FOYER A** **Registration and continental breakfast**

8:45-12:15 **CIRRUS BALLROOM** **All groups until 12:15 PM**

Session Objective: The workshop focus is on the available data and information needs for site assessment and operational planning in the mid-Atlantic Wind Energy Areas. The plenary session is designed to set the stage for the breakout sessions (page 5).

8:45-9:15	Welcome & Keynote Address – Introduction and Scope of Workshop including DOI-DOE MOU, "Smart from the Start" research initiatives, goals of workshop including an update of knowledge; priority data gap identification, and developing partnerships and collaboration – <i>Michael R. Bromwich, Director</i>
9:15-9:40	BOEMRE Renewable Energy Research and Regulatory Program Update – An overview of the planning, leasing and environmental review processes for wind energy on the Atlantic OCS. This will include a brief overview of existing and expected survey guidelines for potential lessees. A state-by-state status will be given, including identification of current and future wind energy areas – <i>Maureen Bornholdt, Program Manager, Office of Offshore Alternative Energy Programs</i>
9:40-10:05	Department of Energy – An overview of market barriers for future wind energy projects, and how these barriers are being address under DOE funding opportunities – <i>Christopher G. Hart, Ph.D., Offshore Wind Manager, DOE</i>
10:05-10:25	Energy Market and Infrastructure Information for Evaluating Alternative Energy Projects for OCS Atlantic – Summary of BOEMRE Study – <i>Maureen Kaplan, Ph.D., Eastern Research Group, Inc.</i>

10:25-10:35 **Break**

10:35-12:15 **Federal Agency Panel** – In addition to BOEMRE and DOE, many other federal agencies have roles in offshore renewable energy, either as a regulator or resource agency. Panel participants will discuss each of their legal mandates and how the agencies are coordinating with each other to reduce duplication and increase efficiency.

- **Moderator** – *Joel Whitman, CEO, Global Marine Energy, Inc.*
- **BOEMRE** – *Maureen Bornholdt, Program Manager, Office of Offshore Alternative Energy*
- **FERC** – *Tim Konnert, Fish Biologist, Office of Energy Projects*
- **FWS** – *David Cottingham, Senior Advisor to the Director*
- **USGS** – *Walter Barnhardt, Director, Woods Hole Coastal & Marine Science Center*
- **NPS** – *Sarah A. Quinn, J.D., External Renewable Energy Specialist*
- **NOAA** – *Emily Lindow, Senior Policy Advisor*
- **FAA** – *John Page, Obstruction Evaluation Group*
- **USACE** – *James Haggerty, NAD Program Manager*
- **USCG** – *George Detweiler, Marine Transportation Specialist*
- **DOD** – *Frederick Engle, Office of the Secretary of Defense*
- **EPA** – *Susan E. Bromm, Director, Office of Federal Activities*
- **ACHP** – *Tom McCulloch, Senior Program Analyst*

Facilitated Q & A session

12:15-1:00 Lunch – Bag lunches provided

**1:00-5:00 ROCKBRIDGE ROOM Technology Assessment & Research (TA&R)
Program: Renewable Energy Studies session – Page 7-9**

CIRRUS BALLROOM

Day One facilitator for environmental sessions will be Brian Balcom, CSA International, Inc.

1:00-3:00 Information Management and Data Sharing Products Panel – Cross-discipline look at mapping and data issues in support of the science needed for planning, decision making and stewardship. Panel participants will discuss existing and future efforts, including Coastal Marine Spatial Planning (CMSP), geo-spatial databases, mapping products, and data portals. (10 minute briefs with Q & A at the end).

- **Moderator** – *Mary Boatman, Ph.D., (BOEMRE)*
- **EcoSpatial Information Database (ESID)** – *Keld Madsen, Geospatial Services Manager, AMEC*
- **Habitat Mapping** – *Chris Caldwell, Branch Chief, NOAA Biogeography Branch*
- **Sonar Mapping for Multipurpose Use and an Integrated Ocean and Coastal Mapping Standard** – *Brian Calder, Ph.D., NOAA/University of New Hampshire Joint Hydrographic Center*
- **Space Use Conflicts** – Developing a geospatial database compatible with the BOEMRE mapping system to assist in determining multiple uses offshore – *John Weiss, Industrial Economics, Inc.*
- **Mid-Atlantic Regional Council on the Ocean – MARCO Data Portal** – *Laura McKay, Program Manager, Virginia CZM Program, Dept of Environmental Quality*
- **Northeast Regional Council on the Ocean – NROC Data Portal** – *Nicholas Napoli, Director of Marine Planning Programs, Massachusetts Ocean Partnership*
- **OBIS-SEAMAP** – *Patrick N. Halpin, Associate Professor of Marine Geospatial Ecology, Duke University*
- **MMC** – The future of data sharing – Update on Multipurpose Marine Cadastre – *Christine Taylor (BOEMRE) and Brian Smith (NOAA)*

Facilitated Q & A session

3:00-3:15 Break

3:15-5:00 LAYTON ROOM Social-Economics Afternoon Session: Overview of Assessment Focus (Environmental Assessment and NEPA) and the Cultural and Historic Resources Session –Page 9

CIRRUS BALLROOM

3:15-5:00 Developers Panel – Monitoring from meteorological towers, buoys and survey plans, capabilities, limitations and lessons from the field.

- **Moderator** – *Jim Lanard, President, Offshore Wind Development Coalition*
- **Fishermen's Energy of NJ, LLC** – *Stephen O'Malley, Engineering Coordinator*
- **Deepwater Wind, LLC** – *Aileen Kenney, Director of Permitting*
- **Bluewater Wind NJ Energy, LLC & Bluewater Wind Delaware, LLC** – *Laurie Jodziewicz, Director of Permitting*
- **Atlantic Wind Connection** – *Kris Ohleth, Director of Permitting, Atlantic Wind Connection*

Facilitated Q & A session

5:00-5:30 Day one summary and direction for day two

Day Two (July 13, 2011) Breakout Sessions

- 1) **Environmental Breakout Sessions: Monitoring and Baseline Studies**,
CIRRUS AB ROOM – Pages 5-6
- 2) **Technology Assessment & Research Program: Renewable Energy Studies**,
ROCKBRIDGE ROOM – Page 8
- 3) **Social-Economic Breakout: Assessment Driven Issues**,
CIRRUS CD ROOM – Page 10
- 4) **Birds, Bats and Offshore Wind Development: Remaining Information Gaps**,
LAYTON ROOM – Page 11

Environmental Breakout Sessions: Focus on Biological and Habitat Concerns Related to Environmental Monitoring and Baseline Studies Breakout Sessions Day Two (July 13, 2011)

8:00-9:00 CIRRUS FOYER A **Registration and continental breakfast**
9:00-5:15 CIRRUS AB ROOM

Day Two facilitator for all environmental breakout sessions will be Brian Balcom, CSA International, Inc.

9:00-10:45 State Planning and Information

Session Objective: To provide information on state ocean management plans and baseline study efforts, including obstacles encountered and remaining gaps and how this information is useful to the OCS development.

- **Moderator** – *Jennifer Ewald, BOEMRE*

9:00-9:15 **New Jersey Ecological Baseline Study** – *Gary A. Buchanan, Ph.D.*,

9:15-9:30 **Massachusetts Ocean Plan** – *Bill White*

9:30-9:45 **Maine State Planning Office, Maine Coastal Program** – *Matt Nixon*

9:45-10:00 **Rhode Island Ocean Special Area Management Plan** – *Grover Fugate*

10:00-10:15 **Developing Environmental Protocols** – *Michelle Carnevale and John King, Ph.D.*

10:15-10:45 **Facilitated Q & A session**

10:45-11:00 **Break**

11:00-12:00 Broad Scale Habitat, Abundance and Distribution – Consultation Process

Session Objective: To provide an overview of the applicable environmental laws and regulations enforced by the other environmental agencies, namely NOAA and FWS, that govern offshore renewable energy activities. Provide the attendees with an overview of the Acts, the information, data, and applications to comply with the Acts, and the timing for these compliance documents.

- **Moderator** – *Kim Skrupky, BOEMRE*

11:00-11:15 Marine Mammal Permits – *NOAA, Michelle Magliocca*

11:15-11:30 ESA Consultations – *NOAA, Kellie Foster (invited)*

11:30-11:45 ESA Consultations – *FWS, Julie Thompson*

11:45-12:00 Facilitated Q & A session

12:00-1:00 Lunch – bag lunches provided

1:00-3:00 Broad Scale Habitat, Abundance & Distribution – Baseline Data

Session Objective: To identify what species are being studied in what locations, during which seasons, using which technologies, and if there is any data (or preliminary data).

- **Moderator** – *Kim Skrupky, BOEMRE*

1:00-1:35 Fisheries Management Council Perspective: Spatial Aspects of Fishery Management Plans – *Tom Hoff, MAFMC & Michelle Bachman, NEFMC & Roger Pugliese SAFMC*

1:35-1:50 NMFS Surveys – *Sofie Van Parijs, Ph.D., NMFS*

1:50-2:05 AMAPPS – Update on this multi-agency project – *Kim Skrupky, BOEMRE*

2:05-2:20 Navy Baseline Studies – *Robin Fitch, U.S. Navy*

2:20-3:00 Facilitated Q & A session – How these data may be incorporated in environmental analyses, which data gaps exist, and which data gaps can be closed soon.

3:00-3:15 Break

3:15-5:15 Acoustic Monitoring Technology and Impacts

Session Objective: To identify which monitoring methods and technologies are currently being used, both unsuccessfully and successfully, on various species, locations, and seasons. And what impacts have been identified

- **Moderator** – *Michael Rasser, Ph.D., BOEMRE*

3:00-3:15 OSC Acoustic Monitoring – *David Zeddies, JASCO*

3:15-3:30 Monitoring Technologies and Acoustics PNNL – *Tom Carlson, PNNL*

3:45-4:00 Acoustic Monitoring, Impacts and Sound Characterization – *Peter Dugan, Cornell*

4:00-4:15 Electromagnetic Fields – *Ann Pembroke, Normandeau Associates*

4:15-4:45 NMFS Large Whales and Acoustics – *Sofie Van Parijs, Ph.D.,*

4:45-5:15 Facilitated Q & A session – How these data may be incorporated in environmental analyses, which data gaps exist, and which data gaps can be closed soon.

5:15–5:30 Day two summary and direction for day three

**Technology Assessment and Research (TA&R) Program:
Renewable Energy Studies
Breakout Sessions Day One (July 12, 2011)**

1:00-5:00 ROCKBRIDGE ROOM

Day One facilitator for all TA&R sessions will be Dan White, Continental Shelf Associates, Inc.

Moderator: Lori Medley, BOEMRE

1:00-1:30	Overview of TA&R Program and Summary Review of Renewable Energy Studies Conducted to Date – <i>Lori Medley, BOEMRE</i>
1:30-2:00	TA&R 634 “Mitigation of Underwater Pile Driving Noise During Offshore Construction” and TA&R 651 “Evaluate the Effect of Turbine Period of Vibration Requirements on Structural Design Parameters” – <i>Dwight Davis, Applied Physical Sciences Corp.</i>
2:00-2:45	TA&R 633 “Wind Farm/Turbine Accidents and the Applicability to Risks to Personnel and Property on the OCS, and Design Standards to Ensure Structural Safety/Reliability/Survivability of Offshore Wind Farms on the OCS” and TA&R 671 “Offshore Electrical Cable Burial for Wind Farms: State of the Art; Standards and Guidance; Acceptable Burial Depths and Separation Distances; and Sand Wave Effects” – <i>Malcolm Sharples, Ph.D., Offshore Risk and Technology Consulting Inc.</i>

2:45-3:00 Break

3:00-3:25	TA&R 656 “Seabed Scour Considerations” – <i>Tom McNeilan, Fugro Atlantic</i>
3:25-3:50	TA&R 627 “Assess/Develop Inspection Methodologies for Offshore Wind Turbine Facilities” and TA&R 650 “Offshore Wind Turbine Inspection Refinements” – <i>Robert Sheppard, Energo Engineering</i>
3:50-4:15	TA&R 669 “Floating Wind Turbines” and TA&R 670 “Design Standards for Offshore Wind Farms” – <i>Qing Yu, American Bureau of Shipping</i>
4:15-4:30	TA&R 672 “Development of an Integrated Extreme Wind, Wave, Current, and Water Level Climatology to Support Standards-Based Design of Offshore Wind Projects” – <i>George Hagerman, Virginia Tech Advanced Research Institute</i>
4:30-4:40	IEC TC 88 status update – <i>James Manwell, Univ. of Mass.</i>
4:40-4:50	TRB “Structural Integrity of Offshore Wind Turbines” report – <i>Walt Musial, NREL</i>

4:50-5:00 Closing remarks and instructions for tomorrow’s sessions

**Technology Assessment and Research (TA&R) Program:
Renewable Energy Studies
Breakout Sessions Day Two (July 13, 2011)**

8:00-9:00 **CIRRUS FOYER A** **Registration and continental breakfast**

9:00-5:15 **ROCKBRIDGE ROOM**

Day Two facilitator for all TA&R sessions will be Dan White, Continental Shelf Associates, Inc.

Moderator: Lori Medley, BOEMRE

9:00-9:30	Open Mic – An opportunity for participants to present any other relevant efforts that have been recently completed, or that are on-going that may have an impact on TA&R research efforts.
9:30-9:50	“Proven Technology” in New Operating Environments – Several differences in the operating environment of the Atlantic seaboard, and the areas where offshore wind turbines currently are sited have been identified, e.g. hurricanes and open-ocean breaking waves. What other issues present unique concerns for the U.S. OCS? What can we adapt from oil and gas experience?
9:50-10:10	Marine Hydrokinetic (MHK) Devices (with special emphasis on current devices in the Gulf Stream) – FERC will be the regulatory agency for construction and operations of some MHK devices on BOEMRE leases, but if the device is not grid connected, BOEMRE will regulate its construction and operations. Design standards have not been developed for these devices. What are the key operational safety/protection of the environment concerns? Are API standards, such as those for the design of mooring systems, appropriate for this industry?
10:10-10:30	Design and Safety Standards Gaps – Several preliminary studies and on-going standards maintenance efforts have been initiated. What gaps have been identified? Are they appropriate for consideration for research under the TA&R program funding?

10:30-10:45 **Break**

10:45-11:05	Regulating Worker Safety – The risks to offshore oil and gas workers and terrestrial wind farm workers will be discussed with the goal of determining the key issues of regulating worker safety on the U.S. OCS.
11:05-11:25	Working with Intellectual Property in Technology and Safety Assessments – Recent documents submitted to BOEMRE have revealed that offshore wind turbines may contain substances that present hazards that are not obvious, e.g. ethylene glycol contained in a dampering system. What other unknown hazards are there? How do we work around IP issues?
11:25-12:00	Participants’ Concerns – Participants will be encouraged to introduce additional topics.

12:00-1:00 **Lunch – bag lunch provided**

1:00-4:00	Development of potential research topics – Based on topics identified in the morning session, those deemed most appropriate for potential funding under the TA&R program will be further defined. Most critical topics will be identified and research requirements including data sources and other challenges will be discussed.
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4:00-5:00 **Wrap Up**

**Social-Economic Breakout:
Assessment Driven Issues
Breakout Sessions Day One (July 12, 2011)**

3:15-5:30 LAYTON ROOM

Day One facilitator for socioeconomic session will be David Blaha, ERM

3:15-3:35 Discussion on the Assessment Driven Focus of This Workshop (Environmental Assessments/NEPA)

3:35-5:30 Cultural and Historic Resources

Session Topics: Historic/Cultural resources, tribal issues, archaeological resources, submerged cultural sites and landscapes.

- **Moderator** – *Brian Jordan, BOEMRE*
- **Fathom Research, LLC** – *Mr. David Robinson*
- **Wampanoag Tribe of Gay Head** – *Ms. Bettina Washington*
- **Narragansett Indian Tribe** – *Mr. Doug Harris*
- **BOEMRE** – *Mr. David Ball*
- **Sea Education Association** – *John Jensen, Ph.D.*

Conclusion for Day 1

**Social-Economic Breakout:
Assessment Driven Issues
Breakout Sessions Day Two (July 13, 2011)**

8:00-9:00 CIRRUS FOYER A Registration and Continental Breakfast

9:00-5:40 CIRRUS CD ROOM

Day Two facilitator for all socioeconomic sessions will be David Blaha, ERM

9:00-9:10 Recap: Assessment Driven Focus of This Workshop

9:10-11:10 Multi-Use Issues/Space-Use Conflicts

Session Topics: OCS renewable energy and space-use conflicts and related mitigation, recreational fishing, commercial fishing, DOD, shipping, human geography/ spatial analysis.

- **Moderator** – *John Primo, BOEMRE*
- **Independent Contractor and University of Maryland, Adjunct Faculty** – *Susan Abbott-Jamieson, Ph.D.*
- **University of Delaware** – *Jeremy Firestone, Ph.D.*
- **Woods Hole Oceanographic Institute** – *Porter Hoagland, Ph.D.*
- **Rutgers University** – *Kevin St. Martin, Ph.D.*

11:10-12:10 Lunch – bag lunches provided

12:10-2:10 Public Perception, Legal Studies, Visual Impacts, Tourism

Session Topics: Marine policy, impact on tourism, public perception, legal issues, visual Impacts on historic properties.

- **Moderator** – *Amardeep Dhanju, BOEMRE*
- **University of Delaware** – *Jeremy Firestone, Ph.D.*
- **Wampanoag Tribe of Gay Head** – *Ms. Bettina Washington*
- **Lawrence Berkeley National Laboratory** – *Mr. Ben Hoen*
- **Clean Power Now** – *Ms. Barbara Hill*

2:10-2:40 Break

2:40-4:40 Economic Impact, Regulatory, Policy, Stakeholder Issues and Infrastructure

Session Topics: Land-based resources (jobs, facilities, infrastructure), property values, navigational access and safety, staging areas, ports and harbors, vessels, grid infrastructure.

- **Moderator** – *Gary Norton, DOE*
- **Virginia Polytechnic Institute & State University** – *Mr. Matt Unger*
- **Eastern Research Group, Inc.** – *Maureen Kaplan, Ph.D.,*
- **Woods Hole Oceanographic Institute** – *Porter Hoagland, Ph.D.*

4:40-5:40 Create Social Science Report – Facilitator/Support Staff, Panel Members, Moderators, and BOEMRE/DOE Personnel

**Birds, Bats and Offshore Wind Development:
Remaining Information Gaps
Breakout Sessions Day Two (July 13, 2011)**

8:00-9:00 **CIRRUS FOYER A** **Registration and Continental Breakfast**

9:00-4:00 **LAYTON Room**

Day Two facilitator for all birds and bats sessions will be Julia Tims, ERM

<p>9:00-12:00 Birds, Bats and Offshore Wind Development: Remaining Information Gaps</p> <p>Session Objective: To present information on immediate information needs and on current and planned research efforts. Following the presentations, there will be a facilitated discussion aimed at identifying and prioritizing the remaining information gaps.</p> <ul style="list-style-type: none"> • Moderator – <i>James Woehr, Ph.D., BOEMRE</i> <p>9:00-9:15 BOEMRE Immediate Information Needs – <i>David Bigger, Ph.D., BOEMRE</i></p> <p>9:15-9:45 “Marine Bird and Offshore Wind Workshop- Summary” – <i>Melanie Steinkamp, FWS</i></p> <p>9:45-11:00 Current research efforts & expected startups – Panel</p> <p><i>James Woehr, Ph.D., BOEMRE</i></p> <p><i>Caleb Gordon, Ph.D., Normandeau</i></p> <p><i>Allan O’Connell, Ph.D., USGS</i></p> <p><i>Richard Veit, Ph.D., CSI/CUNY</i></p>
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11:00-11:15 **Break**

<p>11:15-12:00 Ongoing Offshore Bat Studies in the Gulf of Maine, <i>Steve Pelletier, CWB Stantec</i></p>
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12:00-1:00 **Lunch – bag lunch provided**

<p>1:00-2:30 List of research needs – Report from FWS workshop & Bat Studies– <i>Melanie Steinkamp, FWS & David Bigger, BOEMRE</i></p>

2:30-2:45 **Break**

<p>2:45-4:15 Prioritize research needs – Follow up from FWS workshop & Bat Studies – <i>Melanie Steinkamp, FWS & David Bigger, BOEMRE</i></p>
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<p>4:15-5:00 Create Bird & Bat Research prioritized research needs report</p>
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**Workshop Breakout Overview Data Gaps and Partnerships
Day Three (July 14, 2011)**

- 8:00-9:00** **CIRRUS FOYER A** **Registration and continental breakfast**
- 9:00-12:15** **CIRRUS BALLROOM** **Breakout groups present overview of findings, identify priority data gaps and overlaps and identify partnerships and collaboration**
- 9:00-9:30** **Environmental: Monitoring and Baseline Studies**
- 9:30-10:00** **Social – Economics**
- 10:00-10:15** **Break**
- 10:15-10:45** **Birds & Bats**
- 10:45-11:15** **TA&R**
- 11:15-12:15** **Open Discussion & Public Comment**
- 12:15-1:15** **Lunch – on your own**
- 1:15-4:00** **Development of future study topics with Federal Partners or Collaborators**

2.0 PRESENTATION ABSTRACTS

2.1 PLENARY SESSION

The Plenary Session was attended by all workshop attendees to provide direction and an overview of the objectives of the Atlantic Wind Energy Workshop and ultimately, set the stage for content to be included in the breakout sessions.

2.1.1 Welcome & Keynote Address

Michael R. Bromwich, Director of the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) — The opening remarks delivered by the Director touched on the role of offshore renewable energy development in the Administration's Blueprint for a Secure Energy Future, and explained how the bureau's Offshore Renewable Energy Program is being elevated through the overall reorganization of the former Minerals Management Service. The Director also highlighted steps the bureau is taking internally and with other Federal agencies and State partners to streamline the leasing process while ensuring environmental protection as projects move forward.

BOEMRE Press Release

<http://www.boemre.gov/ooc/press/2011/press0714.htm>

2.1.1.1 BOEMRE Renewable Energy Research and Regulatory Program Update

Maureen Bornholdt, Program Manager, Office of Offshore Alternative Energy Programs — This presentation provided an overview of renewable energy activities, guiding laws and mandates, philosophy of the Program, ongoing consultation and coordination between regulatory agencies (taskforces), regulatory framework, and research efforts (see links below). The key stages of the Renewable Energy Program, emphasizing the importance of engaging intergovernmental task forces, stakeholders, and the public throughout the process were outlined and described. These stages include Planning and Analysis, Lease or Grant Issuance, Site Assessment (see links below), and Commercial development. Ms. Bornholdt explained that future guidance documents will be required and that workshops and interagency coordination can aid in their development. The recent publication of the Draft Environmental Assessment for Wind Energy Areas offshore Delaware, Maryland, New Jersey, and Virginia was outlined, and updates were provided on current progress/projects within each State or region. Continued focus areas and future steps were outlined and discussed. The presentation was concluded with listing the objectives of this Workshop: 1) identify key data needs; 2) prioritize data collection and research initiatives; 3) develop potential synergies for future studies; and 4) cultivate partnerships. The slides for this presentation are provided in **Appendix A, Pages A-2 to A-6**.

Research and Studies Efforts Links

www.boemre.gov/eppd/sciences/esp/RenewableEnergyResearch.htm

www.boemre.gov/tarprojectcategories/RenewableEnergy.htm

http://www.boemre.gov/offshore/RenewableEnergy/PDFs/MidAtlanticWEAs_DraftEA.pdf

Guidance Documents Links

www.boemre.gov/offshore/RenewableEnergy/PDFs/COP_Guidelines_122210.pdf

www.boemre.gov/offshore/RenewableEnergy/PDFs/GGARCH4-11-2011.pdf

2.1.1.2 Department of Energy – Offshore Wind Market Barriers

Christopher G. Hart, Ph.D., Offshore Wind Manager, Department of Energy (DOE) — The National Offshore Wind Strategy (see link below) published on February 7, 2011 was outlined, and key points listed: 1) benefits to the nation; 2) challenges facing offshore wind development; 3) realizing the benefits in spite of the challenges; and 4) understanding and reducing market barriers are critical to the Strategy. The critical objectives that will be required to reduce market barriers, including the costs, siting, deployment, and infrastructure required to support associated with the development of offshore wind energy were discussed. The DOE has established a strategy to address the barriers that incorporates research activities with stakeholder collaboration to identify information needs and the utilization of information from European projects. The wind research solicitations currently published and the topics covered, funded in part by the DOE to aid in filling some data gaps were outlined. Specific challenges to siting and permitting and to infrastructure development were outlined and included ongoing involvement of DOE and interagency collaboration, solutions and the partners involved to overcome the challenges. The presentation concluded with a discussion of each key takeaway point: 1) the environmental and economic benefits of ocean renewable energy are significant, and the resources are abundant; 2) The DOE is leading the nation's efforts to develop and deploy ocean renewable energy technologies; and 3) the DOE's efforts will reduce costs and timelines for projects and enable growth of robust industry. The slides for this presentation are provided in **Appendix A, Pages A-7 to A-9**.

A National Offshore Wind Strategy: Creating an Offshore Wind Energy Industry in the U.S.
http://www1.eere.energy.gov/windandhydro/pdfs/national_offshore_wind_strategy.pdf

2.1.1.3 Energy Market and Infrastructure Information for Evaluating Alternative Energy Projects for OCS Atlantic

Maureen Kaplan, Ph.D., Eastern Research Group, Inc. — A summary of the BOEMRE study focusing on the maritime and industry infrastructure, started in 2008, was presented. The maritime infrastructure research focused on existing ports and the vessels utilizing them, including fishing communities along the east coast of the Atlantic. The assessment was conducted to determine if the existing maritime infrastructure would be sufficient to support offshore wind energy development, including: port sizes, vessel sizes, capabilities, and the associated applicability for use in offshore wind energy development and whether the existing resources could be retrofitted or if purpose-built assets would be required (see link below). The presentation provided information regarding the components of an offshore wind project, including transmission cables, turbine manufacturing, and connection to existing energy infrastructure onshore. The results of this analysis, which included regional maps generated from Platts data, (see link below) showing the existing onshore energy infrastructure was presented. Observations from the study were outlined and indicated that getting the power onshore might be the weakest link and that the consistent theme throughout the study was to identify the point where demand is sufficient to support a domestic supply chain. The slides for this presentation are provided in **Appendix A, Pages A-10 to A-13**. Additional information regarding this project can be found in **Section 4.6**.

