

# Unsolicited Request for Renewable Energy Research Lease

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Northwest National Marine Renewable Energy  
Center at Oregon State University



October 29, 2013

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# CONTENTS

Project Overview .....	5
Purpose & Need.....	6
Area Requesting to Lease .....	7
Technical Evaluation of Candidate Sites .....	7
Stakeholder Coordination & Consultation.....	7
Site Selection .....	8
Coordinates and OCS Lease Blocks .....	9
Map of Area Requested to Lease.....	10
Site Characterization .....	11
Baseline Studies.....	11
Objectives and Proposed Facilities .....	16
Offshore Facilities .....	16
Wave Energy Conversion Devices.....	17
Mooring Systems .....	18
Construction & Installation.....	18
Operations & Maintenance .....	19
Removal & Decommissioning .....	19
Power Transmission & Grid Interconnection.....	20
Marine Transmission Cables.....	20
Onshore Cable Landing Options .....	21
Grid-Interconnection .....	22
Terrestrial Infrastructure .....	22
Onshore Support Facilities & Staging Areas .....	23
Port of Newport.....	23
Port of Toledo.....	24
Regional Marine and Industrial Infrastructure Port of Toledo .....	25
General Schedule of Activities.....	27
OCS Leasing Timeline.....	30
Required Authorizations, Approvals & Permits .....	30

Additional Authorizations ..... 31

Lease Request Process ..... 32

Wave Energy Resource Data ..... 36

Environmental Resources ..... 36

    Air Quality ..... 37

    Marine Geology & Bottom Sediments ..... 37

    Oceanography & Meteorology ..... 38

    Acoustic Environment ..... 39

    Water Quality ..... 39

    Vegetation and Algae ..... 40

    Zooplankton, Crab Larvae & Fish Larvae ..... 40

    Benthic Invertebrates ..... 41

    Fish ..... 42

    Sea Turtles ..... 44

    Marine Birds ..... 44

    Marine Mammals ..... 44

    Federal & State Protected Species ..... 45

    Recreation ..... 47

    Commercial Fishing ..... 48

    Marine Transportation & Navigation ..... 49

    Natural Hazards, Hazardous Materials, Offshore Dump Sites, Unexploded Ordinances ..... 50

    Military Uses ..... 50

    Cultural & Historic Resources ..... 51

    Visual Resources ..... 51

    Socioeconomics and Environmental Justice ..... 51

Conformance to State & Local Energy Planning ..... 53

    State ..... 53

    Local ..... 53

Qualifications Documentation ..... 54

    Legal ..... 54

    Technical ..... 54

    Organization Profile & Structure ..... 54

Laboratory and Field Facilities ..... 55

Prior/Current Projects ..... 55

Project Personnel..... 56

Technical Consultants..... 57

Financial..... 58

    Financing Plan ..... 58

    Experience Raising Capital ..... 60

Acquisition Fee ..... 61

Certification ..... 62

References ..... 63

    Written References..... 63

    Personal Communications ..... 65

Appendices ..... 66

## FIGURES

Figure 1. Map showing OCS blocks in the area requested to lease..... 10

Figure 2: Sample depiction of P MEC-SETS Facility..... 16

Figure 3: Overall SchEdule of Activities ..... 28

Figure 4: Complete Schedule of Activities ..... 29

Figure 5: Lease request process & schedule..... 33

Figure 6: Leasing & Licensing Process & Schedule..... 35

Figure 7: NNMREC Organizational Chart within Oregon State University ..... 58

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## PROJECT OVERVIEW

The Northwest National Marine Renewable Energy Center (NNMREC) was established through the U.S. Department of Energy (DOE) Water Power Program to support wave and tidal energy development for the United States. NNMREC's suite of test facilities, collectively known as the Pacific Marine Energy Center (PMEC), provide a range of ocean renewable energy testing opportunities, from laboratory scale through open ocean testing. NNMREC at Oregon State University (OSU) currently provides non-grid connected wave energy testing off the coast of Oregon at the PMEC North Energy Test Site (PMEC-NETS), and is now developing a utility scale grid connected wave test facility, the South Energy Test Site (SETS), the subject of this BOEM lease application. As the first of its kind in continental North America, the PMEC-SETS will play an integral role in advancing wave energy from early-stage ocean testing through final demonstration for commercialization. PMEC-SETS will serve as an integrated test center to evaluate wave energy converter (WEC) performance and environmental interactions, as well as a training ground for future jobs in the ocean energy industry.