Shipyards construction records

<http://www.shipbuildinghistory.com/>

World Electric Power Plants Database

<http://www.platts.com/Products/worldelectricpowerplantsdatabase>

2.1.2 Federal Agency Panel

Maureen Bornholdt, Program Manager, Office of Offshore Alternative Energy, BOEMRE; Tim Konnert, Fish Biologist, Office of Energy Projects, FERC; David Cottingham, Senior Advisor to the Director, FWS; Walter Barnhardt, Director, Woods Hole Coastal & Marine Science Center, USGS; Sarah A. Quinn, J.D., External Renewable Energy Specialist, NPS; Emily Lindow, Senior Policy Advisor, NOAA; John Page, Obstruction Evaluation Group, FAA; James Haggerty, NAD Program Manager, USACE; George Detweiler, Marine Transportation Specialist, USCG; Frederick Engle, Office of the Secretary of Defense, DOD; Susan E. Bromm, Director, Office of Federal Activities, EPA; Tom McCulloch, Senior Program Analyst, ACH — The Federal agency panel included agencies that have roles in offshore renewable energy, wither as a regulator or resource agency. The purpose of this panel was to provide the mandates of each agency and discuss how the agencies are coordinating with each other to reduce duplication and increase efficiency. Each panel member presented their agency and respective legal mandate, existing Memorandums of Understanding/Agreement, and programs and research (ongoing and completed) specific to offshore energy development. Information presented during this panel is provided in the supplemental **Handout** (Synopsis of Federal and State Regulatory and Research Activities); any additional information that was discussed during this panel was incorporated into the updated Synopsis. The slides for this presentation are provided in **Appendix A, Pages A-14 to A-20**.

Studies discussed in this panel:

EPA Cape Wind Fact Sheet

<http://www.epa.gov/region1/communities/pdf/CapeWind/CapeWindFactSheetFinalVersionJune10.pdf>

USCG Atlantic Coast Port Access Route Study (ACPARS)

<http://www.maritimedelriv.com/Govaffairs/BOEMRE/files/FederalRegisterUSCG-2011-0351.pdf>

2.2 ENVIRONMENTAL BREAKOUT SESSIONS: MONITORING AND BASELINE STUDIES

2.2.1 Information Management and Data Sharing Products Panel

Moderator – Mary Boatman, Ph.D., BOEMRE — This panel provided a cross-discipline look at mapping and data issues in support of the science needed for planning, decision making and stewardship. Panel participants discussed existing and future efforts, including Coastal Marine Spatial Planning (CMSP), geo-spatial databases, mapping products, and data portals.

2.2.1.1 *Ecospatial Information Database*

Keld Madsen, Geospatial Services Manager, AMEC — The EcoSpatial Information Database (ESID) is a BOEMRE project with the purpose to support ecosystem-based management decisions and this project approach addressed four major elements: 1) to acquire relevant ecological resources for the project area; 2) create a robust geospatial database structure that would allow the documents to be accessed; 3) create a GIS mapping application that would allow for spatial query of the resources; and 4) provide the ability to query the resources. A rigorous process was implemented through which the information was compiled, categorized, verified, and the geographical extent identified. Together the geodatabase and applications will offer a decision support system to assist in identifying environmental impacts from proposed offshore energy projects by providing geographically relevant scientific information that is easily

accessible through a cloud configuration. The slides for this presentation are provided in **Appendix A, Pages A-21 to A-22**. Additional information is provided in **Section 4.5**.

2.2.1.2 Mapping Habitats and Species to Meet Local and Regional Needs

Chris Caldwell, Branch Chief, NOAA Biogeography Branch — The purpose of the Biogeography Branch is to develop information and analytical capabilities through research, monitoring, and assessment on the distribution and ecology of living marine resources and their associated habitats for improved ecosystem-based management. Geospatial analysis is conducted to aid in siting of energy projects inclusive of human uses and natural resources from existing and actively collected data. The assessment approach, for both habitat types and for species, begins by selecting an area of interest, followed by selection of the technology type to acquire the data and how it will be analyzed, and lastly, determining how it will be presented and disseminated. The importance of the resources versus the confidence in the data was emphasized. The slides for this presentation are provided in **Appendix A, Pages A-23 to A-25**.

2.2.1.3 Sonar Mapping for Multipurpose Use and an Integrated Ocean and Coastal Mapping Standard

Brian Calder, Ph.D., NOAA/University of New Hampshire Joint Hydrographic Center — This presentation focused on a consistent theme based on the fact that data collected for a specific project or purpose is not transferred in its original form for use in other areas. The importance of integrating existing data so that an area can be mapped once and used many times was emphasized. A set of data collection recommendations and a list of needs were discussed to ensure that data can be transferred for other uses. An agreement on the type of data to collect, the accuracy of the data, the calibration of the equipment, data format, and distribution processes will be required to facilitate the idea of mapping once and using many times. The slides for this presentation are provided in **Appendix A, Pages A-26 to A-28**.

2.2.1.4 Outer Continental Shelf Space Use Conflicts and Analysis of Potential Mitigation Measures: Geodatabase Development

John Weiss, Industrial Economics, Inc. — The objectives of this project were to identify and characterize potential space and use conflicts that could result from OCS renewable energy activities in the Atlantic and Pacific regions and to describe strategies and specific measures for avoiding or mitigating these conflicts, including mechanisms for improved communication and cooperation among stakeholders. The elements of the project included literature review, development of geospatial database, stakeholder engagement, and a report. The specific steps taken to develop the database and navigation within the database to ultimately provide GIS layers of use areas under 13 primary categories or data types was discussed. The slides for this presentation are provided in **Appendix A, Pages A-29 to A-30**.

2.2.1.5 Mid-Atlantic Regional Council on the Ocean – MARCO Data Portal

Laura McKay, Program Manager, Virginia CZM Program, Dept of Environmental Quality — The MARCO Mapping and Planning Portal was developed under an agreement between the Governors of New York, New Jersey, Delaware, Maryland, and Virginia to protect ocean habitats and promote renewable offshore energy. Key offshore habitats were identified and the knowledge of the best locations for wind energies was combined to determine where space use conflicts may arise. Additionally, the MARCO Portal incorporates water quality data and potential risks from climate change. The structure of the MARCO Portal and the steps taken into account during creation of the Portal was discussed. The guiding principles of the project include staying focused on immediate planning needs; trusting that the Portal will grow, evolve,

and adapt over time; and making data needs known over a wide audience and seek traditional knowledge from tribes and ocean users. Some aspects of the MARCO Data Portal were demonstrated while describing some of the categories and data layers, and features. The next steps of the project, including finding a host server, developing a maintenance plan, seeking missing data layers, and securing funding to develop decision support tools was also discussed. The slides for this presentation are provided in **Appendix A, Pages A-31 to A-33**.

MARCO Mapping & Planning Portal
www.midatlanticocean.org

2.2.1.6 Northeast Regional Council on the Ocean – Northeast Ocean Data Portal

Nicholas Napoli, Director of Marine Planning Programs, Massachusetts Ocean Partnership — The Northeast Ocean Data Portal has been developed through a collaborative working group that is entirely self-funded with volunteer effort and coordination with the Northeast Regional Ocean Council (NROC). The goal of the Portal is to integrate data from many providers and provide regionally consistent data products and tools. The progress of data integration and organization within six categories with a total of 29 data layers available was described. Examples of the website and data viewer were presented and it was explained that the data catalog could be downloaded and external datasets could be incorporated. The next steps and ongoing efforts include receiving feedback from stakeholders, coordinating with other working groups, continued data product development, and collaboration with data providers to fill data gaps. The slides for this presentation are provided in **Appendix A, Pages A-34 to A-36**.

2.2.1.7 OBIS-SEAMAP – Protected Species Information & Analysis System

Patrick N. Halpin, Associate Professor of Marine Geospatial Ecology, Duke University — The OBIS-SEAMAP is a spatially referenced online database, aggregating protected marine mammal, seabird and sea turtle observation data, focusing on the activity of the species rather than occurrence only. Raw observation data is used to fully document habitat and density models. This information can be useful for siting of offshore energy development and to understand the potential interaction of migratory species and wind energy development to support environmental impact analysis and forecasting models. The OBIS-SEAMAP database supports multiple data types and because data can be collected and interpreted in many different ways, the data must include extent and effort. The approach to include various data types was outlined, by data type, and examples of the database were presented for various data types. The data needs specific to data resolution for incorporation into the modeling process was described; noting that the OBIS-SEAMAP is a node of the larger OBIS network; the OBIS-SEAMAP specializes in the synthesis and analysis of data and that they would be interested in formally coordinating with the DOI/BOEMRE initiatives on the Atlantic OCS. The slides for this presentation are provided in **Appendix A, Pages A-37 to A-40**.

2.2.1.8 MMC – The Future of Data Sharing – Update on Multipurpose Marine Cadastre

Christine Taylor (BOEMRE) and Brian Smith (NOAA) — The Multipurpose Marine Cadastre data viewer is an integrated marine information system that provides legal, physical, ecological, and cultural information in a common geographic information system (GIS) framework, developed through a partnership between BOEMRE and NOAA. An overview of the website and viewer was provided, and it was emphasized that the data sets comprise federal authoritative data with the purpose of supporting renewable energy siting; however, the project is looking to accept data from other sources and that the data can be used for numerous other ocean planning projects. The eight major categories contained in the MMC include, jurisdictional boundaries, Federal agency regions, Federal georegulations, navigation and

marine infrastructure, marine habitat and biodiversity, human uses, physical and oceanographic, and basemaps. It was noted that data gaps exist in the categories of marine habitat and biodiversity and human uses. Additional data that is currently being worked on includes marine mammal, turtle, avian, Navy/NGA areas, nautical charts, selected State planning areas, AIS tracks and hot/cold maps, and hurricane and extra-tropical storms. In addition the planned improvements for the future include enhanced and new datasets, improved tools, links to additional data and similar portals, special applications provided by ESRI, and developing an on-line decision support tool for assessing site suitability in the marine environment. The slides for this presentation are provided in **Appendix A, Pages A-41 to A-43**.

The Multipurpose Marine Cadastre
<http://www.marinecadastre.gov>

2.2.2 Developers Panel

Moderator – Jim Lanard, President, Offshore Wind Development Coalition — This panel provided information from developers who have firsthand experience and can provide insight from lessons learned. Developers require an efficient and known timeline for permitting from the agencies.

2.2.2.1 Fishermen's Energy of NJ, LLC

Aviv Goldsmith, Engineering Coordinator — Fisherman's Energy is a community-based offshore wind developer formed by principals of the New Jersey fishing companies to enable the fishing industry to participate in and invest in offshore wind energy, and extends participation from Maine to South Carolina. Fisherman's Energy is working on two projects off the coast of New Jersey: 1) A 350 megawatt project in Federal waters and 2) a 25 megawatt project in State waters located 2.8 mi east of Atlantic City. The State waters project proposes to install six turbines parallel to shore in 12 m of water; construction is set to begin in the fall of 2011 and commissioned in the fall of 2012. The process implemented by Fisherman's Energy to collect data, perform site assessments, and conduct impact studies was detailed. The project utilized historical data, publicly available real-time data, conducted site-specific surveys, and deployed monitoring equipment. Site-specific survey types included biological, geophysical, and geotechnical. Monitoring buoys were deployed to record wind, current, wave and wildlife data transmitted to shore for compilation throughout the year-long deployment. An innovative approach is being used to collect additional wind data using a floating vertical LIDAR unit and a horizontal scanning LIDAR. The next phases of the project with the continued collaboration between all stakeholders include collecting additional data and completing the State waters windfarm project. The slides for this presentation are provided in **Appendix A, Pages A-44 to A-48**.

2.2.2.2 Deepwater Wind, LLC

Aileen Kenney, Director of Permitting — Deepwater Wind is led by a management team comprising developers, marine construction firms, investors with oversight from an advisory board. Deepwater Wind was selected through state solicitations to become the preferred offshore wind developer for both Rhode Island and New Jersey. The company has several regional projects, in New England, New York, and southern New Jersey. These projects required meteorological, biological, oceanographic, geophysical, geotechnical, and cultural studies and utilized both traditional and innovative technologies to collect pertinent data. The data collection and analysis methods had both challenges and limitations. Other studies

required include visual, navigational safety, air emissions, and commercial fishing conflicts. The slides for this presentation are provided in **Appendix A, Pages A-49 to A-50**.

2.2.2.3 Bluewater Wind NJ Energy, LLC & Bluewater Wind Delaware, LLC

Laurie Jodziewicz, Director of Permitting — Bluewater Wind was acquired by NRG Energy, Inc. and is referred to as NRG Bluewater Wind. NRG Bluewater Wind is developing the Mid-Atlantic Wind Park offshore Delaware and has executed leases for OCS Blocks 6325 and 6936 offshore Delaware and New Jersey. Installation of meteorological data collection towers within the lease blocks are in the planning stages. Five permits were required to install the necessary meteorological towers. The survey work completed included geological and geophysical surveys, archaeological reports, and biological resource reports. The lessons learned thus far in the project including mobilization of geophysical surveys, timing of survey work, agencies' unfamiliarity with offshore wind activities, and lack of metocean information. An observation highlighted was that although the technology of installing wind turbines is new, the activities that support these activities are similar to other regulated projects that are not new. The slides for this presentation are provided in **Appendix A, Pages A-51 to A-52**.

2.2.2.4 Atlantic Wind Connection

Kris Ohleth, Director of Permitting, Atlantic Wind Connection — The Atlantic Wind Connection (AWC) project is a proposed transmission backbone extending from New Jersey to Virginia that aims at addressing the challenge of juggling variable load and variable production of wind energy that cannot be stored. The project is divided into five phases or segments that will ultimately provide the required infrastructure for offshore wind development with two independent circuits. The network will comprise a multi-terminal high voltage direct current (HVDC) network with a buried transmission cable linking to terrestrial converter stations from offshore converter platforms. Some of the conflicts that have arisen during siting the location of the components include use conflict and air space designation. The system must be installed in areas where wind energy development is likely to occur, and also must avoid conflict with existing uses of the seafloor (e.g., shipping lanes, submarine communication cables, dumping grounds, fish havens). A two-tiered approach was utilized to determine location for the cables and the associated platform or hub sites. AWC has filed with BOEMRE to obtain a Right of Way (ROW) grant for cable and hub sites, and are in the process of developing a general activities plan (GAP) for submittal to BOEMRE in early 2012, and are planning surveys for late summer 2011. The project anticipates that a Phase A notice to proceed would be issued in 2013 and operations would commence in 2016. The continued coordination with wind developers is very important to ensure that the AWC fits the needs of future projects and to ensure project compliance. The slides for this presentation are provided in **Appendix A, Pages A-53 to A-55**.

2.2.2.5 Panel Open Discussion

At the end of the panel and open question and answers session was conducted, attendees were able to ask questions to each panelist or provide information. Key questions and the associated discussions included:

- Why do developers collect their own data rather than using historical and existing data? The reason that developers collect their own data is to gain the specific data needed for their project at the fine scale necessary for the permitting process. The developers need data at their specific project height because a small change in wind speed results in a large change in power output, which is required for investors and required for designers to engineer the system to function.

- For impacts to birds at project sites in New Jersey, is mitigation required? There is a low occurrence of T&E species, monitoring will occur during construction and operations, and curtailment of impacts is a permit condition.
- What funding sources or credits are available for the efforts offshore New Jersey? Federal tax credits, renewable energy certificates, and state portfolios were used to provide funding to conduct baseline studies, and allocated money to the developer for the meteorological buoy.

2.2.3 State Planning and Information

Moderator – Jennifer Ewald, BOEMRE — The objective of the State Planning Panel was to provide information on state ocean management plans and baseline study efforts, including obstacles encountered and remaining gaps and how this information is useful to the OCS development.

2.2.3.1 New Jersey Ecological Baseline Study

Gary A. Buchanan, Ph.D. — New Jersey Department of Environmental Protection conducted the Ocean/Wind Power Ecological Baseline Study to conduct baseline studies to determine the current distribution and usage of this area by ecological resources and to fill data gaps in the areas offshore New Jersey in order to facilitate offshore renewable energy. Field studies and data compilation were conducted within a predetermined study area and included primarily avian, marine mammal, and sea turtle distribution, abundance, and utilization data collection. Additional studies conducted include oceanographic, fisheries, benthic mapping, and GIS and modeling. GIS data layers are available on the website for download (see link below). The survey effort was conducted over a 2 year period along 18,183 km of survey lines. A suite of survey methods were used to collect the data. The data were then interpreted to create sensitivity maps, where the portions of the study area that are more or less suitable for wind/alternative energy power facilities were determined based on potential ecological impact using predictive modeling, mapping, and environmental assessment methodologies. While this information provides broad scale data, site specific data for a project would also be required. Some of the hurdles faced throughout the project included a lack of standard methods for U.S., obtaining NOAA Marine Mammal authorizations, weather challenges, availability of vessels for surveys, and budget. This project is significant in that the data will aid in the development of renewable energy projects, help to assess potential impacts, provide a template for other states, and provide information relevant to the National Environmental Policy Act (NEPA) process and Federal consultation process. Existing data gaps/future plans include the development of a CMSP work plan in coordination with regional working groups and Federal agencies. The slides for this presentation are provided in **Appendix A, Pages A-108 to A-112**.

The New Jersey Department of Environmental Protection (NJDEP), Office of Science
<http://www.nj.gov/dep/dsr/ocean-wind/index.htm>

2.2.3.2 Massachusetts Ocean Plan

Bill White, Assistant Secretary for Federal Affairs, Executive Office of Energy and Environmental Affairs — The Massachusetts Ocean Management Plan was created under the Oceans Act instated by Governor Patrick in 2008 and is the first Ocean Plan in the nation, presenting the most ambitious energy efficiency programs. The need for a comprehensive energy plan was needed in Massachusetts since they do not have any other known indigenous energy sources, and identifying prohibited areas to avoid use conflicts was a priority. The Ocean Plan for

Massachusetts State waters developed a management plan; established prohibited areas; identified renewable energy areas; created buffers from high activity areas, environmentally sensitive areas, water-dependent marine uses, and regulated airspace. A task force has been established to continue coordination with BOEMRE to provide input into an RFI issued by BOEMRE for OCS leasing in Federal waters offshore. The data, information and outreach from the Ocean Plan are useful in the continued coordination and meetings with topic specific working groups, stakeholders, and Federal agencies. Recommendations on the RFI included the review of whale, turtle, avian, fish, fisheries, and navigation data. To reduce potential impacts to these resources, it was recommended that half of the area presented in the RFI be excluded. The next steps include BOEMRE issuing a Call for Interest and Nominations and issue a draft NEPA planning notice. Task forces, working groups, and stakeholder meetings will continue throughout this process. The slides for this presentation are provided in **Appendix A, Pages A-113 to A-116**.

2.2.3.3 Maine State Planning Office, Maine Coastal Program

Matt Nixon, Maine State Planning Office, Maine Coastal Program — Maine has an Ocean Energy Demonstration Siting Initiative that initiated an Ocean Energy Task Force lead by The Department of Conservation (DOC) and State Planning Office (SPO). The Task Force was tasked with siting up to five Demonstration Sites within State waters. This task required analysis of spatial data, coordination with stakeholders, and public meetings. Through process of elimination an original seven sites was narrowed down to three that were selected as demonstration sites. Deep C Wind is a University-led consortium that collected data and identified gaps to facilitate the siting of the testing facilities. Close coordination with academia, NGOs, and state resources was the networking approach used to gather information and identify gaps. The list of needs and obstacles facing the program include reliable funding sources, standards for siting, inter-agency communication, and coordinated data collection efforts. Areas where coordination with federal agencies, academia, and/or private companies could be beneficial include human use mapping, bathymetric mapping, and avian work. The slides for this presentation are provided in **Appendix A, Pages A-117 to A-118**.

2.2.3.4 Rhode Island Ocean Special Area Management Plan

Grover Fugate — The Rhode Island Ocean Special Area Management Plan (SAMP) is a marine spatial planning tool for renewable energy siting started in 2008. The project began by mapping potential wind areas and identifying areas to be avoided. A technology based assessment was conducted to develop a metric based on technical challenge to power production potential to screen for sites. Marine user data and natural resource data were incorporated in the database. Marine resource research included analysis of wind resources, marine mammals and birds, fisheries uses, physical oceanography, ecosystem interactions, sediment and benthic habitat, cultural resources, acoustics and electromagnetic effects, meteorology, engineering, and marine transportation uses. Data were collected utilizing various technologies, and it was suggested that a minimum of 3 years of preconstruction surveys would be required for avian data. Other considerations incorporated into the Ocean SAMP document included socioeconomic issues such as fisheries, sailing events, diving, whale watching tours, recreation and tourism, and cultural and historical resources. The slides for this presentation are provided in **Appendix A, Pages A-119 to A-125**.

Ocean SAMP document

<http://seagrant.gso.uri.edu/oceansamp/>

2.2.3.5 Developing Environmental Protocols

Michelle Carnevale and John King, Ph.D., University of Rhode Island — This project is a study in progress under NOPP to develop standardized protocols for baseline assessment and monitoring for offshore wind, wave and current energy development and develop a conceptual framework and approach for cumulative environmental impact evaluation. European standards and the lessons learned during development of the industry were evaluated and applied as applicable. The approach to achieve the study goals included collaboration with researchers, regulators, and industry professionals to create a project advisory committee to review information and examine the information from a topic-specific reviewer's point. Identification and comparison of techniques currently being used followed to develop a common language. The CEQ Task force and the proposed national priority objectives include ecosystem-based management, coastal and marine spatial planning, informed decisions and understanding, and coordination and support. Tier one screening was conducted to develop criteria, look at other mapping strategies, and recommend scale for surveys and data products from different survey methods. Tier two screening was conducted to look at the ecological components, categories, indices, and models to recommend standard classification schemes, like the U.S. Coastal and Marine Ecological Classification Standard (CMECS). Obstacles encountered and the remaining data gaps to achieve the goals of this project include establishing between agencies and developers effective approaches for baseline studies, development of indices to evaluate impacts, and developing cost-effective and valid monitoring programs. The slides for this presentation are provided in **Appendix A, Pages A-126 to A-129**.

2.2.4 Broad Scale Habitat, Abundance and Distribution – Consultation Process

Moderator – Kim Skrupky, BOEMRE — The objective of this panel is to provide an overview of the applicable environmental laws and regulations enforced by the other environmental agencies, namely NOAA and FWS, that govern offshore renewable energy activities. This panel also provided the attendees with an overview of the regulatory Acts, the information, data, and applications to comply with the Acts, and the timing for these compliance documents.

2.2.4.1 Marine Mammal Permits

Michelle Magliocca, NOAA — The Marine Mammal Protection Act Prohibits the taking of marine mammals unless exempted or authorized under a permit. There are two types of permits that can be issued, a letter of authorization (LOA) or an incidental harassment authorization (IHA), by the Secretary of the Department of Commerce for the incidental take of small numbers of mammals from a specified activity within a specific geographic area. There are two types of harassment levels with different thresholds, Level A: injury, and Level B: behavioral disruption. An LOA includes harassment or mortality, requires regulations, is valid for 5 years, and requires rulemaking with two public comment periods. An IHA includes harassment only, is only valid for 1 year, and does not require rulemaking, but still has one public comment period. Specific considerations relevant to wind include possible permits required for pre-construction surveys, acoustic impacts during construction possibility of entanglement, acoustic impacts during operation, and modifications to avoid impact. The acoustic criteria used to evaluate permit applications include the proposed activity, species impacted, quantity and type of take, and the impact to the species. Requirements for the permit application include mitigation, monitoring and compliance. The slides for this presentation are provided in **Appendix A, Pages A-130 to A-131**.

2.2.4.2 ESA Consultations

Kellie Foster, NOAA and Julie Thompson-Slacum, FWS — The Endangered Species Act and Section 7 Consultation process was outlined in this joint presentation by NOAA and FWS. FWS has jurisdiction for terrestrial species and NOAA handles marine protected species, and the consultation process between the two agencies is similar. The goal is to facilitate interagency cooperation. There are four types of Section 7 consultations, 7(a)(1), 7(a)(2), 7(a)(3), and 7(a)(4) and formal and informal consultations. Informal consultation takes place when the proposed action is not likely to affect any listed species in the project area. Formal consultation takes place when the proposed action is likely to adversely affect a listed species. It was noted that applicants underutilize 7(a)(3) (Early Consultation), which would begin before the proposal stage of an action including any permit or license process. Although 7(a)(3), requires a prospective applicant's Certification as an "applicant for the purposes of Section 7 consultation, it allows any applicant to sit at the table during the consultation process from beginning to end, from submitting information for the consultation to reviewing draft biological opinions. This will expedite the process and a preliminary Biological Opinion will be developed. Flow charts depicting the process and actions required by the applicant and the role of the applicant throughout the process are included. The slides for this presentation are provided in **Appendix A, Pages A-132 to A-136.**

2.2.5 Broad Scale Habitat, Abundance and Distribution – Baseline Data

Moderator – Kim Skrupky, BOEMRE — The objective of this panel was to identify what species are being studied and in what locations, during which seasons, using which technologies, and if there is any data (or preliminary data).

2.2.5.1 Fisheries Management Council Perspective: Spatial Aspects of Fishery Management Plans

Tom Hoff, MAFMC, Michelle Bachman, NEFMC, and Roger Pugliese SAFMC — The Fishery Management Councils (New England, Mid-Atlantic, and South-Atlantic) collaborate with NMFS to develop Fishery Management Plans (FMPs) based on analysis of existing fishery data within each respective region. The FMCs recommend regulations and essential fish habitat (EFH) designations to NMFS based on analysis of data and consultation with stakeholders, state resource managers, and academic partners. The FMCs are looking into emerging relationships and partnerships for future collaboration. The topics that should be considered during wind energy siting and development include closed areas, gear restricted areas, marine protected areas, special management zones, EFH, habitat areas of particular concern (HAPC), and the distribution of fishery resources, activities, and revenues. The panel described the differences in fishery independent data and fishery dependent data incorporated into the FMPs. FMC Programs, areas, and activities that would be useful to BOEMRE include the Swept Area Seabed Impact Approach (SASI) utilized by the NEFMC to estimate the magnitude, location, and duration of adverse effects of fishing on EFH across gears types and FMPs, and to evaluate the cumulative impacts of management alternatives to minimize those effects; the tilefish HAPCs and gear restricted areas within the MAFMC areas; and. all managed areas within the SAFMC area including fishery areas, marine protected areas, coral HAPCs, and the internet mapping server that is available to display the information. The benefits of ecosystem models were outlined, and it was stated that these types of models will begin to be the precedence as the FMCs move forward with ecosystem-based approaches. The panel FMCs expressing their continued support of renewable energy and continued coordination to include fisheries into spatial planning. The slides for this presentation are provided in **Appendix A, Pages A-137 to A-139.**

2.2.5.2 NMFS Surveys

Sofie Van Parijs, Ph.D., NMFS — An overview of NOAA/NMFS surveys was provided and included NOAA CetMap (cetacean density and distribution mapping working group), AMAPPS – Atlantic multi-year multi agency effort, and NMFS standard surveys. The CetMap project aims to create a comprehensive GIS-based visualization tool that will identify the single most appropriate indicator of density or distribution, based on the best available science, for a given area, time, and species. Challenges faced during this project include variation in data quality, identification of data gaps, and the variation in density models throughout regions. The AMAPPS and NMFS standard survey results were presented, pointing out the variation in broad scale versus detailed mapping. Passive acoustic surveys are now providing more detailed information than visual surveys. All of NOAA/NMFS data can be found in the OBIS-SEAMAP database (as discussed in **Section 2.2.1.7**). The slides for this presentation are provided in **Appendix A, Pages A-140 to A-143**.

2.2.5.3 AMAPPS

Kim Skrupky, BOEMRE — The Atlantic Marine Assessment Program for Protected Species (AMAPPS) is a program aimed at collecting broad-scale data on the seasonal distribution and abundance of marine mammals, sea turtles, and sea birds. The program is a collaborated effort that includes BOEMRE, NOAA, FWS, and the U.S. Navy. Additional objectives include collecting similar data at finer scales at sites of particular interest; conducting tag telemetry studies of sea turtles, pinnipeds, and seabirds; exploring alternative platforms and technologies; assessing the population size at regional scales; and developing models and tools to translate the data into seasonal, spatially-explicit density estimates with habitat characteristics. The five-year study plan includes aerial, vessel, and satellite telemetry surveys and continued investigation of advanced data collection technologies such as LIDAR and UAV gliders. Additionally, the program aims to improve existing capabilities for spatial modeling of the collected data. The data will be integrated into a common database that will allow users to query data and view model products to support environmental assessments. The activities completed during the Year 1 include aerial surveys for marine mammals and turtles and sea turtle telemetry tagging. Year 2 activities planned include seal tagging and aerial surveys, additional turtle telemetry surveys, and aerial surveys for waterfowl. The slides for this presentation are provided in **Appendix A, Pages A-144 to A-146**.

2.2.5.4 Navy Baseline Studies

Robin Fitch, U.S. Navy — Navy-Funded data collection includes visual surveys, passive acoustic monitoring, behavioral response studies, and photo identification. Many Navy activities require coordination and permitting with NOAA-NMFS which requires the best available habitat, distribution and abundance data. The Navy-NMFS adaptive management process for annual survey planning was developed to comply with the requirement for monitoring workshops required under the Final Rules for the unintentional taking of marine mammals incidental to Navy activities on Navy training ranges and operating areas. There is ongoing coordination with the National Ocean Council to make the Navy's data available in a portal for use by coastal planners. The slides for this presentation are provided in **Appendix A, Pages A-147 to A-148**.

2.2.6 Acoustic Monitoring Technology and Impacts

Moderator – Michael Rasser, Ph.D., BOEMRE — This panel aimed to identify which monitoring methods and technologies are currently being used, both successfully and unsuccessfully, on various species, locations, and seasons, and to determine what impacts have been identified.

2.2.6.1 OSC Acoustic Monitoring

David Zeddies, JASCO — Acoustic monitoring is being conducted to characterize ambient sound in areas of the OCS that are to be developed for renewable energy using subsurface acoustic monitoring stations (AMARs) to record sounds. The first phase involves characterization of the ambient sound at two sites, selected by BOEMRE, by deploying the ‘float on a rope’ AMARs and recording ocean sounds for 3 continuous months. The resultant data is output to a Wenz curve and spectral analysis is conducted. Data are presented in quartile-distribution plots for the entire duration of recording. The results from data collected at the two sites, Nantucket Sound and Delaware Bay was presented. In Nantucket Sound the spectrogram was compared to wind and wave data from a nearby meteorological buoy and the quartile distributions were presented. In Delaware Bay the same analysis was provided showing the tracks of two hurricanes in the region and the associated increase in sound levels. A summary of the project, is that the ambient sound levels at the two sites can be used for future comparisons and identified the sound sources of most ambient noise as shipping traffic and biological sources. These data are useful for monitoring / assessing protected and endangered species at the development sites. The slides for this presentation are provided in **Appendix A, Pages A-149 to A-155.**

2.2.6.2 Monitoring Technologies and Acoustics PNNL

Tom Carlson, Pacific Northwest National Laboratory (PNNL) — The application of acoustic technologies to ocean energy development includes reconnaissance, site characterization, impact assessment, compliance monitoring, and evaluation. Compliance monitoring required to assure that no ‘takes’ of endangered whales occur utilized passive acoustic detection using tetrahedral arrays and also active acoustic detection using multi-beam or fixed aspect array. The active acoustic system had to use a frequency of operation based on the hearing of the mammal and the pulse duration had to relate to the frequency. Field measurements were taken with an echosounder at multiple frequencies and different pulse durations. The sonar operating at 200 kHz generates sound within the hearing range of killer whales, but evidence is showing that there may be a behavioral response to the sonar pulses. A potential advantage of this behavior response may be that sonar pulses could actually alert marine mammals to the presence of a turbine. The slides for this presentation are provided in **Appendix A, Pages A-156 to A-158.**

2.2.6.3 Acoustic Monitoring, Impacts and Sound Characterization

Peter Dugan Ph.D., Cornell — The processing of collected acoustic data faces many challenges. Data can be processed for multiple reasons, including for species detection, ambient noise, and location of anthropogenic noises. This data can then be analyzed and modeled both spatially and temporally. The archived data is analyzed through various software types and resultant models are produced. Examples of data results from Massachusetts Bay were presented and the models for temporal, spatial, and ambient noise analysis were shown. The sizes of the data sets over a long term project were compared to the effort required to process the data. Data processing has become more efficient due to new technology associated with high performance computing. Some of the challenges with data processing were discussed, including the non-homogenous nature of data formats and the large quantities of data. Moving forward, modeling of noise impacts and tools will be required to disseminate the information to resource managers. The slides for this presentation are provided in **Appendix A, Pages A-159 to A-160.**

2.2.6.4 Electromagnetic Fields

Ann Pembroke, Normandeau Associates — Studies are on-going to examine the effects to marine organisms as a result of electromagnetic fields (EMFs) associated with transmission cables. Concerns arise from electrosensitivity and magnetosensitivity of marine organisms to shielded and unshielded cables for both DC and AC power. Influence from geomagnetic fields was analyzed for buried cables separated by varying distances. A case study on sand bar sharks determined that they are sensitive to DC magnetic field if it is greater than the geomagnetic field, but could not determine if it impacted the species adversely. Sockeye salmon react to geomagnetic cues and their life cycle is dependent on rivers; therefore, it was suggested that DC cables near the mouth of an estuary could impact sockeye salmon migration. A case study on bottlenose dolphin found that they are sensitive to small changes in the geomagnetic field and that they could be exposed to DC fields up to 50 m above the cable; however, their speed and agility would likely limit the exposure duration. A Loggerhead turtle case study found that adults, juveniles, and hatchlings use geomagnetic fields for orientation and may rely on geomagnetic fields for locating nesting beaches. A spiny lobster case study was conducted and found that they are magnetosensitive and could potentially be sensitive to a field up to 20 m on either side of a DC cable. Data gaps include: research has been conducted using only natural electric or magnetic stimuli; the behavioral responses of individuals have not been studied; speculative to extrapolate to population level; and lack of species data throughout life stages. The slides for this presentation are provided in **Appendix A, Pages A-161 to A-162**.

2.2.6.5 NMFS Large Whales and Acoustics

Sofie Van Parijs, Ph.D., NMFS — There are four main research areas that NMFS is working in, including the Ocean Noise Project, long term monitoring and behavior, acoustic abundance, and autonomous acoustic technology. The Ocean Noise project began in 2007 and is ongoing to map and characterize ocean noise within Stellwagen Bank National Marine Sanctuary. The project aims to characterize contributing sound sources (biological and anthropogenic) and evaluate the acoustic impact. Long term monitoring has been ongoing since 2007 and aims to understand the basic acoustic occurrence, distribution, and behavior of different species. Additionally, this will validate passive acoustic results against other monitoring methods. The monitoring data has shown the variation of call types based on locations and time of year and throughout life stages. New tracking methods are being developed to assess behavioral changes. Acoustic abundance estimates can be determined from the AMAPPS data (**Section 2.2.5.3**). Autonomous acoustic technology can record low and mid frequency marine mammal vocalizations and allows detection, classification, and reporting in real time, while simultaneously collecting oceanographic data. There are currently 28 Passive Acoustic Monitoring Field projects on-going within the U.S. The next steps for passive acoustic monitoring include finalization of emerging technologies (e.g., gliders), make processing tools more widely available, develop better integrative tools, and establishing a portal for archived data. The slides for this presentation are provided in **Appendix A, Pages A-163 to A-166**.

2.3 TECHNOLOGY ASSESSMENT & RESEARCH PROGRAM: RENEWABLE ENERGY STUDIES

2.3.1 Overview of TA&R Program and Summary Review of Renewable Energy Studies Conducted to Date

Lori Medley, BOEMRE — The TA&R Program was established in the 1970's to ensure use of Best Available and Safest Technologies (BAST) required through the OSC Lands Act

Amendments of 1978. The TA&R Program focuses on operational safety and protection of the environment. A number of renewable energy studies have been completed or are currently being conducted. The presentation provided a list of the studies (see link below), showed an example of a study abstract from the TA&R web site and how to review the completed final reports, and provided a brief summary of the studies previously conducted that were not covered by other presenters in this session. The slides for this presentation are provided in **Appendix A, Pages A-56 to A-59.**

Studies Efforts Link

<http://www.boemre.gov/tarprojectcategories/RenewableEnergy.htm>

2.3.2 TA&R 634 “Mitigation of Underwater Pile Driving Noise During Offshore Construction” and TA&R 651 “Evaluate the Effect of Turbine Period of Vibration Requirements on Structural Design Parameters”

Dwight Davis, Applied Physical Sciences Corp. — The efforts in this project are focused specifically on analyzing the pertinent noise transmission and radiation mechanisms associated with driving large monopile foundations. Further, the project will identify specific mitigation concepts appropriate to those mechanisms and assess the potential performance of those approaches with the context of achievable engineering design. The goals of the study are to identify risk of sound contributions, to assess mitigation measures, and develop recommendations. Pile driving is the highest noise level/issue of construction or operation and there are no significant current mitigation measures (European practice of starting slow/low impact to startle sea life away before building the drive frequency is not proven effective in protecting marine animals). Current mitigation options include bubble screens, compliant surface, and dewatered cofferdams and early determination is that dewatered cofferdam is effective and practical. The study also focused on particular frequencies audible to marine mammals and they are identified in the report. The slides for this presentation are provided in **Appendix A, Pages A-60 to A-70.**

2.3.3 TA&R 633 “Wind Farm/Turbine Accidents and the Applicability to Risks to Personnel and Property on the OCS, and Design Standards to Ensure Structural Safety/Reliability/Survivability of Offshore Wind Farms on the OCS” and TA&R 671 “Offshore Electrical Cable Burial for Wind Farms: State of the Art; Standards and Guidance; Acceptable Burial Depths and Separation Distances; and Sand Wave Effects”

Malcolm Sharples, Ph.D., Offshore Risk and Technology Consulting Inc. — Safety is a key issue for development of the offshore wind energy industry. Most companies in the oil and gas and chemical industries recognize the importance of formal documentation of safety requirements for design, installation, and operations; however, similar documentation is lacking for the emerging offshore wind energy industry. The existing standards that are in place for other industries are not directly applicable to this new industry. One mission of BOEMRE is to “encourage orderly, safe and environmentally responsible development” and when that mission is fulfilled needs to be determined and outlined. There is a need for development of suitable standards for a wide variety of areas including primary structures; control and protection systems; fire detection and protection; lightening protection; installation, construction, and commissioning procedures; access to and within the structures, and emergency equipment. There was a recommendation to cooperate more with other countries (Europe) that have longer experience with offshore wind facilities and potential structural problems. There was agreement that more research needs to follow up on issues identified in TA&R 633. TA&R 671 focuses on

the issues associated with the burial of the offshore electrical cables. It is anticipated that this study will be completed by the end of 2011. The slides for this presentation are provided in **Appendix A, Pages A-71 to A-82.**

2.3.4 TA&R 656 “Seabed Scour Considerations”

Tom McNeilan, Fugro Atlantic — The objective of this study was to review oceanographic and seabed data from the Atlantic OCS, review European Offshore Wind Farm (OWF) project experience, and describe how OWF structure and cable installation may affect scour susceptibility of the seabed. Scour is common and should be considered inevitable in most seabed substrates. A number of side scan sonar images from existing structures were presented showing scour around the monopile structure as well as cable trenches. A decrease in water depth can lead to higher velocity currents and thus a greater risk of scour occurring. It is believed that the majority of damaging scour occurs during extreme events (hurricanes and northeasters). There is a need for additional studies to determine best methods for predicting and mitigating scour.

- Existing soil and substrate studies onshore are not applicable to offshore.
- Small amount of tilt in tower reduces turbine efficiency considerably.
- Scour is generally a function of sediment disturbance: depth (shallow) and energy - particularly extreme events.
- Scour of piles and cable trenches is common.

The slides for this presentation are provided in **Appendix A, Pages A-83 to A-87.**

2.3.5 TA&R 627 “Assess/Develop Inspection Methodologies for Offshore Wind Turbine Facilities” and TA&R 650 “Offshore Wind Turbine Inspection Refinements”

Robert Sheppard, Energo Engineering — Operators on BOEMRE renewable energy leases are required to conduct an annual self inspection. Also, BOEMRE plans to have an inspector staff that will inspect these facilities. The purpose of these two studies was to develop guidance for Integrity Management (IM) procedures for offshore wind turbine facilities appropriate for use in U.S. waters. Project 627 provided most of the guidance, and project 650 refined the guideline with additional information on inspecting the turbine blades, and methods to measure tower inclinations. The guideline provides recommended inspection frequency based on facility condition and the consequence of failure. It also identifies critical inspection areas and provides inspection approaches. The slides for this presentation are provided in **Appendix A, Pages A-88 to A-91.**

2.3.6 TA&R 669 “Floating Wind Turbines” and TA&R 670 “Design Standards for Offshore Wind Farms”

Qing Yu, American Bureau of Shipping — The objective of TA&R 669 Floating Wind Turbines study is to study the critical design load conditions for floating wind turbines and to identify and rank the critical technical challenges to deploying floating wind turbines on the U.S. OCS. It includes case studies of three types of support structures. The study is scheduled to be complete by the end of 2011. The objective of TA&R 670 is to study the governing load cases and load effects for wind turbines subjected to tropical revolving storms on the U.S. OCS, review and evaluate the existing methods of calculating the breaking wave slamming loads inflicted on offshore wind turbine support structures, and provide recommendations to support future enhancements to the relevant design criteria for offshore wind turbines. This study is also

scheduled to be completed by the end of 2011. The slides for this presentation are provided in **Appendix A, Pages A-92 to A-96.**

2.3.7 TA&R 672 “Development of an Integrated Extreme Wind, Wave, Current, and Water Level Climatology to Support Standards-Based Design of Offshore Wind Projects”

George Hagerman, Virginia Tech Advanced Research Institute — An overview of the program tasks was presented and included the FEMA storm surge study, the analysis of USACE Wave Information Studies (WIS), Synthetic Hurricane Wind Hindcasting, joint storm population probability, water level analysis, wind-driven current analysis, and mapping to IEC design load cases. The FEMA Region III Storm Surge Study aims to identify and reconstruct historical extratropical storms in the region, by analyzing and modeling water levels with all required forcing inputs. Additionally, the study aims to develop a representative set of synthetic hurricanes using validated inputs, including the USACE Wave Information Studies (WIS). An overview of measured current data sets was presented with an example analysis of water level and wind-driven current forecasts for Hurricane Earl. In conclusion, the Expert Group peer review process was discussed. The study is not scheduled to be completed until the end of 2012. The slides for this presentation are provided in **Appendix A, Pages A-97 to A-100.**

U.S. Army Corps of Engineers Wave Information Studies (WIS):

<http://frf.usace.army.mil/wis2010>

2.3.8 International Electrotechnical Commission (IEC) Technical Committee 88 status update

James Manwell, University of Massachusetts — A summary of the International Electrotechnical Commission (IEC) 61400-3 was presented, explaining that this international standard for offshore wind turbines is being revised to include extensive consideration of metocean external design conditions, and will include additional design load cases beyond those of IEC 61400-1. The approach was described and includes preparation of preliminary design (PD), development of structural dynamic model of PD, specification of external conditions, specification of load cases, determination of structural loads and stresses; verification that stresses are acceptable, given chosen material, adaptation of design if necessary and repeat. Progress, methods, and analysis within each of these steps were presented. It was discussed that IEC 61400-3 is being used in most of the world; however it is also recognized that a second edition of this standard is needed and a team has been established to produce this second edition. The scope and new materials to be included in the second edition were provided. The slides for this presentation are provided in **Appendix A, Pages A-101 to A-104.**

2.3.9 Transportation Research Board’s “Structural Integrity of Offshore Wind Turbines” report

Walt Musial, National Renewable Energy Laboratory (NREL) — This study had three main tasks: to examine the applicability and adequacy of existing standards and practices for the design, fabrication, and installation of offshore wind turbines; the expected role of the Certified Verification Agent (CVA) in identifying standards to be used and conducting onsite inspections to verify compliance with the standards; and the experience level, technical skills and capabilities, and support equipment and computer hardware/software needed to be considered a qualified CVA. Some significant findings included: no single set of standards exist that covers all aspects of offshore wind - design through commissioning, and many standards and

guidelines exist which collectively are suitable for offshore wind installations but with some gaps. The slides for this presentation are provided in **Appendix A, Pages A-105 to A-107**.

2.3.10 Round Table Discussion

During the open microphone session a number of potential issues/studies were raised. It was decided to continue quickly with a few of the presentations and spend a majority of the day outlining issues and recommended studies. Some abbreviated presentations were given during Open Mic.

A majority of the day was dedicated to defining, prioritizing and preparing for presentation of the issues and the proposed studies to address the key issues.

2.3.10.1 “Proven Technology” in New Operating Environments

Several differences in the operating environment of the Atlantic seaboard, and the areas where offshore wind turbines currently are sited have been identified (e.g., hurricanes and open-ocean breaking waves). What other issues present unique concerns for the U.S. OCS? What can we adapt from oil and gas experience?

2.3.10.2 Marine Hydrokinetic (MHK) Devices

FERC will be the regulatory agency for construction and operations of some MHK devices on BOEMRE leases, but if the device is not grid connected, BOEMRE will regulate its construction and operations. Design standards have not been developed for these devices. What are the key operational safety/protection and environment concerns? Are API standards, such as those for the design of mooring systems, appropriate for this industry?

A short presentation was given that stressed the need to look at water use conflicts and density of array spreads for anchored/floating structures (fishing and marine mammals). There was agreement to continue this discussion in developing studies and needs.

Another short presentation provided an overview of a small scale project in Florida’s Gulf Stream by Florida Atlantic University. There was discussion of siting, planning and regulatory issues surrounding installation. The presenter indicated that wind technology is probably 30 years ahead of marine hydrokinetic systems technology and that near-shore marine hydrokinetic systems are further along than deepwater/Gulf Stream systems. The slides for this presentation are provided in **Appendix A, Pages A-170 to A-171**.

2.3.10.3 Design and Safety Standards Gaps

Several preliminary studies and on-going standards maintenance efforts have been initiated. What gaps have been identified? Are they appropriate for consideration for research under the TA&R program funding?

Very brief presentation overview with focus on establishing needed data and studies. Several items were discussed and are included in the list of key research gaps in **Section 3.0** of this report.

2.3.10.4 Regulating Worker Safety

The risks to offshore oil and gas workers and terrestrial wind farm workers will be discussed with the goal of determining the key issues of regulating worker safety on the U.S. OCS. Formal

presentation removed in favor of defining goals and studies. A quick statement indicated that this was likely encompassed by the newly awarded TA&R study 686 “Regulating Worker Safety in Renewable Energy Operations on the OCS” (<http://www.boemre.gov/tarprojects/686.htm>) with the National Research Council.

2.3.10.5 Working with Intellectual Property in Technology and Safety Assessments

Recent documents submitted to BOEMRE have revealed that offshore wind turbines may contain substances that present hazards that are not obvious (e.g., ethylene glycol contained in a dampening system). What other unknown hazards are there? How do we work around IP issues?

Formal presentation was removed in favor of determining key issues and identifying study needs. It was agreed that further discussion is needed because of industry’s current lack of information sharing. Michele Myers from AWEA indicated that information sharing is an issue for them also. She said that her organization has been working to provide secure ways for the industry and government to share information. It was noted that the oil/gas industry has regulations requiring information sharing but Wind has some legal protections. One of the reasons cited was that oil/gas was mature and for the most part self funded and did not have as much investment concerns. Right now offshore wind is investor funded and output and efficiency and even small technology innovations can provide a significant competitive advantage.

2.4 SOCIAL-ECONOMIC BREAKOUT: ASSESSMENT DRIVEN ISSUES

The Social-Economic Breakout session consisted of four discussion panels, each of which addressed a range of potential social and economic issues associated with offshore wind energy development. These discussion panels included:

- Cultural and Historic Resources;
- Multi-Use Issues/Space Use Conflicts;
- Public Perception, Legal Studies, Visual Impacts, and Tourism; and
- Economic Impact, Regulatory, Policy, Stakeholder Issues, and Infrastructure.

Unlike most of the other breakout sessions, the Social-Economic Breakout did not include formal presentations, but rather had a moderator and panels who helped lead an interactive discussion around the subject of each discussion panel. Each panel’s discussion; however, was focused on impact assessment-related issues. An overview of this “assessment-driven focus” as well as the key topics discussed by each panel is presented below.

2.4.1 Assessment Driven Focus

David Bennett from BOEMRE made a short presentation to help the Social- Economic Breakout understand the desired assessment-driven focus. In accordance with BOEMRE’s regulations (30 CFR Part 285), a commercial wind energy leaseholder has up to five years to conduct research to determine the suitability of the lease area for wind power development. This research involves several site assessment and site characterization activities. The site assessment activities include the construction and installation of meteorological tower and/or meteorological buoys in order to assess the wind resources of a particular site. The site characterization activities include shallow hazards, geological, geotechnical, and archaeological resource surveys, as well as biological data collection (e.g., benthic habitat, avian resources,

marine fauna). These site assessment and characterization activities can affect a wide range of social and economic resources through increased vessel traffic associated with facility construction, which BOEMRE must assess as part of its permitting process and its NEPA responsibilities. The focus of the Social-Economic Breakout was driven by these assessment responsibilities with a goal of identifying and characterizing information gaps and research needs related to potential social and economic impacts to marine space users that might arise from private sector site assessment and characterization activities. The Breakout discussions, however, were far ranging and did include information needs related to wind energy development and operations.

2.4.2 Cultural and Historic Resources Panel

2.4.2.1 Panel Members

The Cultural and Historic Resources Panel included:

- Moderator – Brian Jordan, Ph.D., BOEMRE
- Panelists
 - Mr. David Robinson – Director, Marine Archaeological Services Division, Fathom Research
 - Mr. Doug Harris – Preservationist for Ceremonial Landscapes and Deputy Tribal Historic Preservation Officer, Narragansett Indian Tribe
 - John Jensen, Ph.D. – Maritime Studies and Ocean Policy faculty at the Woods Hole-based Sea Education Association and Professor of History and Nautical Archaeology at the University of Rhode Island
 - Ms. Bettina Washington – Tribal Historic Preservation Officer, Wampanoag Tribe of Gay Head

2.4.2.2 Summary of Key Discussion Points

The Cultural and Historic Resources Panel discussions primarily focused on the topics of submerged ancient tribal sites and tribal/working marine landscapes.

Some tribal oral histories recount the movement from the east associated with rising sea level, which suggests at least the potential for ancient tribal sites/landforms remaining intact submerged on the continental shelf. The identification of any submerged ancient tribal sites would be extremely important to the tribes and historians in general. There are underwater archaeologists who can recognize the landscapes/landforms where these ancient sites may be found, but there is not an accepted systematic methodology for identifying these sites.

Marine landscapes can be of cultural significance from a tribal or historic perspective. For Native Americans, some marine landscapes are important in terms of traditional beliefs and practices (e.g., sunrise over the ocean). Working marine landscapes (e.g., some New England maritime communities) are also an important part of American history and protection of most (if not all) of these landscapes may be needed to maintain the traditional “sense of place” that reflect the historic roots of these seafaring communities. The locations of many of these communities or ritual sites are known, but we lack documentation of the heritage “context” that helps make these sites more meaningful. This context can be obtained by documenting tribal oral histories and mariner folklore. Linking this contextual story with the physical sites would significantly improve our understanding of the importance of various landscapes.

Doug Harris and Bettina Washington, representing two Tribal Historic Preservation offices, raised concerns about the timing of various cultural resource studies. They point out that a better job is typically done in defining potentially important locations than by only documenting the tribal/historical context. Waiting until applications for leases occur may not leave sufficient time to collect these data considering that the recommended participatory mapping technique can be a lengthy process. They strongly encouraged initiating these studies to collect tribal oral histories and mariner folklore as early in the process as possible.

2.4.3 Multi-Use Issues/Space Use Conflicts Panel

2.4.3.1 Panel Members

The Multi-Use Issues/Space Use Conflicts Panel included:

- Moderator – John Primo, Ph.D., BOEMRE
- Panelists
 - Susan Abbott-Jamieson, Ph.D. – Former Senior Social Scientist in the NMFS Office of Science and Technology; Adjunct Professor at the University of Maryland and an independent contractor
 - Kevin St. Martin, Ph.D. – Professor, Rutgers University, Department of Geography
 - Jeremy Firestone, Ph.D. – Professor, University of Delaware, College of Earth, Ocean and Environment
 - Porter Hoagland, Ph.D. – Senior Research Specialist, Woods Hole Oceanographic Institute

2.4.3.2 Summary of Key Discussion Points

The Multi-Use Issues/Space Use Conflicts Panel discussions focused on two key themes – need for stakeholder engagement and the advantages/disadvantages of separating uses versus allowing multiple uses.

There are clearly many users of the ocean for a wide variety of purposes (e.g., navigation, recreation, commercial fishing, tourism-related functions, shoreline property owners), as well as other stakeholders (e.g., NGOs, government agencies) who may not directly use the ocean, but have interests in or are responsible for managing it. Wind energy activities are now being introduced into this mix of stakeholders and uses that have not had to previously share the areas offshore. The panel discussion emphasized the need for wind energy projects to engage these ocean users and stakeholders early and often to ensure they fully understand the other users of the marine space.

The panel also emphasized the need to engage marginalized/vulnerable stakeholders who may not otherwise participate in the process. This engagement may involve directly reaching out to these populations to ensure their opinions are heard and also ensuring that the appropriate socio-economic data are used to adequately represent all affected populations. While mapping is useful it has the potential to relegate a site to a ‘place’ on a map and fail to convey the social, cultural, economic and historic connections people have to that site. In these scenarios decision-makers may be misinformed and their resultant choice may have significant unintended consequences for the people associated with a particular site.

The panel also discussed that stakeholders come from different cultural backgrounds and understand and relate to the ocean in different ways, which can also affect their understanding and acceptance of wind energy. It is important to accurately understand, document and

represent the social, cultural, economic and historic concerns/perspectives of those involved; particularly marginalized groups and those whose lifeways and livelihood can be impacted by energy development. Cultural models and participatory mapping (e.g., tribes and local communities such as fishers) are two techniques that would be very useful in identify and documenting the values and beliefs of stakeholders and their relationships with the associated spaces – i.e., seascape, coastline.

There was also discussion around the need to better understand cross-cutting issues (e.g., wind farms may affect fish, which may affect fishermen, which may affect marine communities). Most effects on natural resources will result in some effect on communities and socio-economics.

The panel discussion participants expressed interest in trying to accommodate overlapping multiple uses of ocean space rather than “zoning” or segregating uses, to the extent that public safety can be maintained. This shared use approach is the traditional paradigm of the ocean and would help avoid the “us vs. them” conflict. Several participants indicated the need to better understand the lessons that can be learned internationally where offshore wind energy projects have been active longer, such as in Europe.

Cable landfall locations were also identified as an often overlooked component of offshore wind energy projects that will have the most direct effect on local communities and should be considered when evaluating space conflict and multi-use issues.

2.4.4 Public Perception, Legal Studies, Visual Impacts, and Tourism Panel

2.4.4.1 Panel Members

The Public Perception, Legal Studies, Visual Impacts, and Tourism Panel included:

- Moderator – Amardeep Dhanju, Ph.D., BOEMRE
- Panelists
 - Jeremy Firestone, Ph.D. – Professor, University of Delaware, College of Earth, Ocean and Environment
 - Ms. Bettina Washington – Tribal Historic Preservation Officer, Wampanoag Tribe of Gay Head
 - Mr. Ben Hoen – Principal Research Associate, Lawrence Berkeley National Laboratory
 - Ms. Barbara Hill – Executive Director, Clean Power Now

2.4.4.2 Summary of Key Discussion Points

The Public Perception, Legal Studies, Visual Impacts, and Tourism Panel discussed that in general, there appear to be a number of national trends that show increasing general public support in the United States for offshore wind (e.g., desire for energy independence, climate change). One study in Delaware found that people living near the beach would accept a wind farm as close as one mile offshore before they would prefer construction of an oil or gas power plant.

There were many questions raised by the group around public perception of wind energy, such as:

- Does the public understand the tradeoffs among energy sources and do they care?
- What drives public opinion about wind energy – educational materials? the media? other drivers?

- Are public perception data from one project transferable to other projects or is each project unique from a public perception perspective?

Better understanding of public understanding and perceptions of offshore wind energy would be very useful in designing public education programs around wind energy and ensuring stakeholders received the information they need to make informed decisions regarding proposed wind energy projects. There was also discussion regarding collecting and distributing scientific knowledge in an easily understandable format regarding some commonly raised questions with respect to wind energy projects (e.g., effects of electromagnetic fields on benthic species – see recent BOEMRE report *Effects of EMF from Undersea Power Cables on Elasmobranchs and Other Marine Species, 2011* - <http://www.gomr.boemre.gov/PI/PDFImages/ESPIS/4/5115.pdf>).

Tribal representatives indicated they believe the general public does not understand the basis for tribal concerns about some wind energy projects, nor do they understand the significant tribal role in the NEPA process (e.g., federal agencies' tribal trust responsibilities).

The panel discussion participants discussed the visual effects of offshore wind projects. There was recognition that some view sheds are important to protect, especially for important cultural landscapes, traditional cultural properties, and historic sites. Some willingness-to-pay studies have found that people would be willing to pay more for electricity to have wind turbines located further offshore up to about 9 or 10 mi beyond which this willingness to pay diminishes.

The issue of the potential effect of offshore wind turbines on shoreline property values is a common concern. The studies to date have found relatively little relationship between offshore wind farms and property values, even when considering the distance offshore. Longer term studies are needed once offshore wind projects are built in the United States to document whether any effects are measurable.

In terms of tourism, some municipalities have recommended siting criteria to protect tourism (e.g., Ocean City, Maryland). The few studies available that have studied the potential effect of offshore wind energy projects on tourism have not found much impact. In fact, a survey in Delaware found that 45% of respondents expressed interest in taking a boat tour of offshore wind farms, so perhaps these projects may actually serve as a tourism amenity.

In summary, the Breakout identified the need for:

- More funding on basic socio-economic research around offshore wind energy;
- Better understanding as to whether the level of public information on offshore wind energy is correlated with the level of public support for offshore wind energy projects;
- Better understanding of the type of information needed to enable the public to make informed decisions; and
- More regional studies to better understand public perceptions to supplement the more localized research conducted in Delaware and Cape Cod to date.

2.4.5 Economic Impact, Regulatory, Policy, Stakeholder Issues and Infrastructure Panel

2.4.5.1 Panel Members

The Economic Impact, Regulatory, Policy, Stakeholder Issues and Infrastructure Panel included:

- Moderator – Mr. Gary Norton, Senior Wind Energy Specialist, SRA International/DOE Wind Energy Program
- Panelists
 - Mr. Matt Unger – Energy Research Specialist, Virginia Polytechnic Institute & State University
 - Maureen Kaplan, Ph.D. – Vice President, Eastern Research Group, Inc.
 - Porter Hoagland, Ph.D. – Senior Research Specialist, Woods Hole Oceanographic Institute

2.4.5.2 Summary of Key Discussion Points

The Economic Impact, Regulatory, Policy, Stakeholder Issues and Infrastructure Panel discussions covered a wide range of issues, which are briefly summarized below.

The supply chain for offshore wind energy projects can be quite important as many project components are manufactured internationally. Further, installation vessels are very expensive and can significantly affect construction costs. It is also important to understand the on-shore infrastructure requirements (e.g., cable landings, substation improvements, transmission lines, port facility improvements).

In assessing the economic impact of offshore wind energy projects, the direct, indirect, and induced economic effects must be considered. It can often be difficult to determine where the economic benefits of a project (including employment) will accrue, considering many project components are manufactured internationally and many installation vessels are internationally owned. There are several models that are often used in assessing the economic impact of large construction projects (e.g., IMPLAN, REMI). These models; however, were not developed specifically for a marine application.

Several discussion participants indicated that there are opportunities for the United States and local communities to capture more of the economic benefits of offshore wind projects by developing the manufacturing capability domestically as well as in ancillary areas such as cable laying, but these will require some private sector investment and a commitment to local education and training. In Europe, manufacturing offshore wind energy components has helped reinvigorate some declining maritime economies.

From a policy perspective, two key questions were raised:

- Is offshore wind energy economic or does it require government incentives?
- Should regulatory or policy changes be enacted such that local communities benefit from offshore wind energy projects?

2.5 BIRDS, BATS AND OFFSHORE WIND DEVELOPMENT: REMAINING INFORMATION GAPS

This session presented information on immediate information needs and on current and planned research efforts. Following the presentations, there was a facilitated discussion aimed at identifying and prioritizing the remaining information gaps.

2.5.1 BOEMRE Immediate Information Needs

David Bigger, Ph.D., Avian Biologist, Office of Alternative Energy Programs, BOEMRE — presented “Immediate Information Needs” related to birds. The planning and analysis stage is when potential Wind Energy Areas (WEAs) are identified with extensive input from other federal government agencies, states and local governments, and tribes. Once the areas are identified, there is an environmental review to assess the impacts of issuing the lease and activities that the holder of the lease may do as they prepare a construction and operations plan. In February 2011, BOEMRE announced the WEAs and launched an Environmental Assessment (EA) to evaluate potential impacts of leasing, site assessment and characterization activities off Delaware, Maryland, New Jersey, and Virginia. The Draft EA was released this week for a 30-day public comment period. After a lease is secured, there is a 5-year period to collect site-specific data, which may include archaeological, biological, geophysical, geotechnical, shallow hazard and other site characterization surveys. After the lessee submits the construction and operations plan (COP), which describes the overall site investigation results, BOEMRE prepares the EIS and conducts environmental and consultation and technical reviews. Immediate information needs include the following: maps of species distribution and abundance; identification of priority species; estimated number of surveys needed to detect bird aggregations; and risk assessment for priority species. Species distribution and abundance maps need to be updated as areas are developed. The slides for this presentation are provided in **Appendix A, Pages A-174 and A-175**.

Studies discussed in the presentation included the following:

Rhode Island Ocean Special Area Management Plan (SAMP).

<http://seagrant.gso.uri.edu/oceansamp/>

2.5.2 Marine Bird and Offshore Wind Workshop - Summary

Melanie Steinkamp, USFWS — The goals of this workshop were to present current knowledge of the distribution and abundance of marine birds and to identify and prioritize scientific research and monitoring needs for marine birds as they relate to decisions being made about offshore wind development and marine bird population management. Preparation for the workshop was extensive and included compiling maps of seabird distribution and abundance using data from the historic seabird database housed by USGS. Maps were specific to regions and time periods. The maps initiated lively discussions about data adequacy, persistent aggregations (hot spots) and the need to have clearly documented metadata about the underlying data. Breakout sessions were held on identifying overlap between birds and wind structures, defining “persistent aggregations”, and determining confidence level with existing data. During one of the breakout sessions, participants identified physical oceanographic features that are likely predictors of where bird congregations will occur and the factors that make an area more or less desirable for wind development. There was consensus among all breakout groups on these factors which include physical characteristics such as currents and land features, species life history traits/behaviors, and species status. The last day of the workshop focused on future

efforts to gather information needed to help make the most informed decisions about sighting wind facilities in the near term. Data gaps identified include baseline information and movement patterns (diurnal and nocturnal) for the south Atlantic Bight; nocturnal movement patterns (everywhere); migratory routes (including passerines); fine scale near shore information; bird prey data; integration of radar with other seabird data; small boat surveys of targeted areas; pre-development monitoring at colonies; commuting patterns of post-breeding birds; matrix of science needs according to risk; and a clearinghouse of all data. Future science needs include predictive modeling to help us forecast where we expect to find birds in the system, given a set of ocean habitat variables or characteristics and existing distribution and abundance data. The slides for this presentation are provided in **Appendix A, Pages A-176 to A-180**.

Studies discussed in the presentation included the following:

Database of historic (and most recent) seabird data compiled by the USGS.

The summary and presentations from the June 2011 Workshop on Offshore Marine Bird

Science and Wind have been posted on the Northwest Atlantic Marine Bird Conservation Cooperative website. You can find the information at the following link:

<http://www.acjv.org/marinebirds.htm>

2.5.3 BOEMRE Research on Birds on the Atlantic OCS

James Woehr, Ph.D., BOEMRE — This presentation summarized nine studies that BOEMRE is involved in, including the high-def and endangered species studies that Dr. Caleb Gordon discussed earlier. Other studies mentioned included the Massachusetts Audubon Study, which tracks movements of long-tailed ducks using satellite telemetry and is important to determine nocturnal locations, and a project on the movements of American Terns and Oystercatchers near Nantucket Sound, which will utilize VHF receivers to monitor birds. A new study to begin in the fall will involve surgical implantation of placing satellite transmitters on seaducks scoters, gannets and red-throated loons to identify their winter congregations and both spring and fall migration corridors and track them during migrations. The study will look at scoters, northern gannets, and red-throated loons. The study will also include the experimental use of externally attached transmitters that are solar powered, as well as surgically implanted transmitters. The slides for this presentation are provided in **Appendix A, Pages A-181 and A-182**.

Studies discussed in the presentation included the following:

Acoustic/Thermographic Monitoring of Temporal and Spatial Abundance of Birds near Structures on the Atlantic OCS (Pandion Systems, Inc. – now Normandeau Associates).

<http://www.pandionsystems.com/Resources/PandionProjects/FeaturedProject/tabid/145/ArticleId/20/Offshore-Wind-Wildlife-Monitoring-Technologies-for-BOEMRE.aspx>

Automated Analysis of Bird Vocalization Recordings (Cornell University).

Compendium of Avian Information and Comprehensive GIS Geodatabase (USGS-PWRC).

http://www.pwrc.usgs.gov/resshow/windpower/oconnell_seabird_dist.cfm

Massachusetts Audubon Society. 2009. Determining Night-time Distribution of Long-tailed Ducks Using Satellite Telemetry. OCS Study MMS 2009-020. Available at:

<http://www.gomr.boemre.gov/PI/PDFImages/ESPIS/4/4823.pdf>

Pilot Study of Aerial High-Definition Imagery Surveys for Seabirds, Marine Mammals, and Sea Turtles on the Atlantic OCS (Pandion Systems, Inc. – now Normandeau Associates).

<http://www.pandionsystems.com/Resources/PandionProjects/FeaturedProject/tabid/145/ArticleId/20/Offshore-Wind-Wildlife-Monitoring-Technologies-for-BOEMRE.aspx>

Potential for Interactions Between Endangered and Candidate Bird Species and Wind Facility Operations on the Atlantic OCS (Pandion Systems, Inc. – now Normandeau Associates).

<http://www.pandionsystems.com/Resources/PandionProjects/FeaturedProject/tabid/145/ArticleId/8/Potential-for-Interactions-Between-Endangered-and-Candidate-Bird-Species-with-Wind-Facility-Operatio.aspx>

Potential study – Movements of Common Terns and American Oystercatchers around and near Nantucket Sound (probably private contractor).

Potential study – Spring and Fall Migration Corridors and Winter Aggregations of Scoters, Northern Gannets, and Red-throated Loons between Long Island Sound and the Carolina Outer Banks (probably USFWS-SDJV and USGS-PWRC).

Surveying for Marine Birds in the Northwest Atlantic (USFWS-ACJV).

http://www.acjv.org/mb_resources.htm

2.5.4 Emerging Results and Technologies for Offshore Wind Wildlife Studies

Caleb Gordon, Ph.D., Normandeau Associates — This presentation summarized three current research and development projects by Normandeau Associates for BOEMRE:

Endangered Bird Species Risk Assessment on AOCS. BOEMRE contract M08PC20060, “Potential for interactions between endangered and candidate bird species and wind facility operations on the Atlantic OCS.”

<http://www.pandionsystems.com/Resources/PandionProjects/FeaturedProject/tabid/145/ArticleId/8/Potential-for-Interactions-Between-Endangered-and-Candidate-Bird-Species-with-Wind-Facility-Operatio.aspx>

Acoustic/Thermographic Offshore Monitoring System. BOEMRE Contract M10PC00101, “Acoustic monitoring of spatiotemporal abundance of birds on the Atlantic Outer Continental Shelf.”

<http://www.pandionsystems.com/Resources/PandionProjects/FeaturedProject/tabid/145/ArticleId/20/Offshore-Wind-Wildlife-Monitoring-Technologies-for-BOEMRE.aspx>

Aerial High-definition Imaging Pilot Study. BOEMRE Contract M10PC00099, “Pilot study of aerial high-definition surveys for birds, marine mammals and sea turtles on the Atlantic Outer Continental Shelf.”

<http://www.pandionsystems.com/Resources/PandionProjects/FeaturedProject/tabid/145/ArticleId/20/Offshore-Wind-Wildlife-Monitoring-Technologies-for-BOEMRE.aspx>

The objectives of the Endangered Bird Species Risk Assessment were to evaluate the potential for the three endangered, threatened, and candidate species of interest (Red Knot, Piping Plover, Roseate Tern) to be impacted by wind facilities located on the Outer Continental Shelf (OCS) and to determine the best methods to evaluate locations of future wind facilities to minimize risks to the species. It was a multifaceted project that included studies of bird mortality and behavior near a wind turbine, tracking migratory patterns of Red Knots using light-sensitive Geolocators, Geospatial analysis of migratory pathways using Avian Knowledge Network data, and the development of a new collision risk model that incorporates behavioral avoidance. The overall conclusion of the study was that risk to all three focal species from offshore wind development on the AOCS is generally low.

The objective of the Acoustic/Thermographic Offshore Monitoring (ATOM) System is to gather species-specific data on birds and bats flying at rotor swept altitudes at proposed offshore wind facility locations, using the species-diagnostic power of animal vocalizations, with quantification power bolstered by thermographic video data. This technology was deployed for the first time this summer, and the first marine deployment on the AOCS will be in fall, 2011.

The objective of the Aerial High-definition Imaging Pilot Study is to determine optimal technology and methodology for conducting high-definition aerial ocean wildlife surveys in the U.S. Aerial imaging is popular in Europe (UK) because it has the advantage of better quality data that's more repeatable. Also, animals aren't disturbed as the studies are conducted from high altitude. The technique is more cost effective than boat-based surveys for most offshore wind survey areas. A multi-camera system is envisioned that utilizes newer cameras and higher flights versus what is currently used in Europe. They are aiming for high quality pictures. The slides for this presentation are provided in **Appendix A, Pages A-183 to A-189**.

Other studies discussed in the presentation included the following:

Burger et al., in review, Renewable Energy – Red Knot risk analysis
Burger, J., C. Gordon, L. Niles, J. Newman, G. Forcey, and L. Vlietstra. 2011. Risk evaluation for federally listed (Roseate Tern, Piping Plover) or candidate (Red Knot) bird species in offshore waters: A first step for managing the potential impacts of wind facility development on the Atlantic Outer Continental Shelf. *Renewable Energy* 36:338-351.
Hatch and Brault. 2007. Collision mortalities at Horseshoe Shoal of bird species of special concern. Report No. 5.3.2-1. Cape Wind Associates. Boston, Massachusetts
Niles, L.J., J. Burger, R. Porter, A.D. Dey, H. Sitters, J. Fox, and C. Gordon. 2010. Preliminary data on migratory, breeding, and wintering movement patterns of Red Knot *Calidris canutus rufa* indicate unexpected variability. *Wader Society Group Bulletin* 117:123-130
Vlietstra et al. in review, JFO – Mortality monitoring results.
Warren-Hicks et al. in review, JWM – Collision Risk Modeling.

2.5.5 Seabird Survey and Observation Database & Hierarchical Models for Estimating Seabird Distributions in the U.S. Atlantic

Allan O'Connell, Patuxent USGS — This presentation summarized a study that was conducted to 1) compile all available seabird survey data for the western Atlantic between Maine and Florida and 2) using these datasets, evaluate seabird distribution in anticipation of offshore development. The Atlantic Seabird Database (ASD) now includes 75+ datasets dating back to the early 1900's with the bulk of it collected between the 1970s and the present. All data was standardized for modeling, georeferenced, and a survey effort map was created, merging both air and vessel survey methodologies. The database continues to grow and now houses >400,000 observations, including data from Canada. The database includes both scientific and non-scientific data. There are approximately 70 seabird species in the ASD, with approximately 10 to 15 sensitive species of interest to regulatory agencies such as BOEMRE and the FWS. Modeling exercises have included broad species distribution mapping species richness modeling, and models of count data for species of interest. The ASD will be transitioned to the USFWS. The slides for this presentation are provided in **Appendix A, Pages A-190 to A-195**.

An example of datasets in the ASD:

Manomet Center for Conservation Sciences, 1978-1980, Gulf of Maine, Mid-Atlantic Bight.
Cetacean and Seabird Assessment Program, 1980-1988, Gulf of Maine, Mid-Atlantic Bight.
Georgia pelagic surveys, 1982-1985, South Atlantic Bight.
Southeast Fisheries Science Center surveys, 1992, 1998, 1999, South Atlantic Bight.
Winter Survey of the Mid-Atlantic, 2001-2003, Mid-Atlantic Bight.
Cape Wind, Mass Audubon, 2002-2006, Nantucket Sound.
North Carolina shelf—trophic predators, 2004-2005, Offshore North Carolina.
Bar Harbor whale watch, 2005-2006, Offshore Mount Desert Island, Maine.

NOAA Herring Acoustic Survey, 2006-2010, Gulf of Maine, Mid-Atlantic Bight.
NOAA Ecosystem Monitoring Survey, 2007-2010, Gulf of Maine, Mid-Atlantic Bight.

Publications from current project:

- O'Connell, Jr., A.F., B. Gardner, A.T. Gilbert, and K. Laurent. 2009. Compendium of Avian Occurrence Information for the Continental Shelf Waters along the Atlantic Coast of the United States (Database Section – Seabirds). A final report for the U.S. Department of the Interior, Minerals Management Service, Atlantic OCS Region, Herndon, VA. 50 pp. Contract No. M08PG20033.
- Spiegel, C. and S. Johnston. 2011. Compendium of Avian Occurrence Information for the Continental Shelf Waters along the Atlantic Coast of the United States (Database Section – Shorebirds). A final report for the U.S. Department of the Interior, Bureau of Energy Management, Regulation, and Enforcement, Atlantic OCS Region, Herndon, VA. 27 pp. Contract No. M08PG20033//Interagency Agreement between USGS and USFWS, Region 5, Division of Migratory Birds, Hadley, MA.
- Zipkin, E.F., B. Gardener, A.T. Gilbert, A.F. O'Connell, Jr., J.A. Royle, and E.D. Silverman. 2010. Distribution patterns of wintering sea ducks in relation to the North Atlantic Oscillation and other local environmental characteristics. *Oecologia* 163:893-902.

2.5.6 At-Sea Distributions of Pelagic Seabirds off the East Coast of the United States, 2010, A Preliminary Report to BOEMRE

Richard Veit, Ph.D., College of Staten Island — This study includes large scale data from research vessels. One survey is the Ecomon (ecosystem monitoring) survey, which had a stratified sampling regime (seasonal) and included samples of zooplankton using nets. The second survey was the herring cruise, which only occurred in the fall. During this cruise acoustic data on zooplankton and fish were collected with bird observations. Data from 3 Woods Hole Oceanographic Institute (WHOI) cruises was also used. Hotspots were determined by combining shipboard data with large spatio-temporal databases. This is important information for offshore wind turbines. It is known that seabirds are highly aggregated species - the challenge is getting models to fit these areas. In summary, the findings indicate that hotspots are evident and persistent, there are changes evident since 1970s, and that changing climate has affected birds. The slides for this presentation are provided in **Appendix A, Pages A-196 to A-202.**

Studies discussed in the presentation included the following:

Ecosystem Monitoring Program (EcoMon), NOAA Herring Acoustic Survey (2006-2010), and WHOI cruises.

Manomet Bird Observatory Data 1970s-1980s.

Powers, K.D. 1983. Pelagic distributions of marine birds off the Northeastern United States. U.S. Department of Commerce. NOAA Technical Memorandum NMFS-F/NEC-27. 201 pp.

Santora, J.A., C.S. Reiss, V.J. Loeb, and R.R. Veit. 2010. Spatial Association between hotspots of baleen whales and demographic patterns of Antarctic krill *Euphausia superba* suggests size-dependent predation. *Marine Ecology Progress Series*: 405-255-269.

2.5.7 Ongoing Offshore Bat Studies in the Gulf of Maine – Steve Pelletier, CWB

Steve Pelletier, CWB — Studies in 2004-2005 showed a lot of mortality (100s) of bats near terrestrial wind turbines. Projects that are 40 km apart show similar activity trends. Much can be learned about biology, range, patterns from this data. There are historical coastal observations of bats by Maine lighthouse keepers, who saw many migratory bats, and there have been a number of recent studies on offshore bats. Bats typically fly <10 m above sea level and rise rapidly when near vertical objects (e.g., ships, turbines, lighthouses). Acoustic surveys were conducted from April to November in 2009 and 2010 along the coast of Maine to document offshore bat activity. Deployment options were limited by island/lighthouse accessibility. The islands had a mix of habitats and the study extended over an area of 125 mi in 2009 and 175 mi in 2010. A few acoustic monitors were also installed onshore, overlooking the coast. Bats were detected at all sites in 2009 and 2010. Peak movement periods of resident and non-migratory species were detected. There was an overall decline in activity between July-November. There were no clean patterns in species composition at the sites. Migratory patterns may be seen in the data for green hoary bats and pink silver haired bats. The slides for this presentation are provided in **Appendix A, Pages A-203 to A-210**.

Studies discussed in the presentation included the following:

- Ahlén, I, B. Hans, and B. Lothar. 2009. Behavior of Scandinavian Bats during Migration and Foraging at Sea. *Journal of Mammalogy* 90, 1318-1323.
- Ahlén. 2005. Summary: Bat casualty risks at offshore wind power turbines. Report from introductory studies.
- Ahlén. 2007. Risk Assessment for Bats at Offshore Windpower Turbines.
- Cryan. 2007. Offshore Island Study.
- Geo-Marine Inc. 2008. TI camera/vertical radar, New Jersey.
- Griffin. 1940. Multiple observations aboard ships at sea summarized by Hutterer et al. 2005. Bat migrations in Europe: a review of banding data and literature.
- Merriam. 1887. Lighthouse counts, Mt. Desert Rock, Maine.
- Miller. 1897. Highland Lighthouse, Truro, Massachusetts.
- T. Kunz, Boston University. 1990. Mist netting, Cape Cod, Massachusetts.
- Tetra Tech. 2009. Acoustic Surveys, Block Island, Rhode Island.

3.0 INFORMATION GAPS AND RECOMMENDATIONS

3.1 PLENARY SESSION

This panel provided direction and an overview of the objectives of the Atlantic Wind Energy Workshop and set the stage for content to be included in the breakout sessions. This session also provided a panel comprising Federal agency representatives that have roles in offshore renewable energy, either as a regulator or resource agency. The outcomes of this panel included that this workshop provided the starting point to continue interagency coordination and communication and the recognition that Workshops like this one and other information transfer meetings (ITMs) are excellent venues for continued coordination and communication.

3.2 ENVIRONMENTAL BREAKOUT SESSIONS: MONITORING AND BASELINE STUDIES

The Environmental Breakout identified priority information gaps/research needs throughout each panel, which are described below. These themes were all deemed important and are not prioritized. The slides for the Environments Breakout sessions summary presentation are provided in **Appendix A, Pages A-211 to A-214**.

3.2.1 Information Management and Data Sharing

There are multiple databases and portals aimed at providing user-friendly platforms to support dissemination of the science needed for planning, decision making, and stewardship. There are many current databases that exist and were discussed that cover varying regional areas and contain a range of resource specific data layers. Data sources and data collection methods vary throughout the portals, but the goal is the same, to provide existing data and tools for analysis. However, with all the various databases available, there are common challenges and needs identified:

- Continued transparency and data sharing;
- Organization and availability of data;
- Data storage capacity;
- Raw data needs;
- Complete coverage of regions;
- Cataloging of existing data; gap analysis; and
- Data quality and comparability (apples to apples).

3.2.2 Developers' Perspective

The developers provided insight on current and ongoing projects, including individual wind projects and the offshore transmission backbone. As developers make decisions regarding offshore projects, the existing regulatory process is viewed as extensive and unclear which provides a lot of uncertainty; and therefore, risk in potential projects. Four key issues were identified with the existing process for project development and permitting that would assist existing developers and encourage more developers to explore offshore wind projects:

- Timeline for permitting is a big risk for developers; developers are looking for an efficient and established/known timeline from the agencies;

- Established timelines would encourage more interest from developers;
- Permitting requirements are perceived as extensive and unclear and may be prohibitive for many developers; and
- Need for consistency within Federal agencies between offices.

3.2.3 State Planning and Information

Many states have conducted baseline studies and developed state planning tools and documents to support offshore renewable energy development. The approach taken by each state varied based on existing information and specific goals and was driven by their State Coastal Management Plan. Developers must also keep in mind that in addition to the Federal process that must be followed for projects; there is also a State process that must be followed as well. There is information available at the State level can assist with the planning of projects. All of the State panelists discussed common challenges and needs that were also similar to the Federal challenges and needs including:

- Data are more regional in nature, limited site-specific data;
- Large quantity of data to process;
- Lack of standard survey methods;
- Lack of data quality guidelines (QA/QC);
- Reliable data standards will ensure that investors are making wise decisions by siting a wind project within areas identified using baseline data; and
- Ensure redundancy is not occurring.

3.2.4 Broad Scale Habitat, Abundance and Distribution – Consultation Process

A key component of the consultation process includes compliance with the applicable environmental laws and regulations that govern offshore renewable energy activities and are enforced by Federal agencies, including NOAA and USFWS. Two primary Acts that require compliance include the ESA and Section 7 Consultation and the MMPA. Compliance with these two Acts requires very specific information and data. Specific recommendations that were identified for assisting with compliance with these key Acts include:

- Proper characterization data is needed to adequately prepare take estimates (IHA, LOA);
- Developers need to identify project-specific risks; common impacts noted – noise, entanglement, bird strike, vessel strike, oil/fuel spill;
- Need to begin consultation early;
- Joint guidance between BOEMRE, NMFS, and USFWS for data collection; and
- Establish timelines for consultation.

3.2.5 Broad Scale Habitat, Abundance and Distribution – Baseline Data

There are numerous projects and studies (completed and ongoing) to collect data specific to multiple resources. The data provides information on a wide variety of species that are being studied, in what locations, during which seasons, and using which technologies. The common needs identified include:

- Data sharing between stakeholders and agencies to be able to assess and identify impacts to fisheries (one stop shop);

- Continue investigating other survey technologies – HD video and photo, AUV, UAV, marine mammal tagging;
- Need more information on risk to assess remaining data gaps; and
- Need to compile existing protocols and study results for project-specific surveys.

3.2.6 Acoustic Monitoring Technology and Impacts

There are many different monitoring methods and technologies that are currently being used, both successfully and unsuccessfully, for a variety of species, locations, and seasons, for which impacts have been identified. Monitoring methods varied based on the specific information goals and impact types being assessed. The common challenges and needs identified were:

- Data management can be challenging (non-homogenous, differing formats, data volume);
- Impacts of EMF (DC vs. AC transmission) to Atlantic marine species have not been studied;
 - Species' sensitivity has not been characterized
 - Species at risk have been identified (slow-moving benthic species)
- Data processing capability – make it more available, better ways to process the data, and data processing standards; and
- Tools available to integrate acoustic data into spatial models.

3.2.7 Common Themes

The primary common themes throughout the environmental studies sessions included:

- The need for data collection, processing, quantity, and quality standards and protocols;
- Data management and sharing is challenging but key to the process;
- Establishment of timelines throughout the process is needed; and
- Consistency and cooperation between agencies, State and Federal, is essential.

3.3 TECHNOLOGY ASSESSMENT & RESEARCH PROGRAM: RENEWABLE ENERGY STUDIES

The Technology Assessment & Research (TAR) Program Breakout included representatives from BOEMRE, the commercial wind industry, contractors conducting studies funded under BOEMRE's TA&R Program and other interested individuals. The Breakout had an open forum and attendees discussed the various technical issues raised by the presentations and general comments raised during the course of the sessions. From these discussions the group collaborated and identified the key research gaps and data needs required to advance BOEMRE's technical and regulatory missions. As outlined below the attendees developed a list of 10 topics that needed to be addressed and reached agreement on a priority ranking for each in terms of funding.

A majority of the breakout session was dedicated to identifying the studies that should be included in order to properly address or establish baseline data to address the topic. By direction the descriptions of proposed studies were left at a high level in order to encourage creativity and flexibility in proposals/white papers that would be requested if the studies are to be funded.

The below topics are ranked in order 1 through 10 based on participant agreement.

Key: RG: Research Gap

KDN: Key Data Need

The slides for the Technology Assessment & Resource Breakout summary presentation are provided in **Appendix A, Pages A-219 and A-220**.

Suggested Research Topics:

Gulf Stream/OCS Mooring Issues – (RG); Ranking 3

- Evaluate mooring load and power transmission cable requirements and systems
- Analyze station keeping alternatives for optimizing device capacity factor
- Develop model inputs/outputs relative to Guidelines API RP 2SK and other applicable class rules

MHK Mooring Space and Use Conflicts – (RG); Ranking 2

- Estimate density of proposed systems as function of device type
- Evaluate proposed mooring systems for installation practicality and safety.
- Identify marine mammal entanglement potential
- Identify fisheries conflicts by gear type and mooring type

Managing Risk for Multiple uses of Wind and MHK Projects – (RG); Ranking 10

- Project developer risk for damage to vessel or injury to personnel
- Vessel operator risk for damage to project facilities
- Exclusion zone requirements (turbine vs. electric service platform)
- Surveillance/deterrent technology evaluation

Example Formats/Templates for key BOEMRE document submission requirements – (KDN); Ranking 4

- Develop a Safety Management Plan for a hypothetical wind farm to serve as an example.
- Develop Facility Design Report template consistent with regulatory requirements
- Develop Fabrication and Installation Report template consistent with regulatory requirements

Audit Standards/Procedures Audit Criteria/Procedures Template and Checklist – (KDN); Ranking 7

- Develop Safety Management System Criteria for Audit of systems/facilities (turbines and cables) to support Industry system integrity management and Audit Checklists for regulators

Incident Reporting and Lessons Learned for Development of Safety Management Systems – (KDN); Ranking 8

- High failure rates have occurred over time with concerns over timely/accurate/complete reporting. Need timely feedback to the industry

Wind Turbine Condition Monitoring for Safety and Inspection – (KDN); Ranking 1

- Structural condition monitoring is not currently required
- Structural monitoring requirements as contrasted to monitoring output and efficiency
- What are opportunities to add onboard monitoring to optimize or reduce inspection requirements, measure fleet-wide response of structural systems, and determine response to structure over time to project practical design and life extension of structures/project?
- What instrument state of the art technology options are available?
- How should data be interpreted/used?
- What levels initiate action – What Action?

- Industry/manufactures should supply some set of specifications that could be monitored and action levels for monitoring data
- How should data be collected: real time; some regular interval; after extreme event; or black box?

Study of Fundamental/Structural Soil Conditions Requirements – (RG); Ranking 6

- Lateral load deformation predictions based on methodology used for oil and gas API-RP 2A unverified for large diameter relatively short monopiles
- Industry needs improvement in the ability to predict the long term performance and response of foundations

Fatigue Design Methodologies and Design Criteria – (RG); Ranking 5

- Study fatigue design methodologies applicable to complex fixed and floating offshore wind turbine support structures
- Recommend a rational, practical fatigue design method for offshore wind turbine support structures
- Evaluate fatigue design criteria for offshore wind turbine support structures

Design Guideline for Stationkeeping Systems of Floating Wind Turbines – (RG); Ranking 9

- Study simulation methods for the design of stationkeeping systems of floating wind turbine
- Identify critical design parameters for various types of stationkeeping systems (mooring, tendon, anchor, etc.) of floating wind turbine
- Recommend a design guideline for stationkeeping systems of floating wind turbine
- Initiate/Cooperate in international Studies to Support IEC Standard Development, particularly differences between offshore floating wind and MHK

3.4 SOCIAL-ECONOMIC BREAKOUT: ASSESSMENT DRIVEN ISSUES

The Social-Economic Breakout identified five priority information gaps/research needs themes, which are described below. These themes were all deemed important and are not prioritized. The slides for the Social-Economic Breakout summary presentation are provided in **Appendix A, Pages A-215 and A-216.**

3.4.1 Cultural Landscapes

Cultural landscapes include both tribal and working marine landscapes. These landscapes, especially those that are relatively intact, have special meaning and importance from a tribal and historic perspective. These landscapes are truly a case where the whole is equal to more than its parts. Simply protecting an historic building or an archaeological site, or even a traditional cultural property, will not preserve these landscapes. Fully understanding these landscapes is a critical first step to predicting how offshore wind energy projects may affect them. Two specific information gaps/research needs were identified:

- Collect and map historic/current social-cultural landscape data using participatory tribal (indigenous) and community mapping techniques; and
- Collect marine cultural heritage landscape “context” from tribal oral histories/mariner’s folklore within designated Wind Energy Areas.

This research will help BOEMRE to better describe these cultural landscapes in their NEPA documents and enable decision-makers to make more informed decisions.

3.4.2 Submerged Ancient Tribal Sites

Native Americans inhabited what is now the Outer Continental Shelf thousands of years ago before it was inundated by rising sea levels. Although most evidence of their presence was probably eroded away by the rising shoreline, some geomorphic settings could have been quickly flooded potentially preserving some archaeological sites in the sediments. These sites are of special value as they can assist in understanding and adding detail to tribal oral histories of their ancestors moving west from the sea. This information also has the potential to reveal much about how the earliest populations of North America lived on and used the coastal lands that are now submerged.

In terms of data information gaps/research needs, the following were identified:

- Need to develop a standardized methodology or guidelines for identifying submerged ancient landforms and tribal sites during the site characterization activities; and
- Use available research data to start developing a tribal-sensitive predictive model of where submerged ancient tribal sites are more likely to be found, similar as to the predictive models that are routinely used in terrestrial settings.

The development of a standardized methodology and a predictive model will enable BOEMRE to more thoroughly assess the potential for and protect submerged ancient tribal sites as part of their review of offshore wind proposals.

3.4.3 Multiple Use of Ocean Space

As discussed above, there are many users of the ocean and even more stakeholders. Rather than “zoning” the ocean for single uses, the Social-Economic session advocated for multiple use of the ocean to the extent it can be done safely. The session recommended the following research needs to better characterize the potential for multiple use of ocean space:

- Research and characterize (i.e., social, cultural, economic and historic) current multiple use of the ocean within the designated Wind Energy Areas, as well as successes and failures with multiple uses in other parts of the United States, techniques such as cultural models and participatory mapping are means of providing the necessary data characterizing stakeholder space use, particularly for those groups that are potentially the most vulnerable (i.e., Tribes, fishers, local communities, and other potentially marginalized groups); and
- Evaluate and identify lessons learned from international offshore wind experience with accommodating multi-users, as they have a longer track record of dealing with these issues.

Documentation regarding multiple use of ocean space will enable BOEMRE to better evaluate and disclose potential use conflicts in their NEPA documents and develop appropriate mitigation measures.

3.4.4 Economic Impact Modeling

Economics are always a key consideration in evaluating proposed wind energy projects. Project sponsors/proponents often tout a project’s employment benefits, while other stakeholders often question where these economic benefits will be realized and raise concerns

about a project's effect on local property values. There are several widely used and accepted models for evaluating the economic effects of proposed construction projects (e.g., IMPLAN, REMI), but these models need to be adapted to a more coastal/offshore-oriented setting. There is clearly a need for an objective and defensible model to quantify the economic effects of wind energy projects. Therefore, the Social-Economic session identified the following research needs:

- Adapt current economic models in a contextually appropriate and transparent way to more accurately assess socio-economic effects of offshore wind (e.g., jobs, impacts on ports, property values); and
- Better understand and predict where the economic costs and benefits will occur (e.g., locally, regionally, domestically, and internationally).

The development of a better economic model will enable BOEMRE to more accurately predict the economic effects of a proposed wind energy project, especially in terms of local benefits.

3.4.5 Public Perceptions and Understandings

There are major gaps in our understanding of public perceptions about offshore wind energy. In addition, different stakeholder groups may culturally approach similar issues differently. A better understanding of the public's knowledge and concerns about offshore wind development could enable the development of better public engagement and education programs, and allow resource managers to make more informed decisions. Therefore, the Social-Economic session identified the following research needs:

- Identify, characterize and document key values and beliefs of stakeholder groups that influence their perception of the seascape and offshore wind energy development, using techniques such as cultural models, oral histories, and participatory mapping.
- Expand the scope of current localized perception studies to cover large coastal regions such as the Mid-Atlantic.

3.5 BIRDS, BATS AND OFFSHORE WIND DEVELOPMENT: REMAINING INFORMATION GAPS

The Birds, Bats and Offshore Wind Development session identified five priority information gaps/research needs themes, which are described below. These themes were all deemed important and are not prioritized. Data pertinent to these themes should be compiled into a wind development scale risk model along with available existing information. The slides for the Bird, Bats and Offshore Wind Development Breakout summary presentation are provided in **Appendix A, Pages A-217 and A-218.**

3.5.1 Nocturnal Patterns

Nocturnal movement patterns of birds and bats offshore are not well understood. A detailed understanding of these patterns is critical to predicting how offshore wind energy projects may affect birds and bats that migrate during the night. In addition, it is important to understand how species that fly at night and are attracted to light may be affected by turbine lighting. Specific information gaps/research needs identified were:

- Develop technology to study offshore nocturnal movements of birds and bats;
- Research and characterize nocturnal movements of birds and bats within the designated WEAs; and
- Research and characterize the issue of light attraction to better understand how species may be affected by turbine lighting.

Research in these areas will help BOEMRE to better describe the nocturnal movements of birds and bats in their NEPA documents and more thoroughly assess the potential impacts to birds and bats.

3.5.2 Migratory Data

There is a lack of existing data on offshore migration routes and migration shortcuts. These routes need to be identified for targeted species or areas in order to ascertain where birds and bats are likely to fly within the WEAs. Specific information gaps/research needs identified were:

- Develop technology to study the offshore migration patterns of birds and bats; and
- Research and characterize offshore migration routes, including migration shortcuts, of birds and bats in relation to the designated WEAs.

Research in these areas will help BOEMRE to better describe the offshore migration routes and patterns of birds and bats in their NEPA documents and more thoroughly assess the potential impacts to birds and bats.

3.5.3 Sensitivity Analysis

A sensitivity analysis determines species vulnerability based on population status and behavior, including flight characterization and flight altitude. This information is needed to prioritize species in study areas. Specific information gaps/research needs identified were:

- Identify and compile existing data on species vulnerability; and
- Continue to fill in information gaps as new data are collected.

Research in this area will help BOEMRE to better prioritize species of birds and bats in their NEPA documents and more thoroughly assess the potential impacts to these species.

3.5.4 Distribution Data

There is a lack of data on species distribution offshore. These data are critical to determine which species of birds and bats are likely to fly within the WEAs and their key use areas. Specific information gaps/research needs identified were:

- Identify and compile existing species distribution models that extend offshore; and
- Continue to fill in information gaps as new data are collected.

Research in these areas will help BOEMRE to better describe the offshore distribution of birds and bats in their NEPA documents and more thoroughly assess the potential impacts to birds and bats.

3.5.5 Abundance Data

There is a lack of data on species abundance offshore. These data are critical to determine the number of birds and bats that are likely to fly within the WEAs. Specific information gaps/research needs identified were:

- Identify and compile existing species abundance data; and
- Continue to fill in information gaps as new data are collected.

Research in these areas will help BOEMRE to better describe the offshore populations of birds and bats in their NEPA documents and more thoroughly assess the potential impacts to birds and bats.

3.5.6 Decision Support Tool

The group recommended that a decision support tool, or “Best Bird Map”, be developed from information generated during the five research topics described above. A “Best Bat Map” would follow the same theme. The group agreed that the next steps in developing the maps include:

- Get the most out of existing data (improving metadata, removing data artifacts, and developing data quality estimates);
- Hold a Structured Decision Making (SDM) workshop for sensitivity analysis (identify species vulnerabilities, risks, and priority species);
- Determine predicted distribution (i.e., where we expect to find birds given a set of variables or characteristics) and abundance; and
- Weight distribution and abundance by risk (model output e.g., color coded Best Bird or Bat Map).

3.5.7 Other Data Needs

The group identified other bird-related data needs as pre-development monitoring at colonies, distribution and behavior of post-breeding birds, and the effects of turbines/structures on environmental conditions that influence bird distribution and abundance (attraction, eddies). Additionally, the group stressed the need for a permanent full time data manager for the seabird database and continued improvement in data sharing.

Other bat-related data needs include annual variability in distribution and abundance, regional use, flight characterization (foraging, migration, and breeding), distance to shore gradient, influence of white nose syndrome on behavior and populations, turnover rates, and standardization of data collection (e.g., identifying the metrics/answers needed to make decisions – this is also needed for birds).

4.0 ADDITIONAL TOPICS DISCUSSED

This section provides additional information on topics that were discussed during the closing breakout sessions. This information includes the following:

- BOEMRE's Environmental Studies Program (**Section 4.1**)
BOEMRE Fact Sheet – Environmental Studies Program provides numerous links to on-going studies at <http://www.boemre.gov/eppd/PDF/BOEMREEnvironmentalStudiesfactsheet.pdf>.
- The Draft BOEMRE “Smart From the Start” Atlantic OCS Initiative – Sufficient Conditioning of Commercial Wind Lease Issuance Memo (**Section 4.2**).
- BOEMRE Fact Sheet – Renewable Energy on the OCS that provides a summary of the regulatory process and the Obama Administration Goals for Offshore Renewable Energy (**Section 4.3**).
- A summary of the U.S. Army Corps of Engineers role in the offshore renewable Energy projects (**Section 4.4**).
- Additional information regarding **Section 2.2.1.1**: the EcoSpatial Information Database (**Section 4.5**).
- Additional information regarding **Section 2.1.1.3**: Energy Market and Infrastructure Information for Evaluating Alternative Energy Projects for OCS Atlantic (**Section 4.6**).
- Fiscal Year 2010 Report Conceptual Model of Offshore Wind Environmental Risk Evaluation System, Environmental Effects of Offshore Wind Energy (**Section 4.7**).
- NOPP presentation summary. The slides for this presentation are provided in **Appendix A, Pages A-220 to A-223 (Section 4.8)**.

4.1. OVERVIEW OF BOEMRE'S STUDIES AND RESEARCH PROGRAMS

BOEMRE is the federal bureau responsible for overseeing the safe and environmentally responsible development of energy and mineral resources on the OCS. This includes oil and natural gas, renewable energy and marine minerals. BOEMRE's stewardship of the nation's offshore resources is guided by the National Ocean Policy vision of a “healthy and resilient, safe and productive, understood and treasured” OCS.

BOEMRE is one of the leading contributors to the growing body of scientific knowledge about the nation's marine and coastal environments. The bureau's Environmental Studies Program (ESP), which was established in 1973, funds on average \$30 million per year for scientific studies in the Atlantic, the Gulf of Mexico, the Pacific and Alaska. Data gained from these studies inform policy decisions regarding leasing and development of OCS energy and mineral resources. The information is also used by other federal, state and local agencies, by researchers in the nation's universities, and by the private sector.

Since its inception, the ESP has been committed to quality science by funding more than 1,000 studies in many areas: physical oceanography, atmospheric sciences, biology, protected species, social sciences and economics, submerged cultural resources, and fates and effects (which refers to understanding and reducing the environmental impacts of energy development projects).

BOEMRE oversees scientific research conducted through contracts, cooperative agreements with state institutions or universities and inter/intra-agency agreements. These arrangements, such as through the National Oceanographic Partnership Program, allow the bureau to leverage federal resources, meet national priorities, satisfy common needs for robust scientific

information and contribute to the global effort of better understanding the marine and coastal environment.

For the most up-to-date information on current studies, please visit:

<http://www.boemre.gov/eppd/sciences/esp/HappeningNow.htm>

4.1.1 Environmental Studies Process

ESP planning includes multiple and diverse inputs from citizens and organizations, national and regional scales, and work with stakeholders to better define information needs. The process from development to approval is described below.

First, Studies Development Plans (SDP) are written by Headquarters and each Regional Office which contain descriptions of expected OCS Program activities covering a designated three year period and the proposed studies that have been designed to collect information to meet the needs of users. Information users include groups such as BOEMRE scientists, rule writers, modelers, and decision makers. To create the SDP, each Regional Office solicits staff and external public and local/state/Federal government input during the development of the SDP. The goal is to anticipate potential OCS activities and describe the environmental information and scientific research needed for future management decisions.

Some of the environmental information needs may be met through existing research programs, but others lead to the development of study proposals. The proposed studies are evaluated by the Headquarters office for program relevance, programmatic timeliness, and scientific merit. One of those methods is BOEMRE's OCS Scientific Committee (SC), a federal advisory committee. The SC advises the bureau on the feasibility, appropriateness and scientific value of the studies proposed for the Environmental Studies Program.

For more information, see:

<http://www.boemre.gov/mmab/scientificcommittee/ocssc.htm>

As described above, the ESP integrates advice from a wide range of sources when formulating the annual research program plan known as the National Studies List (NSL). The NSL for each fiscal year contains all the approved studies for the ESP. A priority order for the many proposed studies is developed and evaluated again by Headquarters, principally considering program relevance, timing, and budgetary constraints. Discussions are conducted with each of the program offices in the Regions and when consensus is achieved, the NSL is recommended to the Associate Director for approval.

Once the annual appropriations for the Department have been approved, studies on the NSL are procured via competitive procurements, cooperative agreements with a State institution or university, or through interagency agreements with other Federal agencies. Standard reporting and distribution requirements for conveying findings are included in all contracts and agreements. The ESP makes all studies results available to the public by publishing reports on the Internet through the Environmental Studies Program Information System (ESPIS).

<https://www.gomr.boemre.gov/homepg/espis/espismaster.asp?appid=1>

4.1.2 Technology Assessment & Research (TA&R) Program

In addition to the ESP, BOEMRE's TA&R Program supports research associated with operational safety and pollution prevention as well as oil spill response and cleanup capabilities.

The TA&R Program was established in the 1970's to ensure that industry operations on the OCS incorporated the use of the Best Available and Safest Technologies (BAST) subsequently required through the 1978 OCSLA amendments and Energy Policy Act of 2005. The TA&R Program is comprised of three functional research activities: For more information on the TA&R program: <http://www.boemre.gov/tarhome/index.htm>

- Operational safety and engineering research;
- Oil spill response research; and
- Renewable energy research.

4.1.3 Renewable Energy Studies and Research

To review the more than 40 BOEMRE studies that specifically apply to our renewable energy programs, go to: <http://www.boemre.gov/eppd/sciences/esp/RenewableEnergyResearch.htm>. Each listing not only describes the research being conducted but also shows the institution performing the work, the cost of the effort, timeframe, and any associated publications, presentations, or affiliated web sites.

4.1.4 Next Steps

The findings of the workshop will play a significant role in developing future studies and research through the ESP and TA&R Program. Some of the data gaps and research needs identified through the workshop are already being addressed by the ESP and TA&R Program.

Within funding restraints, the remaining data gaps and research needs that are clearly understood will be addressed in the FY 2013-2015 Studies Development Plan and or future Broad Agency Announcements. Data gaps and research needs requiring more discussion will likely be addressed as topics at BOEMRE's next renewable energy workshop.

In addition, BOEMRE is often approached by other agencies and organizations interested in funding or addressing data gaps and research needs related to offshore renewable energy. This workshop summary is also intended to benefit those agencies and organizations.

4.1.5 Other Relevant Workshop Reports

The DOE Wind and Water Power Program sponsored the ***Offshore Resource Assessment and Design Conditions Public Meeting*** on June 23-24, 2001 in Crystal City Virginia. The meeting focuses on the critical meteorological and oceanographic measurements and data needed for successful deployment of offshore renewable energy technologies, including wind and MHK. The report may be found here: http://www1.eere.energy.gov/water/pdfs/radc_public_meeting_9-14-11.pdf

The DOE Wind and Water Power Program sponsored the ***Advanced Marine Renewable Energy Instrumentation Experts Workshop***, April 5-7, 2011 in Broomfield, CO. This workshop brought together technical experts from government laboratories, academia, and industry representatives from marine energy, wind, offshore oil and gas, and instrumentation developers to present and discuss the instrumentation needs of the marine energy industry. <http://www.nrel.gov/docs/fy12osti/51584.pdf>

The Ocean Research & Resource Advisory Panel held a workshop on ***Offshore Renewable Energy: Accelerating the Decision-Making Process*** on May 24-25, 2011. This meeting featured federal agencies and members of industry, in a forum to facilitate open discussions and creative problem-solving to overcome impediments to industry progress toward deploying operation projects. The report may be found at: <http://www.nopp.org/publications-and-reports/> once available.

The USFWS sponsored, ***Marine Bird and Offshore Wind Workshop*** to present current knowledge of the distribution and abundance of marine birds and to identify and prioritize scientific research and monitoring needs for marine birds as they relate to decisions being made about offshore wind development and marine bird population management. You can find the information at the following link: <http://www.aciv.org/marinebirds.htm>

4.2 DRAFT MEMO - BOEMRE 'SMART FROM THE START' ATLANTIC OCS WIND INITIATIVE - SUFFICIENT CONDITIONING OF COMMERCIAL WIND LEASE ISSUANCE

DRAFT MEMORANDUM

From: National Wildlife Federation (NWF), Natural Resources Defense Council (NRDC)

To: Environment, Ocean, and Energy NGOs

Re: BOEMRE 'Smart from the Start' Atlantic OCS Wind Initiative – Sufficient Conditioning of Commercial Wind Lease Issuance

Date: March 7, 2011

Overview:

The Obama Administration's recently announced offshore wind initiative for the waters off the Atlantic coast states, "Smart from the Start," seeks to expedite the development of first generation offshore wind projects on the East Coast, while ensuring that these projects are carefully and appropriately sited. As a first step, the Department of the Interior is working with the Governors of the Atlantic coast states to identify "wind energy areas" which may be appropriate for the development of offshore wind. The Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE) is soliciting comments by March 11th on the proposed Environmental Assessment (EA) for renewable energy leasing and site assessment activities to be conducted within wind energy areas (WEAs) along the coasts of New Jersey, Delaware, Maryland, and Virginia. Our groups will be commenting on this notice and hope your organizations will as well. As part of our comments, we are seeking clarification of two key issues, namely the nature of the leases that would be issued and assessed in the EA and the nature of the environmental review that will be performed in connection with the Construction and Operation Plan (COP). We hope that your groups will include a similar request for clarification in your comments.

Our organizations support well-planned offshore wind energy development given its enormous potential to expand the supply of clean and climate-friendly energy sources. We recognize that more certainty is needed for developers to commit the millions of dollars necessary to conduct site assessment and site characterization activities on an area of the OCS. This lack of certainty is a significant deterrent to attracting the early investment needed to make large-scale offshore wind generation a reality.

We are also committed to ensuring that this development proceeds in an environmentally sound way. To this end, we support a process that will expedite prompt site characterization and assessment, while at the same time ensuring that no development rights are granted until after there has been a full environmental review of the proposed project and the project has been approved.

For these reasons, NWF and NRDC believe that it is essential that Interior clarify the nature of the leases that it intends to issue for these WEAs and that it clarify that a full Environmental Impact Statement will be prepared in connection with the COP. The following principles, which have been developed after consultation with the Offshore Wind Development Coalition, are being offered to clarify these two key issues. We believe that the multiple goals of thorough and well-timed environmental review, investor certainty, and a streamlined process will be achieved by adhering to these basic principles.

Principles:

- The lease shall ensure that no other party will be granted any right or interest that would interfere with the conduct of reasonable site assessment and characterization activities for the lease site;
- The lease shall provide the lessee with the exclusive right to apply for the approval of a Construction and Operation Plan (COP) for the site and with the right to have no COP application from other potential lessees considered unless the lease has been terminated by the Secretary. A basis for termination shall include but is not limited to the lessee's failure to make sufficient progress toward an approvable COP or the lessee's abandonment of the lease;
- The lease shall confer no right of occupancy on submerged lands of the OCS other than for routine site characterization and assessment activities;
- The grant of a lease shall in no way affect or impair the Secretary of the Interior's authority to deny pursuant to the factors in OCSLA section 8(p), without compensation, development rights to the lessee in connection with its review of the COP.

Background:

On February 9, 2011, BOEMRE issued a Notice of Intent (NOI) to prepare a regional Environmental Assessment (EA) for commercial wind lease issuance and site assessment activities for WEAs off the coasts of New Jersey, Delaware, Maryland and Virginia. According to the NOI:

“The proposed action is the issuance of renewable energy leases within the WEAs described in Section 3 of this Notice, and approval of site assessment activities on those leases. The regional EA will consider the environmental consequences associated with reasonably foreseeable leasing scenarios, reasonably foreseeable site characterization scenarios in these lease areas (including geophysical, geotechnical, archeological and biological surveys), and reasonably foreseeable site assessment scenarios (including the installation and operation of meteorological towers and buoys) on the potential leaseholds.”¹

The NOI defines a renewable energy lease as giving “the lessee an exclusive right to apply for subsequent approvals that are necessary to advance to the next stage of the renewable energy development process.”² The next stage is described as review and approval of a site assessment plan (SAP), and after sufficient collection of site characterization and assessment data, the lessee would submit a construction and operation plan (COP).

The notice envisions that the proposed regional EA would constitute NEPA compliance throughout both the leasing and SAP stages for all leases issued in the areas covered by the WEAs (approximately 900 square miles). However, the NOI notes that NEPA analysis for the COP will *likely* take the form of an Environmental Impact Statement (EIS).

¹ 76 Fed. Reg. 7226-7227 (Feb 9, 2011).

² *Id.*

Full environmental review of any project is required under law, and is needed to protect wildlife and other natural resources and secure public support for projects. This can be achieved in the “Smart from the Start” initiative if the initial lease for any part of the WEA’s covered by the current NOI is sufficiently conditioned so as to not constitute an irreversible or irretrievable commitment of resources by the Government. Developers would not receive right to erect any wind turbines until the Government reviews and approves the developer’s COP and issues an EIS analyzing all potential impacts of the project.

THE BUREAU OF OCEAN ENERGY MANAGEMENT,
REGULATION AND ENFORCEMENT

FACT SHEET

Renewable Energy on the Outer Continental Shelf

In 2009, President Barack Obama and Secretary of the Interior Ken Salazar announced the final regulations for the Outer Continental Shelf (OCS) Renewable Energy Program, which was authorized by the *Energy Policy Act of 2005* (EPAct). These regulations provide a framework for leases, easements, and rights-of-way for activities on the OCS that support production, and transmission of energy from sources other than oil and natural gas.

The Department of the Interior (DOI) and its Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) continue to seek ways to improve the leasing and permitting process for developing this vital component of our nation’s comprehensive energy policy without cutting corners on safety or environmental protection. In the foreseeable future, we anticipate development of renewable energy from three general sources on the OCS:

Ocean Wave Energy (Hydrokinetic)

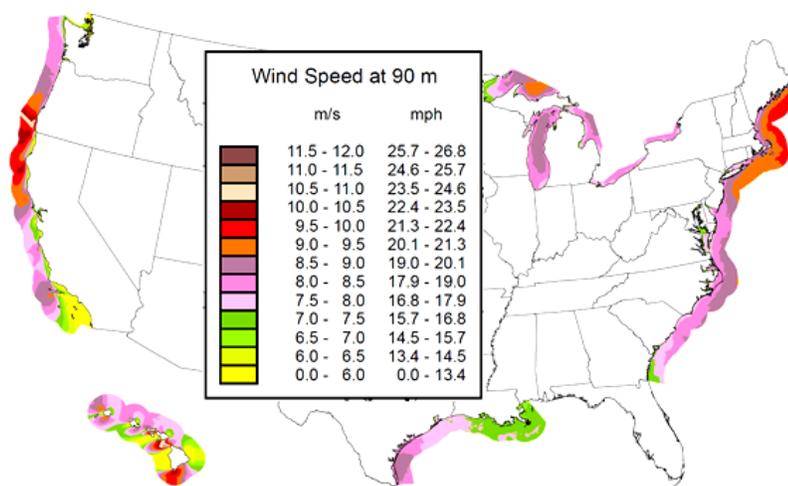
There is tremendous energy in ocean waves. Wave power devices extract energy directly from the surface motion of ocean waves. A variety of technologies have been proposed to capture that energy, and some of the more promising designs are undergoing demonstration testing.

Ocean Current Energy (Hydrokinetic)

Ocean currents contain an enormous amount of energy that can be captured and converted to a usable form. Some of the ocean currents on the OCS are the Gulf Stream, Florida Straits Current, and California Current. While technology is still at an early stage of development, it is likely that submerged water turbines similar to wind turbines would be employed to extract energy from ocean currents.

Offshore Wind Energy

Offshore wind turbines are being used in a number of countries to harness the energy of the moving air over the oceans and convert it to electricity. Offshore winds tend to flow at higher sustained speeds than onshore winds, thus making turbines more efficient.



Source: National Renewable Energy Laboratory

Estimated Offshore Wind Resources

A sustainable source of wind, wave and ocean current energy can be added to our nation’s portfolio by tapping into offshore energy resources in an environmentally responsible manner.

Despite tremendous offshore wind capacity, the United States has no offshore wind energy production to date. Offshore Atlantic winds could produce an estimated 1,000 gigawatts of energy.

The first commercial wind lease was signed in 2010 by Secretary Salazar and Cape Wind Associates for a project in federal waters offshore Massachusetts.

The Process

There are several federal agencies with responsibilities for the regulation and development of offshore renewable energy. BOEMRE issues leases and grants for both OCS wind and hydrokinetic projects. BOEMRE also permits the construction and operation of wind facilities, while the Federal Energy Regulatory Commission will permit the construction and operation of hydrokinetic facilities on BOEMRE-issued wave and current leases.

As required by EPOA, BOEMRE will issue leases on a competitive basis unless it determines that no competitive interest exists. After a lease is acquired, the developer must submit and receive approval of appropriate plans (wind) or license applications (hydrokinetic). At the end of the lease term, the developer must decommission facilities in compliance with BOEMRE regulations.

In the fall of 2010, Secretary Salazar launched the “Smart from the Start” wind energy initiative to expedite the responsible development of wind energy projects off the Atlantic coast. In coordination with the relevant states, BOEMRE has identified Wind Energy Areas (WEAs) offshore the Atlantic coast that appear most appropriate for renewable energy development, and will take steps to make the permitting process for projects more efficient. The “Smart from the Start” initiative will be integrated fully with President Obama’s Executive Order on coastal and marine spatial planning efforts.



A number of states on the Atlantic coast have initiated planning for projects to support their renewable energy portfolio standards and developers are pursuing leases. For example, Florida is interesting in developing ocean current energy. Pacific Northwest states are looking into developing wave energy. On both coasts, BOEMRE is working with interested and affected federal, state, local and tribal governments through individual state intergovernmental renewable energy task forces, memoranda of understanding (MOU), and other arrangements to assure proper consultation and coordination. Secretary Salazar and the Governors of 11 east coast states signed a MOU that established the Atlantic Offshore Wind Energy Consortium in May 2010. The Consortium has been working with BOEMRE on regional issues relating to siting, data and science, and authorization of renewable energy projects on the OCS.

BOEMRE and the Department of Energy (DOE) signed a MOU to address numerous offshore renewable energy issues of mutual interest; and DOI and DOE issued the first interagency plan on offshore wind energy, demonstrating a strong federal commitment to expeditiously develop a sustainable, world-class offshore wind industry in a way that reduces conflict with other ocean uses and protects resources. BOEMRE is also working with other interested federal agencies to establish MOUs to coordinate OCS renewable energy activity.

BOEMRE also has the authority to issue Rights-of-Way (ROW) for offshore transmission lines linking OCS renewable energy installations to facilitate efficient interconnection to the onshore electrical grid. To date, BOEMRE has received one application for such a ROW—a project entailing a 750-mile backbone transmission line running about ten miles offshore from New York to Virginia.

Obama Administration Goals for Offshore Renewable Energy

- Achieve 10 megawatts of wind capacity in the OCS and Great Lakes by 2020 (Great Lakes are not regulated by BOEMRE);
- Complete a non-competitive offshore wind lease in 2011;
- Complete a competitive offshore wind lease in 2012; and
- Implement a streamlined, yet rigorous, environmental review process to facilitate responsible OCS renewable energy development.

For more information, please visit: <http://www.boemre.gov/offshore/RenewableEnergy/index.htm>



Summary for Workshop Report

The Regulatory Program of the U.S. Army Corps of Engineers plays a key role in authorizing offshore renewable energy projects, including wind. Pursuant to Section 10 of the Rivers and Harbors Act of 1899, the Corps regulates construction activities in navigable waters and devices affixed to the seabed of the Outer Continental Shelf (OCS). Discharges of dredged and fill material into inland and coastal waters of the United States (within the three-mile limit of state waters) are regulated pursuant to Section 404 of the Clean Water Act.

BOEMRE is the lead federal agency under the National Environmental Policy Act (NEPA) for wind energy projects on the OCS. The Corps participates in the NEPA process as a cooperating agency. Both agencies are currently working on a Memorandum of Understanding to synchronize administrative processes for authorizing projects on the OCS.

The litmus test for deciding whether a proposal receives a permit is the public interest review process. The Corps must determine that a given proposal would not be contrary to the public interest in order to issue a permit. There are approximately two dozen public interest review factors that we consider in the review process. Some factors may or may not be applicable to a given proposal, and the specific weight that each factor carries in the review process varies from project to project.

The Corps district offices stand ready to work collaboratively with applicants, federal and state agencies, and other key stakeholders in reviewing offshore wind energy projects.

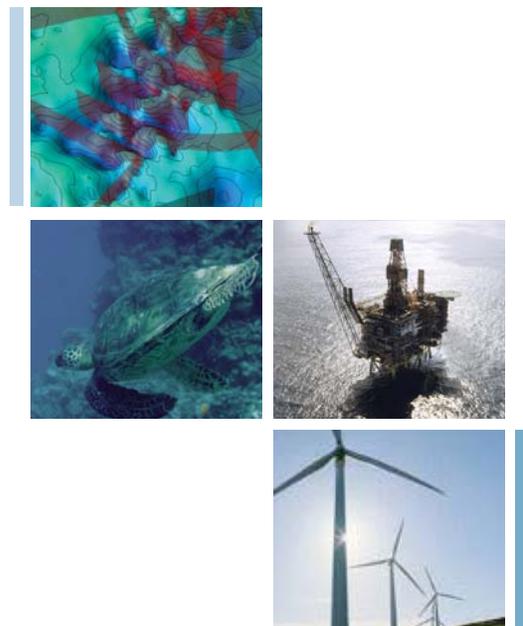
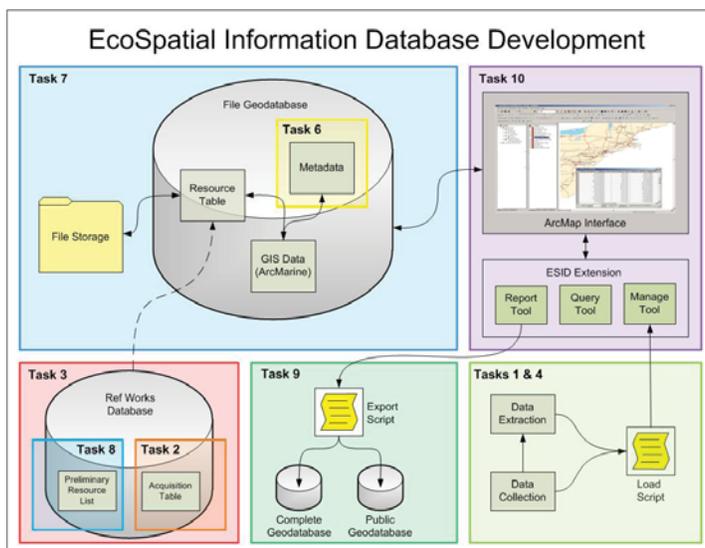
- Create an expandable & sustainable geodatabase
- Create a searchable map interface to access the data

This project is implemented using BOEMRE GIS Application Development requirements to include:

- Implementation and enforcement of BOEMRE database standards definition
- Utilizes BOEMRE specified UML Data modeling for ESRI Geodatabases
- Development of functions and managed linking of documents (images, web pages, etc) to geospatial features for display through web applications

The ESID will consist of data with emphasis on the ecology for the specified subjects including pelagic ecology (plankton, nekton, sargassum), infauna, meiofauna, demersal fishes, coral and hardbottom, seagrass, water quality and geology.

Because of the criticality of the ESID database architecture, the database is being designed using the ESRI ArcMarine data model. This will also help in meeting a system requirement to provide cadastral data to the Multi-purpose Marine Cadastre (MMC) currently in development and co-managed by BOEMRE and the National Oceanic and Atmospheric Agency.



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4.6 ENERGY MARKET AND INFRASTRUCTURE INFORMATION FOR EVALUATING ALTERNATIVE ENERGY PROJECTS FOR OCS ATLANTIC

Energy Market and Infrastructure Information for Evaluating Alternative Energy Projects for OCS Atlantic

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The presentation for the Atlantic Wind Energy Workshop focuses on supporting infrastructure for wind energy for the Atlantic OCS region, particularly in the Mid-Atlantic region. Topics reviewed include ports, vessels, shipbuilding and repair facilities, submarine electric cable manufacture and installation, electric substations, and transmission lines. Based on the information provided for proposed projects on the ports potentially used for the construction and operation phases of a windfarm, the set of 35 large deep-water ports along the East Coast could be supplemented by up to 223 additional ports. The final set of potential ports will be identifiable once we learn the channel draft needed for vessels installing meteorological towers and routine operations and maintenance. The DE/MD/NJ/VA region contains 36 ports.

MARAD's 2008 survey of the U.S. privately-owned fleet identified 98 ocean-going vessels and 551 oil and gas industry vessels meeting Jones Act requirements. A better understanding of the modifications needed to lift boats, lift barges, jack-up rigs, or semisubmersible vessels to equip them for installing wind turbines is needed before examining the competition for these vessels by the oil and gas industry. If new vessels are needed, there are four major shipyards along the East Coast, 16 smaller shipyards in the DE/MD/NJ/VA region, and at least one shipyard expressing an interest in building a turbine installation vessel.

The capability to manufacture and install submarine electric cables lies primarily overseas, as does the manufacture of offshore wind turbines. The level of demand needed to prompt investment in domestic capabilities has not yet been identified.

ERG examined commercial GIS-based data for electric substations, transmission lines and other parameters. The sparse availability of appropriate substations near the coast (within 20 miles) and transmission costs appear to be the weakest link in the infrastructure needed to get offshore wind power integrated in the onshore electric grid.



U.S. DEPARTMENT OF
ENERGY

PNNL-19500

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

Conceptual Model of Offshore Wind Environmental Risk Evaluation System

Environmental Effects of Offshore Wind Energy Fiscal Year 2010

RM Anderson
AE Copping
FB Van Cleve

SD Unwin
EL Hamilton

June 2010



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under Contract DE-AC05-76RL01830

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Conceptual Model of Offshore Wind Environmental Risk Evaluation System

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Prepared for
the U.S. Department of Energy
under Contract DE-AC05-76RL01830

Pacific Northwest National Laboratory
Richland, Washington 99352

Summary

In this report we describe the development of the Environmental Risk Evaluation System (ERES), a risk-informed analytical process for estimating the environmental risks associated with the construction and operation of offshore wind energy generation projects. The development of ERES for offshore wind is closely allied with a concurrent process undertaken to examine environmental effects of marine and hydrokinetic (MHK) energy generation, although specific risk-relevant attributes will differ between the MHK and offshore wind domains.

During fiscal year 2010, a conceptual design of ERES for offshore wind will be developed. The offshore wind ERES mockup described in this report will provide a preview of the functionality of a fully developed risk evaluation system that will use risk assessment techniques to determine priority stressors on aquatic organisms and environments from specific technology aspects, identify key uncertainties underlying high-risk issues, compile a wide-range of data types in an innovative and flexible data organizing scheme, and inform planning and decision processes with a transparent and technically robust decision-support tool. A fully functional version of ERES for offshore wind will be developed in a subsequent phase of the project.

Acronyms and Abbreviations

DOE	U.S. Department of Energy
ERES	Environmental Risk Evaluation System
FY	fiscal year
GIS	geographic information system
GPS	Global Positioning System
KMS	knowledge management system
MHK	marine and hydrokinetic
PNNL	Pacific Northwest National Laboratory

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1.0 Introduction

The Wind and Water Power Program of the U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy is working with wind industry partners to develop clean, domestic, innovative wind energy technologies. The generation of energy from offshore wind has the potential to play a significant role in the nation's renewables portfolio. The first U.S. offshore wind farm has recently been granted rights to develop off the Atlantic coast; to date, no offshore wind farms have been developed. It is commonly believed that the lack of information on potential environmental impacts from the installation and operation of the facilities has slowed and confounded regulatory processes for moving forward efficiently on offshore wind development in the United States.

Pacific Northwest National Laboratory (PNNL) plans to evaluate the available information on environmental impacts from the installation and operation of offshore wind farms through the design and application of a risk framework entitled the Environmental Risk Evaluation System (ERES). The application of ERES and the specific decision-support tools developed to evaluate environmental effects of offshore wind will address the most important issues, risk categories, and information needs identified by stakeholders. During fiscal year (FY) 2010, a conceptual design of ERES for offshore wind will be developed. A visualization interface that will display output from ERES will be outlined, and a mockup created to demonstrate the usage and utility of the approach. A fully functional version of ERES for offshore wind will be developed in a subsequent phase of the project. Stakeholder input as well as guidance from the DOE Wind Program will be solicited in developing the design and specifications for this future version.

2.0 Conceptual Design of the Risk-Informed Decision Support Framework

The development of the ERES for offshore wind is closely allied with the process undertaken to examine environmental effects of marine and hydrokinetic (MHK) energy generation, although specific risk-relevant attributes will differ between the MHK and offshore wind domains. For both offshore wind and MHK, the ERES is tied closely to a knowledge management system (see below). The following description of the design of the ERES provides the overall concepts, while later sections address the specific application of the ERES for offshore wind.

Development and Application of ERES for Water Power. The concept for the ERES has been developed for application to MHK energy generation under the DOE Water Power program. As the U.S. MHK industry moves forward to deploy pilot, demonstration and commercial projects in coastal waters, concerns from regulators and stakeholders have focused on potential threats to marine life and to existing beneficial uses of marine waters. The ERES is under development to evaluate the relative risks of the many potential interactions between stressors (i.e., MHK systems and their component parts) and receptors in the marine environment (i.e., organisms such as marine mammals, fish, turtles, diving birds, as well as the waterbodies themselves through deteriorating water quality or changes in sediment transport).

The tools and processes developed under the ERES will be common between MHK and offshore wind, while the application of those tools, the specific risk models, and the outputs of the two renewable energy sources will be distinct. In addition, the cases, tools, and processes of the ERES developed for MHK and offshore wind can be disassociated from one another at any time if necessary or desirable.

Knowledge Management System. A knowledge management system (KMS) has been created for MHK to organize and manage data and information for the ERES. This KMS is called *Tethys*, after the mythical Greek titaness of the sea. We propose to develop a parallel KMS named *Zephyrus*, after the Greek god of the west wind, to house and organize offshore wind environmental effects data. There are obvious crossovers between MHK environmental effects and those for offshore wind, notably the effect that wind platforms or wave buoys have on animals and physical processes in the ocean. In addition, many effects will be peculiar to offshore wind, most notably the effect that the rotors will have on migratory seabirds and perhaps bats. To best accommodate the needs of MHK and offshore wind, portions of the KMS will be shared, while other portions will contain data used only for one or the other renewable energy source. However, the structure of the KMS will allow separation of the MHK and offshore wind databases and all their relevant content at any time, if that becomes necessary or desirable.

The primary function of a KMS is to facilitate the creation, annotation, and exchange of information on environmental effects of offshore wind technology. The offshore wind KMS would be populated with data from multiple sources, including existing pilot and commercial offshore wind projects from the United States and abroad, from targeted environmental studies supported by DOE and other sources, and data generated by PNNL, other national laboratories, and universities. Data will eventually include tabular and geospatial data, text-based electronic documents, maps and geographic information system (GIS) layers, photographs, engineering drawings and specifications, technology descriptions, and demographic data. Figure 1 shows the similarities and differences between ERES processes for MHK and offshore wind.

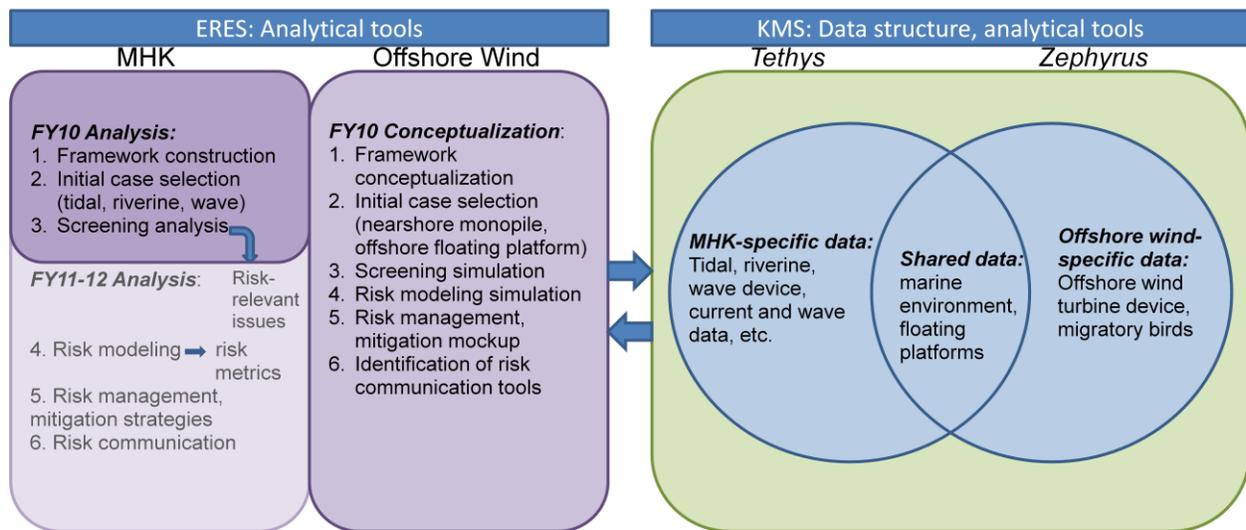


Figure 1. Relationship between the marine and hydrokinetic (MHK) and offshore wind environmental risk evaluation systems and knowledge management systems.

Table 1 provides a conceptual representation of the process of developing the ERES and the KMS for offshore wind and MHK. Risk analysis steps include identification of analysis cases, risk analysis screening to identify highest risk-relevant issues, and risk modeling to estimate risk metrics for risk-relevant stressor–receptor interactions. The risk metrics will be used to develop risk management and mitigation strategies and to communicate those risks.

Table 1. Steps and outcomes for offshore wind ERES development.

Steps	Purpose	Inputs	Outputs	FY10
1. ERES framework development	Definition of domain for risk-relevant factors	Stressor, receptor, and context data	Risk-relevant attributes	Conceptual description
2. Initial case selection	Priorities include “spanning the analytical space”	Project info, selection criteria	3 initial cases selected for analysis	Conceptual description
3. Screening analysis on initial cases	Highest risk issues identified	Data for verification	Risk-relevant issues	Conceptual description, description of analytical tools, linkage to KMS
4. Risk modeling	Cumulative risk output calculated	Deterministic, probabilistic, impact models, sensitivity analysis	Risk metrics that relate each stressor to receptor	Conceptual description, description of analytical tools, linkage to KMS
5. Risk management and mitigation	Strategies developed, verified by field data	Risk-relevant issues, risk metrics	Risk mitigation strategies	Conceptual description
6. Risk communication	Risk and risk tools presented in formats accessible to stakeholders	Risk metrics, risk-relevant issues	Risk visualization, communication tools	Conceptual description, mockup of visualization tools

3.0 Risk Evaluation Process for Offshore Wind

The process for developing the ERES for offshore wind follows the six steps laid out in Table 1. Due to funding and schedule constraints, each step will consist of a limited mock up during FY10. Key portions of the ERES development include identifying and developing analytical tools to carry out screening analyses and risk modeling, developing risk management and mitigation strategies, and creating methods for risk communication.

Identifying or Creating Analytical Tools. Analytical tools that will be included in the ERES will be useful in performing risk- and decision-related analysis. Existing tools will be used where available and

tools will be adapted or developed where necessary. Deterministic models may include detailed hydrodynamic models to examine circulation spatially and temporally in the vicinity of proposed wind farms. Probabilistic models will be used to understand other interactions such as collision risk for migrating birds at wind turbine rotor altitude. More complex models such as hydrodynamic models or models based on geographic information system (GIS) platforms will remain outside the ERES and be available as linked models. Tools that are locally available (embedded within the ERES) will perform simpler analyses based on spreadsheet functionality and other features. These will include tools to conduct sensitivity/what-if analyses, and functionality to perform Monte Carlo simulation. Visualization and animation tools will be applied to display risk communicative results.

The analytical tools will be applied to create estimates of risk; analysis outputs will be summarized and entered into the KMS. These results might include risk data sheets that list scenarios, impact severities, and measure(s) of uncertainty. As much as possible, these results will be spatially specific, including Global Positioning System (GPS) and/or latitude-longitude coordinates. Displays and animations created for risk communication will also be added to the KMS. These outputs might include cumulative distribution functions and risk contour maps.

Linking the KMS to the Analytical Tools. The KMS will be linked to the analytical tools as an evidence marshaling tool, allowing users to bring together disparate pieces of evidence (e.g., documents, database records, data values from tables, simulation results), in order to make them available as input parameters for risk models. This linkage from the KMS to the ERES will provide an unprecedented level of transparency in the use of data to support the analysis tools and risk outcomes.

In addition, outputs from the risk analyses, as well as supporting evidence provenance and other annotations, will be entered into the KMS, linking back to the input data files. This association of data will allow analysis results to be linked to specific candidate sites, geographic regions, site developers, or other attributes, creating patterns and linkages that may be of interest to the offshore wind stakeholder community.

4.0 Risk Management and Communication

Risk metrics will be used to develop risk management and mitigation strategies to address the most pressing issues identified in the study. Consultation with a wide range of stakeholders and regulatory agency staff will be necessary to develop acceptable mitigation strategies.

Outputs of the risk modeling within the ERES will be used to drive visualization, animation, and other displays to provide accessible outputs of the analyses. These visualizations will include ancillary environmental- and technology-related data as well as data of risk-relevance. Figure 2 provides an illustration of the functionality of the ERES user interface. The menu-driven structure allows users to select features that relate to the specific cases of interest from drop-down menus.

Different categories of users will use output data from ERES in different ways, constituting different “use cases”. For example, MHK device developers and project developers may be most concerned with details of different technologies and wind farm geometries and the environmental risks each may pose. Regulators and researchers may be concerned with all the details of risk computations as well as the

outputs and visualizations. Members of the interested public may be most concerned with the degree of impact expected and how those risks may affect them individually—for example, in terms of electricity costs, property values, and viewshed impacts.

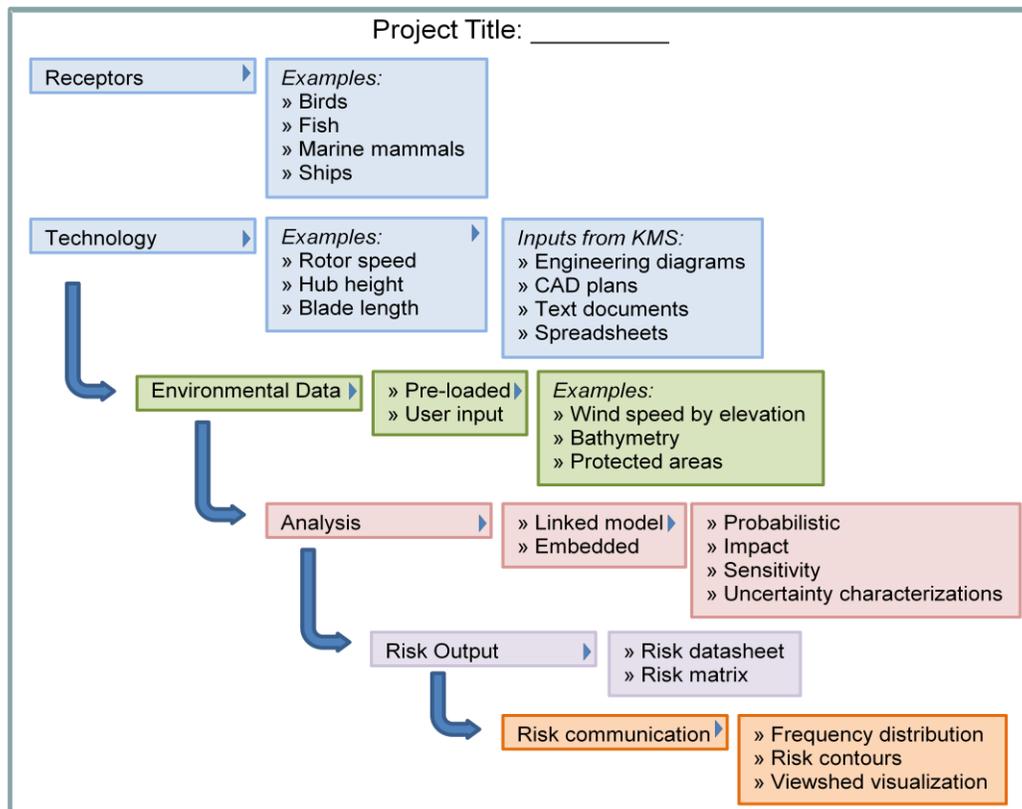


Figure 2. Stylized example of the ERES user interface. The boxes represent drop-down menus that will allow the user to interact with the ERES and KMS. The user would be able to customize a risk analysis by choosing specific case attributes (receptors or technologies) and environmental data, then applying analytical tools (risk models), customizing the outputs (risk datasheets or matrices), and specifying the communication products (visualization, cumulative frequency distributions).

Under the current project, a mockup of the visualization interface will be presented in the form of a series of PowerPoint slides. The mockup will represent selected modes of application of the ERES in a decision environment and will convey the overall vision for this risk-informed decision support tool. For the purposes of the mock up, three use cases will be defined; the themes that will be mocked-up for each case are outlined below.

1. Developer Use Case:

- different sizes and locations of wind farms
- different wind turbine generator technologies
- aggregated and disaggregated risk metrics (e.g., risk contours, cumulative distribution functions, measles chart, spatial dependence).

2. *Regulator and Researcher Use Case:*

- model/analytical flow diagram
- knowledge management system
 - multiple study comparisons
 - input uncertainty depiction
 - input characterization (time and space, metadata, other assumptions)
 - environmental data (birds, whales, fish, winds, other)
 - receptor data (bird migration routes, fish harvest activity, shipping lanes)
- complex model
 - multiple model icons, model choice (e.g., bird/ship collision risk, viewscape visualization, noise propagation contours, electromagnetic field densities)
 - functionality of model(s)
 - output of model(s).

3. *Interested Public Use Case:*

- viewshed visualization
 - alternative wind farm locations and sizes
 - alternative vantage points
 - alternative visibility conditions
- social networking data, comment information.

As an example, Figure 3 displays environmental data on wind speed vs. elevation (e.g., regulator and researcher use case) as it could appear within the ERES software interface. This elementary example shows wind speeds over an ocean area at an elevation of 50 m. The stippled areas show layouts for offshore wind farms at two locations, nearshore and in deeper water. The relative risk of deployment and environmental effects could be derived from applying the ERES tools to determine tradeoffs between the increased cost of deploying farther from shore and capturing the stronger winds.

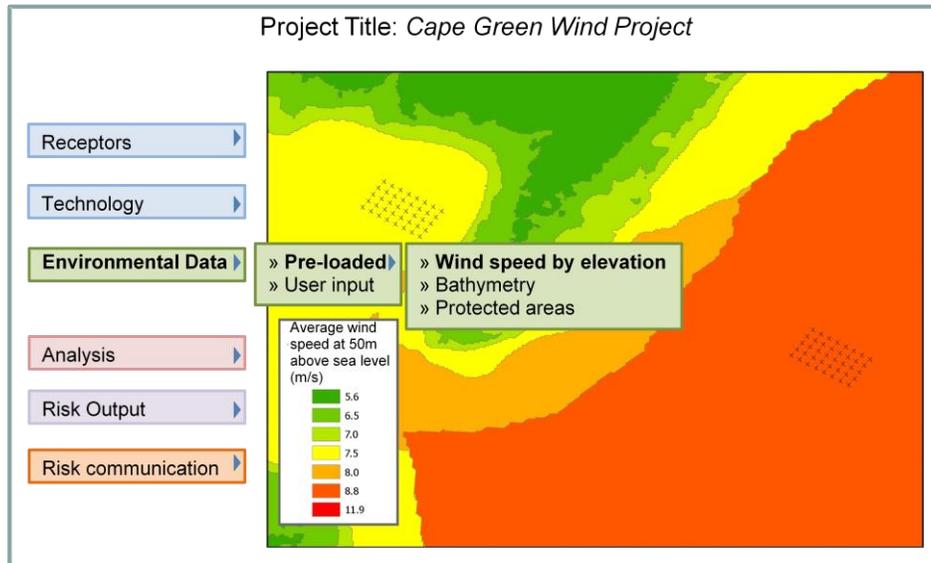


Figure 3. Example of visualization of ERES data.

5.0 Transition from Mockup to Full Functionality

The offshore wind ERES and KMS mockup described in this report will provide a preview of the functionality of a fully developed risk evaluation system that could be used to assess environmental risks associated with offshore wind energy development. The fully functional waterpower ERES and KMS will be developed by PNNL in the 2010–2012 fiscal years and will demonstrate capabilities of the system as it applies to MHK. For both water and wind power, when fully developed, the proposed risk evaluation system and associated KMS will use risk assessment techniques to determine priority stressors on aquatic organisms and environments from specific technology aspects, identify key uncertainties underlying high-risk issues, compile a wide range of data types in an innovative and flexible data organizing scheme, and inform planning and decision processes with a transparent and technically robust decision-support tool.



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U.S. DEPARTMENT OF
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4.8 NATIONAL OCEAN PARTNERSHIP PROGRAM OVERVIEW

During the afternoon of Day 3, an open-discussion session was held with Federal partners and collaborators to develop future study projects based on the information provided during the workshop. A presentation was given by the National Ocean Partnership Program (NOPP) to explain the NOPP is a long-term interagency, inter-sector collaboration motivated by common needs. NOPP was established to promote national goals of assuring national security, advancing economic development, protecting quality of life, and strengthening science education and communication through improved knowledge of the ocean; and to coordinate and strengthen oceanographic efforts in support of those goals by: a) Identifying and carrying out partnerships among federal agencies, academia, industry, and other members of the oceanographic scientific community in the areas of data, resources, education, and communication, and b) Reporting annually to Congress on the Program.

NOPP facilitates partnerships and inter-agency coordination through interagency discussion forums, interdisciplinary workshops, and funding of inter-sector, collaborative research projects (<http://www.nopp.org/>). Funding is granted through a proposal review process by an advisory committee that looks at relevance of project, project goals, partnerships proposed, capabilities and qualifications, and appropriateness of cost. Previous collaborative projects were outlined to provide examples of the partnerships and types of projects. Partners often included members of regulatory agencies, industry, and academia to achieve a common goal through cross-sector collaboration and joint funding. The slides for the Environments Breakout sessions summary presentation are provided in **Appendix A, Pages A-221 to A-223**.

APPENDIX A: PRESENTATIONS

Presentations are not included in this .pdf due to size constraints

**APPENDIX B:
SPEAKER/PRESENTER BIOSKETCHES**

SPEAKER/PRESENTER BIOSKETCHES **Listed by Session and Presentation Order**

PLENARY SESSION

Director Bromwich

Michael R. Bromwich is the Director of the Bureau of Ocean Energy Management, Regulation and Enforcement and has served in that position since June 21, 2010. He was asked by President Obama and Interior Secretary Ken Salazar to lead reforms that will strengthen oversight and regulation of offshore oil and gas development and oversee the fundamental restructuring of the former Minerals Management Service, which was responsible for overseeing oil and gas development on the Outer Continental Shelf.

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Dr. Christopher G. Hart graduated from the United States Naval Academy with a degree in Naval Architecture, Ocean, and Marine Engineering and immediately accepted a commission as a Special Operations Officer in the U.S. Navy. After ten years of Active Duty, during which he saw combat deployments in Operations Iraqi and Enduring Freedom, Dr. Hart began his graduate school studies at the University of Michigan. In the ensuing 44 months, Dr. Hart earned a PhD and MSE in Naval Architecture and Marine Engineering, along with an MBA. Dr Hart has served as the Offshore Wind Manager at the United States Department of Energy (DOE) since June, 2010. During his tenure at DOE he has worked to create an offshore wind energy industry in the United States by building a team of innovative, committed civil servants and contractors, authoring the National Offshore Wind Strategy, and allocating nearly \$80M of program funds.

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Dr. Maureen Kaplan is a Vice President in Eastern Research Group's in the Economics and Regulatory Analysis section. For the past six years, she has supported BOEMRE in socioeconomic analyses for energy operations in OCS regions. She managed the analysis and identification of infrastructure components relative to offshore wind, wave, and ocean energy projects in Atlantic and Pacific OCS regions; examined infrastructure supporting offshore oil and gas operations in the Gulf of Mexico; developed a Gulf-wide methodology for estimating the jobs and revenues associated with coastal travel, tourism, and recreation; prepared an in-depth analysis of the jobs in the offshore oil services industry and a geographic distribution of those jobs, and other projects. She looks forward to participating in this exciting collaboration.

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Mr. Joel Whitman is CEO of Global Marine Energy, Inc. an American-owned company recently founded as part of the strategic expansion for GMSL, to address the growing demand for offshore power cable installation expertise in North America. He also serves as the Director Corporate Strategy, Marketing and Communications for Global Marine Systems Limited, the world's largest independent provider of submarine cable installation and related engineering services, and a pioneer in the field of subsea cabling since the mid-1800's. Mr. Whitman joined Global Marine in 2005 and has worked alongside his colleagues to solidify the company position in its core markets, such as Telecommunications and to diversify the business into new and emerging markets.

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Mr. Timothy Konnert is a fish biologist who has worked in the Federal Energy Regulatory Commission's Division of Hydropower Licensing for almost 9 years. For the last 5 years he has played an integral role on the Commission's Marine and Hydrokinetic Energy Team in alleviating some of the regulatory barriers for the hydrokinetic industry, including the development of the hydrokinetic pilot project licensing procedures. Mr. Konnert is currently the Commission's project coordinator for three of the four active hydrokinetic pilot project licensing proceedings on the U.S. east coast.

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Dr. Walter Barnhardt is a marine geologist working on basic scientific problems that have societal and management implications. His research focuses on the geology of continental shelf and coastal environments, and understanding the processes that control sediment transport and vulnerability to change. Since 1988, he has led numerous seafloor mapping surveys along the U.S. East and West Coasts and in the Hawaiian islands. Currently he is the Director of the USGS Woods Hole Science Center in Woods Hole, Massachusetts. He supervises approximately 100 marine scientists, technologists, and

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Ms. Sarah A. Quinn is the External Renewable Energy Specialist for the National Park Service (NPS) Washington Office. She is tasked with providing policy support to the parks, regional offices, and directorate and with helping coordinate with agency partners to facilitate smart siting and design. Previously, Ms. Quinn worked for the Bureau of Land Management California State Office where she was a renewable energy program and environmental coordinator. She was also detailed at the Regional Solicitor's Office to resolve legal questions related to processing renewable energy applications. Sarah joined federal service as a Presidential Management Fellow. In addition to her renewable energy background, she is an attorney and member of the Colorado Bar.

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Ms. Emily Lindow is the Senior Policy Advisor to the Assistant Administrator at NOAA Fisheries Service (NMFS). She has the lead for the NMFS energy policy portfolio, which includes offshore oil and gas, liquefied natural gas, conventional hydropower, offshore wind, marine hydrokinetic energy, and coastal nuclear energy. Ms. Lindow has substantial energy and environmental policy experience, having served as the Senior Policy Advisor to the Secretary of Commerce and the NOAA under Secretary, as well as working for the Senate Commerce Committee. She recently served as a Senior Analyst for environmental, regulatory, and Arctic issues at the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling. Ms. Lindow has Master of Environmental Management degree from Duke University and a Master of Arts degree in International Relations from Johns Hopkins School for Advanced International Studies.

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Mr. John H. Page, Jr., Supervisor for wind turbine evaluations at the Federal Aviation Administration Headquarters, Obstruction Evaluation Group, is responsible for the oversight of wind turbine evaluations and their impact on the National Airspace System, as well as the development of policies and procedures related to evaluation of wind turbines. Prior to beginning his work in the Obstruction Evaluation Group John served as the Lead, Air Traffic Specialist for Unmanned Aircraft Systems (UAS) NextGen and Futures Integration and as a subject matter expert in the FAA's Air Traffic Organization UAS Group.

Prior to coming to work for the FAA Mr. Page served in the United States Army as an Air Traffic Controller (ATC). He held positions of varying levels of responsibility including ATC Facility Manager, Squadron Logistics Officer, Installation Operations Officer, ATC Human Resource Manager, and

Department of the Army Regional Representative Noncommissioned Officer to the FAA Western-Pacific Region. Mr. Page retired from the Army in February 2007 with 22 years of service.

He has a Bachelor of Applied Science Degree in Technology and Resource Management from Troy University and is currently pursuing his Master of Aeronautical Science Degree in Aeronautical Management from Embry-Riddle Aeronautical University. He is a graduate of the FAA's Program for Emerging Leaders, a member of the Sergeant Audie Murphy Leadership Club, and a recipient of the Army Aviation Association Order of Saint Michael Award for outstanding service to the aviation community. He is married to the former Rena Messer of Kerrville, Texas they have two children and reside in Stafford, Virginia.

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Mr. Jim Haggerty is the Regulatory Program Manager for the North Atlantic Division Office of the U.S. Army Corps of Engineers located in Brooklyn, New York. He has been with the North Atlantic Division since September 2001, initially as the Administrative Appeals Review Officer before ascending to the Program Manager position in April 2006. He began his career with the Corps in March 1985 as a Regulatory project manager in the New York District office. As Program Manager he is responsible for overseeing the administration of the Regulatory Program by district offices in New England, New York, Philadelphia, Baltimore and Norfolk, Virginia. He graduated from Polytechnic Institute of New York University in May 1979 with a B.S. degree in Meteorology & Oceanography.

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Mr. George H. Detweiler, Jr., retired from the U. S. Coast Guard with over 20 years service. He returned to the Coast Guard as a marine transportation specialist in the Marine Transportation Systems Management Directorate at USCG Headquarters. His major projects have included conducting port access route studies, creating ships' routing measures, conducting tribal consultations, and reviewing offshore renewable energy installations (OREIs) proposals. Mr. Detweiler has worked on the Cape Wind project and has been a panelist at the recently completed EnergyOcean International Conference and Exhibition in Portland, Maine, and the last AWEA conference in Atlantic City, New Jersey.

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Ms. Susan E. Bromm has been employed by the U.S. EPA since 1980 in various positions involving many aspects of domestic and international environmental protection. She is currently the Director of the Office of Federal Activities (OFA) at EPA headquarters in Washington, DC, responsible for EPA's activities implementing the National Environmental Policy Act and for EPA's international enforcement capacity building programs. Prior to moving to OFA in March 2008, Ms. Bromm directed the waste remediation enforcement office, establishing policy for compelling private parties to clean up old and abandoned toxic waste sites under the billion dollar Superfund program and the RCRA corrective action program. She also led efforts to implement the liability reforms contained in the Small Business Liability Relief and Brownfields law. Previous to working in the Office of Site Remediation Enforcement, Ms. Bromm directed the RCRA enforcement program, establishing national policy on waste enforcement, penalties and site clean-up. From 1980 to 1988, Ms. Bromm held a variety of positions with responsibility for developing hazardous waste regulations and setting hazardous waste facility permitting policies. Ms. Bromm is an attorney and a graduate of Georgetown University Law Center. Her undergraduate degree is from the State University of New York at Albany. She is a member of the District of Columbia bar and the American Law Institute.

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Dr. Thomas McCulloch is Senior Program Analyst and Senior Archaeologist with the Advisory Council on Historic Preservation's Office of Federal Agency Programs. He has been with the Council about 24 years. Dr. McCulloch's primary focus is working with Federal agencies with strong archaeological, land-managing, and scientific responsibilities to ensure effective compliance with the National Historic Preservation Act. He has responsibilities for the Army Corps of Engineers (non-regulatory), the Department of Energy, NASA, NOAA, BOEMRE, and the Bureau of Reclamation. He is the staff liaison with the ACHP's Archaeology Task Force and Subcommittee, which has recently revised the ACHP's human remains policy, developed a new archaeology and heritage tourism policy statement, and developed new interactive archaeology guidance on the ACHP's website. Dr. McCulloch also regularly teaches the ACHP's introductory and advanced training courses.

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Dr. Mary Boatman is an oceanographer in the Environmental Sciences Branch of the Environmental Division in Herndon, Virginia. She is currently on a two year detail to the National Ocean Council as an Ocean Policy Advisor.

She is working on the implementation of the National Ocean Policy established by President Obama in July, 2010. She has a Ph.D. in Chemical Oceanography from Texas A&M University.

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Mr. Keld Madsen has six years of professional geospatial consulting services experience with AMEC Environment & Infrastructure and holds a M.S. in Planning and Land Management from Aalborg University, Denmark. He currently serves as the GeoSpatial Services Group Manager and is a member of the Information Management Department. His experience covers a wide range of geospatial service related functions including database development, GIS analysis, map production, raster creation and analysis, GIS implementations and application development support. He has provided technical and management assistance as well as on-site training to West Virginia University GIS Technical Center. Prior to current focus on the ESID project Keld Madsen was the project manager for FEMA Map Modernization in the State of Kentucky overseeing an engineering/GIS team on multi-year, multi-county map modernization (DFIRM) projects. He has been responsible for project deliverables, schedules, QA/QC, H&H analyses oversight, development and production of DFIRM panels, DFIRM databases, and Flood Insurance Studies.

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Mr. Chris Caldow is Chief of NOAA's Biogeography Branch, based in Silver Spring, Maryland. The Branch specializes in integrating and synthesizing spatial information into decision tools for managers of marine and estuarine ecosystems. Mr. Caldow is a Marine Biologist by training, with a strong research interest in the application of biogeographic principles to broad management issues such as Coastal and Marine Spatial Planning. His educational background includes an M.S. in Biology from the University of Houston, and B.S. in Aquatic Biology at the University of California, Santa Barbara. Mr. Caldow came to NOAA as a Knauss Marine Policy Fellow in 2000, and has been with the Biogeography Branch since then. The Biogeography Branch is part of the Center for Coastal Monitoring and Assessment (CCMA), one of NOS' National Centers for Coastal Ocean Science (NCCOS).

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Dr. Brian Calder is a Research Associate Professor at, and Associate Director of, the Center for Coastal and Ocean Mapping and NOAA-UNH Joint Hydrographic Center (CCOM/JHC) at the University of New Hampshire. He graduated M.Eng (with Merit) and Ph.D in Electrical & Electronic Engineering from Heriot-Watt University in Edinburgh, Scotland in 1994 and 1997 respectively, but became an accidental hydrographer after joining CCOM/JHC in 2000. His research interests have primarily revolved around

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John Weiss

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Mr. John Weiss, a Senior Associate at IEC, has nearly 20 years of experience as a consultant to public agencies and private entities. His work spans a range of environmental and energy-related issues, from the assessment of costs and benefits of offshore renewable energy, to the development of a model for assessing the environmental and social costs attributable to offshore oil and gas development, to the analysis of the efficacy of a state tax credit as a catalyst for investment in renewable energy and energy conservation projects. Mr. Weiss re-joined IEC in 2005, having previously worked at the firm from 1994-2000. From 2001-2004, he was an Associate Director at Cambridge Energy Research Associates (CERA) where he developed and communicated strategic insights to a global energy industry clientele, with a focus on emerging technologies and the potential impacts of emerging public policies. Mr. Weiss is a graduate of Brown University and the Massachusetts Institute of Technology.

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Ms. Laura McKay has been with the Virginia Coastal Zone Management Program since 1988 and has served as its Program Manager since 1994. The Virginia CZM Program is a network of state natural resource agencies and coastal city and county governments that implement Virginia's laws and policies to protect and restore coastal ecosystems and economies. As Program Manager, Ms. McKay initiated multiple-year land acquisition, habitat restoration and ecotourism projects as well as several Special Area Management Plans (SAMPs). She serves on the Management Board of the Mid-Atlantic Regional Council on the Ocean (MARCO) and as the Leader of its Coastal and Marine Spatial Planning Action Team. In that capacity she initiated the development of MARCO's Mapping and Planning Portal in fall 2009. Ms. McKay has a Bachelor's degree in Environmental Studies from Smith College and a Master's of Public Administration from the Rockefeller School of Public Affairs at the State University of New York at Albany.

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As Director of Marine Planning Programs for the Massachusetts Ocean Partnership, Mr. Nicholas Napoli leads MOP's programs to advance science based and stakeholder informed ocean planning. In this capacity, he manages over a dozen projects including the development of statewide and regional data and information networks, the characterization of key ocean uses and industries, the development of models and other analysis and software tools to support decision making, and the development of environmental and socioeconomic indicators to measure progress.

John Weber

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Mr. John Weber has 13 years of experience in the environmental field, focusing on coastal and ocean management issues. He is currently the CMSP Managing Director for the Northeast Regional Ocean Council, a partnership of New England states and federal agencies collaborating on ocean management issues, where he is providing strategic direction for the Northeast response to the National Ocean Policy, particularly the Coastal and Marine Spatial Planning Framework. He recently served as the Ocean Program Manager for the Massachusetts Office of Coastal Zone Management, where he managed the development and implementation of the Massachusetts Ocean Management Plan, completed in late 2009. Mr. Weber's previous private- and public-sector experience included review of urban waterfront development and planning activities, dredging, coastal erosion, and wetland restoration projects. Mr. Weber has a B.S. in Coastal Geology from Long Island University and an M.S. in Marine Resource Management from Oregon State University.

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Patrick Halpin is an Associate Professor of Marine Geospatial Ecology and Director of the Geospatial Analysis Program at the Nicholas School of the Environment, Duke University Marine Lab. Prof. Halpin's research focuses on marine geospatial analysis, ecological applications of geographic information systems and remote sensing; and marine conservation and ecosystem-based management. Prof. Halpin leads the Marine Geospatial Ecology Lab at Duke University and sits on a number of international scientific and conservation program steering committees. The Marine Geospatial Ecology lab leads the development of marine information's systems such as OBIS-SEAMAP (<http://seamap.env.duke.edu>) and marine animal habitat and density modeling systems (<http://serdp.env.duke.edu>).

Christine Taylor

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Ms. Christine Taylor has been the Lead Physical Scientist for The Bureau of Ocean Energy, Regulation and Enforcement's (BOEMRE) Mapping and Boundary Branch, and the co-lead on the Multipurpose Marine Cadastre project for a little over 2 years. In addition to her work on the MMC, she focuses on mapping projects related to renewable energy siting and oil and gas lease sale areas and participates in a number of interagency working groups aimed at promoting GIS data and project sharing, including the National Ocean Council's Interagency Information Management System - CMSP Data Portal Working Group. Prior to her employment with BOEMRE Christine served as the GIS Coordinator for NOAA's National Marine Sanctuary Program. She has over 20 years experience working as a GIS professional.

She holds a M.S. in Environmental Science and Planning from Johns Hopkins University and a B.S. in Geography and Environmental Planning from Towson University.

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Mr. Brian Smith is a Coastal Ecologist at the National Oceanic and Atmospheric Administration's Coastal Services Center. His focus is coastal and marine spatial planning implementation in addition to development and application of the Multipurpose Marine Cadastre. An experienced facilitator of collaborative projects, he has over 10 years of experience working with partners to conserve coastal resources.

Prior to his current position, Mr. Smith worked as a Research Coordinator for the Great Bay National Estuarine Research Reserve and as a Regional Biologist for Ducks Unlimited. He holds an M.S. in Fisheries Biology and a dual B.S. in Environmental and Forest Biology and Resources Management from the State University of New York, College of Environmental Science and Forestry.

Jim Lanard

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Mr. Jim Lanard is President of the Offshore Wind Development Coalition, which was recently formed by seven offshore wind developers and includes the American Wind Energy Association as one of its founding members. The Offshore Wind Development Coalition serves as an advocate for offshore wind developers and their supply chain partners before federal legislative and regulatory bodies.

Prior to his current position, Mr. Lanard was Managing Director of Deepwater Wind, where he was involved in the company's offshore wind development initiatives in Rhode Island, New Jersey, New York and Massachusetts and supported the company's strategic planning, policy development and regulatory affairs efforts. He also worked at Bluewater Wind for several years, leading Bluewater's strategic planning and advocacy initiatives.

Mr. Lanard has worked in the environmental and energy sectors for his entire career. He has been executive director of two non-governmental environmental groups, Chief of Staff to a Member of the U.S. House of Representatives, Director of Environmental Programs and Government Relations for The Walt Disney Company's Disney's America project, and partner in an energy and environmental consulting firm. Mr. Lanard is a member of the New Jersey, Pennsylvania and Florida Bars and is also a former adjunct assistant professor at Rutgers University and Drexel University.

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Ms. Aileen Kenney is the Director of Permitting at Deepwater Wind, a leading offshore wind developer. She is responsible for overseeing the permitting of Deepwater Wind's portfolio which includes projects off the coast of Rhode Island, New Jersey, New York and Massachusetts. Ms. Kenney has worked on the permitting of wind and other energy projects in the United States and abroad for over 11 years. Prior to joining Deepwater Wind, she was the National Director of Wind Energy at Tetra Tech EC, Inc. During her time with Tetra Tech, their wind energy program was responsible for permitting over 335 projects representing over 20,000 MW of installed capacity. She co-managed preparation of the Wind Energy Siting Handbook for the American Wind Energy Association, published in 2008. Ms. Kenney received her B.A. and M.A. in Environmental Science & Policy from Clark University.

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Ms. Laurie Jodziewicz (jaws-a-wits) is Director of Permitting at NRG Bluewater Wind. She has been in the renewable energy industry since 1998, most recently at the American Wind Energy Association (AWEA). For six years at AWEA she managed project siting, wildlife, and offshore wind policy issues before industry organizations, government agencies, environmental groups and the media. Prior to her involvement with wind she gained experience in a number of energy organizations spanning the solar, distributed generation and natural gas industries.

Kris Ohleth

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Ms. Kris Ohleth is the Director of Permitting for the Atlantic Wind Connection backbone transmission project. Her past positions include Policy Manager for Coastal and Marine Spatial Planning issues for Ocean Conservancy and the Director of Environmental Affairs for both Deepwater Wind and Bluewater Wind. Ms. Ohleth worked as a research technician and editor for the National Marine Fisheries Service in Woods Hole, Massachusetts and as a communication coordinator for The Nature Conservancy. She earned an undergraduate degree from Rutgers University and a master's degree from the University of Rhode Island in Coastal and Ocean Policy. She is on the Board of the US Offshore Wind Collaborative, the New Jersey Environmental Lobby, and is the Chair of the New York/New Jersey Chair of the Women of Wind Energy.

ENVIRONMENTAL BREAKOUT: MONITORING AND BASELINE STUDIES

Jennifer Ewald

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Ms. Jennifer Ewald has been working in the field of Marine Science for 15 years, as a Project Manager she is operationally experienced deploying over 200 oceanographic moorings in coastal Atlantic, Pacific and Alaska waters for NOAA, the Prince William Sound Science Center and State of Alaska specializing in current measurements and acoustics. Her passion for evaluating technology to improve methods of data collection, quality analysis and assessing user needs to most effectively produce accurate and relative results to the public, resource managers, emergency responders, researchers and policy makers lead to her recognition by the Department of Commerce with a Bronze Medal Award for the modernization of the National Current Observation Program (NOAA) in 2008. She received a degree in Marine Science from Coastal Carolina University in 1999 and delivered a Master's Thesis on coastal circulation in Narragansett Bay at the University of Rhode Island in 2001. Ms. Ewald joined the Environmental Studies Program in May 2010, focusing on the coordination of renewable energy research within the agency and with external partnerships.

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Mr. Brian J. Balcom is a Senior Scientist in CSA International, Inc.'s (CSA's) Western Regional Office located in Salinas (Monterey County), California. He is a benthic ecologist with nearly 30 years of experience in biological baseline studies and assessments of the potential effects of man's activities on the marine environment. With CSA since 1981, Mr. Balcom has provided marine biological technical expertise, environmental impact assessment (EIA) capabilities, and management oversight on numerous multidisciplinary assessments of proposed activities in federal and state waters (e.g., oil and gas exploration, development and abandonment activities, and liquefied natural gas [LNG] terminal and pipeline installation and operation). He has managed EIAs for compliance with the National Environmental Protection Act (NEPA) and Council on Environmental Quality (CEQ), and protective regulations including the Endangered Species Act (ESA), Marine Mammal Protection Act (MMPA), and California Environmental Quality Act (CEQA). Mr. Balcom has prepared assessments related to noise effects on marine mammals and sea turtles, with an emphasis on endangered and threatened species.

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Dr. Gary A. Buchanan was project manager for the Ocean/Wind Power Ecological Baseline Studies, a two year study of avian, marine mammal and sea turtle species in the offshore waters of New Jersey. He is the Manager of the Office of Science for the New Jersey Department of Environmental Protection (NJDEP), oversees multidisciplinary research and science-based technical support, and is responsible for the coordination and administration of the NJDEP Science Advisory Board. He has degrees in biology and environmental science with a focus on aquatic ecology, marine/estuarine ecology, and ecotoxicology. With more than 28 years of experience, he has conducted a variety of field, laboratory and research projects involving water quality, natural resources, ecology, ecotoxicology, environmental toxicology, ecological risk assessment, and hazardous waste site investigations. He has managed technical groups which have conducted numerous ecological and environmental investigations at sites across the United States.

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Mr. Bill White serves as the Assistant Secretary for Federal Affairs in Governor Patrick's Energy and Environmental Affairs Office in Massachusetts. In this role, Mr. White leads the state's efforts on the federal leasing process for offshore wind development. He has played a key role in securing Federal permits for the historic Cape Wind project and attaining federal funding for the Massachusetts Wind Technology Testing Center, the largest wind blade test facility in the world. Previously, Mr. White worked at the Harvard Kennedy School where he directed the John F. Kennedy Jr. Forum. During the 90s, Mr. White served as a Special Assistant to the President in the Clinton White House and worked at the U.S. Department of State. During the Gulf War, Mr. White helped organize the international media center in post-liberated Kuwait. He is a graduate of Boston College (B.S.) and Harvard Kennedy School (MPA). Mr. White lives with his wife and two kids in his hometown of Milton, Massachusetts.

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In his capacity as a planner at the Maine Coastal Program, Mr. Matt Nixon's duties involve spatial analysis, data collection and collection effort coordination, coastal public access policy development, and coastal and marine spatial planning policy development and implementation. He was involved in the state's efforts to site three ocean energy test areas in Maine state waters and is currently coordinating the data and spatial analysis piece for Maine's next evolution of CMSP. Prior to his work in Maine, Mr. Nixon worked for the U.S. EPA, Atlantic Ecology Division where he focused on database structure

and maintenance, spatial analysis, and water quality analysis. Mr. Nixon has a Master's degree in Coastal and Marine Policy and Law from the University of Rhode Island.

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Mr. Grover Fugate is Executive Director of the Rhode Island Coastal Resources Management Council (CRMC). In his role over a 25 year period, Mr. Fugate has been responsible for overseeing the development of all policies and programs for the state's coastal program. Currently, he is serving as project manager of the Rhode Island Ocean Special Area Management Plan (SAMP), the CRMC's seventh such regulatory program. The SAMP will provide management of a variety of existing and new uses in state ocean waters and focuses in part on providing guidance for the development of offshore renewable energy resources. Due to his leadership with the model Ocean SAMP project, Mr. Fugate has earned many significant awards, including the prestigious Susan Snow-Cotter Award for Excellence in Ocean and Coastal Resource Management from the National Oceanic and Atmospheric Administration (NOAA). He has also been presented with several Sea Grant Awards including, the 2008 Sea Grant Life Time Achievement Award for coastal management. Mr. Fugate is the author of a number of academic journal articles on coastal and natural resources management issues and is a adjunct faculty member at the Marine Affairs Program at the University of Rhode Island and also a guest lecturer at Brown University and Roger Williams University

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Ms. Michelle Carnevale is a Coastal Manager at the University of Rhode Island's Coastal Resources Center. She currently conducts research and outreach on offshore renewable energy development in support of the National Oceanographic Partnership Program (NOPP) Project "Developing Environmental Protocols and Modeling Tools to Support Ocean Renewable Energy and Stewardship" (Project Number: M10PS00152) and the Ocean Special Area Management Plan (SAMP), an ecosystem-based marine spatial planning project. Specifically, her research has examined offshore renewable resources, technology, and the environmental effects of its development. In addition, Ms. Carnevale has been heavily involved in the creation of a regulatory framework for offshore renewable energy to be used at the state level in Rhode Island. Ms. Carnevale joined the Coastal Resources Center in 2009, after receiving a Master's degree in Marine Affairs and a Master's in Business Administration from the University of Rhode Island, where her graduate research focused on offshore renewable energy development in New England. She also holds a B.S. in Marine Ecology from Cornell University.

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Ms. Julie Slacum has been a Fish and Wildlife Biologist with the U.S. Fish and Wildlife Service, Chesapeake Bay Field Office since 1999. For the first ten years of her career she worked for the Coastal Program on habitat restoration projects for endangered species and migratory birds. Most of this work involved invasive species control. Ms. Slacum worked on multiple invasive species policy issues, the largest and most controversial one being the proposed introduction of a non-native oyster to the Chesapeake Bay. She also coordinated an eight state regional panel on aquatic invasive species for several years. In 2009, she became the Endangered Species and Conservation Planning Division Chief. In that position, she supervises eleven employees that evaluate and review project related impacts on Service trust resources (threatened and endangered species, migratory birds, interjurisdictional fisheries, refuges) under the Endangered Species Act, Fish and Wildlife Coordination Act, Bald and Golden Eagle

Protection Act, Migratory Bird Treaty Act, and Sikes Act. Before she started employment with the Service, she received a dual B.S. Degree in Biology and Environmental Science from Salisbury State University and University of Maryland Eastern Shore. She then went to receive a M.S. in Fisheries through the University of Maryland Marine, Estuarine, and Environmental Sciences program.

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Dr. Sofie Van Parijs has worked on passive acoustic research from the poles to the Tropics for over 17 years. She has undergraduate and masters degrees from Cambridge University, U.K. and a Ph.D. from Aberdeen University, UK. She worked as a postdoctoral scientist at the Norwegian Polar Institute, James Cook University in Australia and Cornell University before moving to the Northeast Fisheries Science Center (NMFS/NOAA) in 2004. At NMFS she is the program leader for large whale and passive acoustic research within the Protected Species Branch. She has published over 40 papers in international journals and represents NMFS in a wide range of fora within the U.S. and internationally. Her expertise in marine bio-acoustics has addressed questions on behavioral ecology, distribution, abundance, long term monitoring, mitigation and effects of ocean noise on marine mammals. This has given her extensive experience collecting data with archival, real time acoustic recorders and autonomous vehicles.

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Dr. David Zeddies is a Senior Scientist with JASCO Applied Sciences. He has a Ph.D. in Neuroscience from Northwestern University in Evanston, Illinois; and, is also trained as an engineer, with a BSME from the University of Illinois in Champaign-Urbana. Dr. Zeddies has published refereed articles on auditory neurophysiology, sound source localization by fish, and the impacts of intense sounds on fish hearing. Dr. Zeddies academic and professional work includes methods of acoustic measurement and assessment of risk due to anthropogenic sounds on marine life.

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Mr. Tom Carlson has been active in research of active and passive acoustics for over 30 years. Passive acoustic research includes the effect of impulsive sounds generated by pile driving on fish, detection, classification, and localization of vocalization marine mammals, broad band noise measurement at prospective marine hydrokinetic sites, and instrumentation and software for the acquisition, processing, and analysis of underwater noise. Active acoustic research includes target strength models and measurements for fish and marine mammals and the development of micro-transmitters for acoustic telemetry.

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Dr. Peter J. Dugan is a research scientist with a background in electrical engineering and advanced computing. As a research scientist, Dr. Dugan spent 16 years in industry working for Hughes Aircraft Company and Lockheed Martin. He has authored several U.S. patents and trade secrets plus a host of professional peer-reviewed articles and presentations. His current research includes advanced methods for detection and classification using passive acoustic data and is the Principal Investigator, along with Dr. Christopher Clark, for the ONR Grant for Detection, Classification and Localization, awarded 2011. Dr. Dugan is currently the Director of Applied Science and Engineering at the Cornell Lab of Ornithology, Bioacoustics Research Program where his team works on animal vocalization recording and analysis hardware and software to promote conservation efforts.

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Ms. Michelle Bachman has worked as a Fishery Analyst for the New England Fishery Management Council in Newburyport, Massachusetts since 2008. NEFMC, which is one of eight regional councils established by the Magnuson Stevens Fishery Conservation and Management Act, manages fishery resources in federal waters off Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut. Michelle's focus is on issues related to Essential Fish Habitat, including designation, evaluation of fishery impacts, and development of measures to minimize fishery impacts. In addition, Ms. Bachman works on issues related to deep-sea corals and marine spatial planning. She provides staff support for the Council's Habitat, MPA, and Ecosystem Committee, and chairs the Habitat Plan Development Team. Ms. Bachman has an undergraduate degree in Biology and Environmental Studies from Tufts University, and a master's degree in Living Marine Resource Science and Management from the University of Massachusetts Dartmouth.

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Ms. Ann Pembroke is Vice President and Technical Director of the Marine Sciences group at Normandeau Associates. With an M.S. from the University of Delaware in Marine Studies, her career focus has been on impact assessment of marine development. Initially specializing in plankton resources, she has worked her way through the food web and has addressed impacts to benthos, fish, and marine

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Mr. Roger Pugliese, Senior Fishery Biologist with the South Atlantic Fishery Management Council has, over 25 years, facilitated development of Fishery Management Plans ranging from South Atlantic Red Drum to Atlantic Dolphin and Wahoo to habitat plans for Coral and Live Bottom Habitat and Pelagic Sargassum. He is responsible for the Council's Spatial GIS, Essential Fish Habitat and broader habitat conservation and ecosystem coordination efforts including the development of the Council's Habitat Plan and the Fishery Ecosystem Plan which supports Comprehensive Ecosystem-Based Management Amendments. To facilitate regional ecosystem coordination, he also serves on the Southeast Coastal and Ocean Observing Regional Association Board of Directors, is a member of the South Atlantic Landscape Conservation Cooperative Steering Committee, Chairs the South Atlantic Committee for the Southeast Area Monitoring and Assessment Program and is a member of the Governor's South Atlantic Alliance Executive Planning Team, the Southeast Aquatic Resources Partnership and the South Atlantic Regional Research Plan Development Team.

SOCIAL ECONOMIC BREAKOUT: ASSESSMENT DRIVEN ISSUES

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Dr. Brian Jordan is the Federal Preservation Officer and Headquarters Archaeologist for the Department of the Interior's Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE). Prior to joining BOEMRE, Dr. Jordan was the assistant state underwater archaeologist for Maryland, working for the Maryland Historical Trust. In Maryland, he built up the remote-sensing and data processing capabilities of the Maryland Maritime Archaeology Program. Other government experience included building and overseeing the cultural and historical resources component of NOAA's National Marine Protected Areas Center. In his career as a marine archaeologist, Dr. Jordan has participated in and conducted marine archaeology surveys and excavations in numerous countries on four continents, including Turkey, Denmark, Portugal, and Morocco. He also worked with and advised institutes and government representatives of several countries on the survey, excavation, and management of submerged cultural resources. Past research focused on environmental factors affecting the preservation of wooden shipwrecks in the marine environment.

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Mr. David Blaha has over 29 years' International Environmental, Social and Health Impact Assessment experience primarily in the energy, mining and metals, military, and transportation sectors. His particular energy experience includes hydropower, windpower, natural gas pipelines and LNG (including onshore and offshore Deepwater Ports). He is an expert on the regulatory/procedural requirement of NEPA, Section 7 of the Endangered Species Act, Section 106 of the Natural Historic Preservation Act and Executive Orders for wetlands, floodplains, and environmental justice in the U.S. He specializes in assessing/permitting large (often >\$1 billion) infrastructure projects.

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Mr. David Robinson, M.A., R.P.A., is an underwater archaeological consultant and the director of the New Bedford, Massachusetts-based Fathom Research, LLC's Marine Archaeological Services Division. He has worked in the submerged cultural resource management field since 1991, during which time he has directed archaeological projects throughout New England, the Great Lakes and Lake Champlain, the Mid-Atlantic, the Deep South, and in the Gulf of Mexico. Since 2001, Mr. Robinson has performed multi-disciplinary investigations to assess and identify both historic and prehistoric submerged cultural resources in support of the environmental permitting review for seven different offshore renewable energy projects in the Mid-Atlantic and New England regions. Most recently, he was an invited presenter during a symposium on modeling surviving prehistoric landforms on the Outer Continental Shelf at the BOEMRE's 2011 Information Transfer Meeting, and is a co-author of the 2011 BOEMRE-funded study - *Prehistoric Site Potential and Historic Shipwrecks on the Atlantic Outer Continental Shelf*.

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Mr. Dave Ball is the Regional Historic Preservation Officer for the Pacific OCS office of the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE). He also serves as the BOEMRE Diving Safety Officer. Since joining BOEMRE in 1999, Mr. Ball has been involved with documenting a number of historic shipwrecks on the Atlantic and Gulf of Mexico Outer Continental Shelf (OCS). He has directed terrestrial and underwater projects throughout the United States and is currently responsible for archaeological and cultural heritage resources on the Pacific OCS. Mr. Ball received his Master of Arts degree in Anthropology from Florida State University in 1998 and is an elected member of the Advisory Council on Underwater Archaeology Board of Directors.

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Dr. Jeremy Firestone, Professor, College of Earth, Ocean, and Environment and Director, Center for Carbon-free Power Integration, University of Delaware. He has a J.D. from University of Michigan and Ph.D., Public Policy Analysis, from University of North Carolina. Firestone helped organize the first American Wind Energy Association (AWEA) Offshore Wind Power Workshop; was Conference Chair, 2010 Philadelphia Offshore Wind Forum; and has made presentations on wind power at events sponsored by NREL-IEA, NYSEDA, DOE-DOI, Cornell University, Williams College, University of Hawaii, European Offshore Wind Conference, AWEA WINDPOWER and other venues. He served on the

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Dr. Amardeep Dhanju is an Ocean Policy Analyst in the Environmental Studies Program at the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE). He is coordinating the National Ocean Policy initiative with a focus on Coastal and Marine Spatial Planning (CMSP). Dr. Dhanju is also engaged with social science issues related to offshore renewable energy regulation at the Bureau. Dr. Dhanju graduated with a Ph.D. in Marine Policy from University of Delaware in 2010. His dissertation focused on policy and regulatory issues related to offshore wind power development in the

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Mr. Ben Hoen is a researcher at Lawrence Berkeley National Laboratory, concentrating primarily on the investigation of individual and community responses to a number of different renewable energy sources, such as large scale wind and residential solar. In 2009, Mr. Hoen completed a multi-year study investigating the effects that nearby wind facilities have on surrounding property values, and since has continued this work as part of a team investigating noise and annoyance issues surrounding existing wind facilities in the U.S. He is co-authors on a number of LBNL report's and journal articles and is asked to speak frequently on the subject of renewable energy and public acceptance. He holds a Bachelor degree in Finance and General Business, and a Master of Science Degree in Environmental Policy.

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Over the course of the past 30 years, Ms. Barbara Hill has held a variety of management positions within non-profit organizations focused on renewable energy, land preservation and affordable housing. From 2001 to 2005 she served as the Project Manager for Offshore Wind with the Massachusetts Technology Collaborative, Renewable Energy Trust, the state's development agency for clean energy and the innovation economy. She is a founding initiator of the CLEAN campaign, a collaborative of grassroots led organizations working for a new national energy policy advocating CLEAN's Call to Action. Ms. Hill is also a 2008 Senior Fellow with the Breakthrough Institute and serves on the Board of Directors of the U.S. Offshore Wind Collaborative.

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Mr. Gary Norton is Program Manager for Wind and Water Power at Sentech Inc, now part of SRA International. In this capacity, he provides technical and programmatic support for the U.S. Department of Energy's (DOE) Wind Program and was instrumental in developing the agency's strategy for Offshore Wind Energy. Mr. Norton's experience in wind energy dates back to developing the first utility interface turbines and installing the world's first wind farms in California in the early 1980's. In his varied career he has also provided fail-safe power stations at remote pipeline valves for major multinationals such as Chevron and Exxon, conducted renewable energy field tests at the South Pole for the National Science

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TECHNOLOGY ASSESSMENT AND RESOURCE PROGRAM: RENEWABLE ENERGY STUDIES

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Dr. Malcom Sharples is President of Offshore Risk & Technology Consulting for the last 10 years – which deals with work in the area of risk analysis, accident investigation of offshore rigs, safety management system, and research in various areas of offshore equipment including wind farms. Assignments have included developing plans for offshore oil companies in the arctic, and developing innovative techniques for spotting areas of high consequence potential accidents. Dr. Sharples has been engaged by BOEMRE in research work on wind farms with a view to providing advice on regulatory requirements. Prior to starting his own consultancy, he was Vice-President of the American Bureau of Shipping, and prior to that he was President of Noble Denton & Associates Inc. marine surveyors for insurance interests, having been one of the original founding associates in 1972. He serves on the Board of Directors of Keppel Offshore & Marine in Singapore which has over 20 active shipyards and on the Board of the Offshore Energy Center (offshore drilling rig museum and educational outreach center), in Galveston. Dr. Sharples is a Fellow of SNAME, a longtime member of the Marine Technology Society and the Society of Petroleum Engineering and is a practicing Professional Engineer in Texas, and in Ontario Canada where he graduated from the University of Western Ontario. He holds a Doctorate from University of Cambridge.

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Mr. Tom McNeilan is a Registered Professional Engineer with degrees in Civil Engineering and Geotechnical Engineering. His 37 years of professional experience has focused on the siting, design, installation, and performance of offshore energy structures and large coastal infrastructure. He directs Fugro's marine engineering and survey practice for offshore renewable energy along the U.S. east coast and in the Great Lakes regions. Mr. McNeilan has been the project manager for offshore wind off the U.S. east coast and the United Kingdom; offshore oil and gas developments along the U.S west and east coasts, the Gulf of Mexico, and Alaska, as well as offshore northern Europe, the Middle East, India, and southeast Asia; deep-water and near-shore LNG terminals; and many large coastal infrastructure projects. Mr. McNeilan was the principal in charge of the BOEMRE-funded research on the influence of seafloor scour on offshore wind turbines.

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Mr. George Hagerman has more than 30 years experience researching renewable ocean energy systems, including offshore wind power, wave power, tidal current energy, and ocean thermal energy conversion (OTEC). His research focus areas are resource assessment, metocean extreme event analysis, site characterization, and energy cost modeling.

Mr. Hagerman is a research faculty member at the Virginia Tech Advanced Research Institute in Arlington, Virginia, and Director of Offshore Wind Research for the Virginia Coastal Energy Research Consortium, where he has coordinated the work at five universities to support a feasibility-level reference baseline design and cost estimate for a hypothetical offshore wind project off Virginia, to be compared with new-build fossil fuel generation.

Mr. Hagerman has been invited to brief federal and state regulatory agencies, and to testify before legislative committees of the U.S. Congress and the Virginia General Assembly. In 2009, the Minerals Management Service recognized his service with an Offshore Leadership Award.

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BIRD, BATS AND OFFSHORE WIND DEVELOPMENT: REMAINING INFORMATION GAPS

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Dr. James Woehr is an Avian Biologist in the Environmental Assessment Branch of the United States Department of the Interior Bureau of Ocean Energy Management, Regulation and Enforcement in Herndon, Virginia. Dr. Woehr has been a Certified Wildlife Biologist since 1979 and has over 25 years of involvement in bird conservation at local, state, and national levels. He has a B.S. degree in aerospace engineering, an M.S. in Wildlife Management, and a Ph.D. in Ecology. Dr. Woehr has been a Design Engineer in the aerospace industry, an Environmental Science Professor at the State University of New York College at Plattsburgh, a Financial Planner and Investment Broker for a Wall Street firm, Coordinator of Nongame and Endangered Species programs for Alabama Department of Conservation and Natural Resources, and Senior Scientist for the Wildlife Management Institute before joining BOEMRE as the headquarters avian biologist. These diverse experiences provide Jim with an understanding of the perspectives of the multiple parties in the wind energy development business and lead him to seek affordable, responsible solutions acceptable to all parties. Dr. Woehr represents BOEMRE at national and international bird conservation meetings and in negotiations with state and federal agencies and wind energy developers over bird conservation, monitoring, and mitigation measures related to siting and development of offshore wind energy facilities. He also reviews BOEMRE's NEPA documents for adequacy in addressing bird conservation needs and issues. Dr. Woehr is also an active participant in BOEMRE's environmental sciences program in which he proposes avian research projects, leads evaluation teams selecting the contractors who will perform the studies, and oversees the performance of selected contractors.

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