The PMEC-SETS project would be located approximately five nautical miles off the coast of Newport, Oregon, in an area characterized by a predominantly sandy bottom with water depths ranging from 32 to 41 fathoms (58 – 75 meters). The exact location has not yet been determined, as site assessment activities and further consultation with agencies and stakeholders will be used to inform the location and configuration of the project structures. However, NNMREC-OSU has selected an area of interest for project site, which was identified by the Newport community through an extensive stakeholder engagement process.

Primary project components would include test berths (where WEC devices would be anchored and moored), marine transmission cables, and an onshore control center to transfer power to grid. The test berths would be located on the Outer Continental Shelf (OCS) and occupy an area of approximately 2-square nautical miles. A total of four grid-connected test berths are planned, each with its own buried subsea cable to transmit energy, as well as performance and environmental data, from the test berth to an onshore control center. Central Lincoln Public Utility District (CLPUD) would handle the grid-interconnect; power transmission and purchase options are being explored with the CLPUD and Bonneville Power Association (BPA).

The general site selection process was completed in January 2013, and final site selection and project design are now underway. The submittal of this lease request to the Bureau of Ocean Energy Management (BOEM) is the first step in the regulatory process, and NNMREC-OSU plans to initiate the Federal Energy Regulatory Commission (FERC) Licensing Process once BOEM issues a Determination of Competitive Interest for the lease request. The precise sequence of the overall regulatory process will depend on a variety of factors, but NNMREC-OSU aims to complete the regulatory process in [REDACTED]

Upon completion of the regulatory process, the project would enter the installation phase, which NNMREC-OSU expects to begin in late [REDACTED]. The transmission cables and test berths would likely be installed at the same time, but it is possible that the some infrastructure would be

installed in phases. NNMREC-OSU aims to commence operations at P MEC-SETS [REDACTED] with deployment of the first WECs at the facility. Based on experiences of other renewable energy test facilities, such as the National Renewable Energy Laboratory (NREL) and the European Marine Energy Center (EMEC), P MEC-SETS is expected to operate for up to [REDACTED] years.

## PURPOSE & NEED

Full-scale ocean testing for WECs is necessary to evaluate the technology, optimize energy extraction, and research potential environmental impacts. In 2012, the NNMREC-OSU became home to the nation’s first non-grid connected ocean test facility capable of testing a variety of WEC technologies while monitoring interactions with the local ecosystem, the North Energy Test Site (NETS) of P MEC. While the P MEC-NETS is a critical step forward, the lack of grid emulation for WECs above 100kw average power produced is a limitation for devices advancing through technology readiness levels (TRLs). While WECs can be tested “self-contained” at NETS, that mode of testing will not fully provide developers an understanding of WEC performance under grid connection—which is necessary for commercial demonstration of WEC technologies.

The overall purpose of SETS is to demonstrate the viability of wave energy off the northwest coast of the U.S. by providing a fully functional ocean test facility for prototype and utility scale WECs connected to the electrical grid. In addition to serving as an integrated test center to evaluate WEC performance and environmental interactions on a commercial scale, SETS will also function as training ground for jobs in the ocean energy industry.

Technology developers and policy-makers alike have determined that a full-scale grid connected ocean test facility is needed to achieve industry commercialization and fully reap the benefits of this clean, renewable energy resource. The interest and value in this type of test center has been documented in numerous reports reflecting industry and stakeholder interests. In particular, the U.S. Department of Energy’s (DOE) technology roadmap for wave energy indicates a demonstration center as necessary step in commercializing this energy sector. Fulfilling this need is the primary purpose of P MEC-SETS. P MEC-SETS will provide standardized testing and power analysis at an accredited facility, along with demonstration of power on the grid, standardized fault testing, and interconnection and grid synchronization data.

*P MEC Vision:  
Leverage NNMREC  
expertise and industry  
partnerships to develop  
a full scale, grid-  
connected ocean energy  
demonstration center  
that can accommodate  
multiple devices of  
various technology  
types and scales.*

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## AREA REQUESTING TO LEASE

### TECHNICAL EVALUATION OF CANDIDATE SITES

As a first step in a comprehensive evaluation of potential sites for the PMEC-SETS (or Proposed Project), NNMREC-OSU conducted a feasibility study of candidate sites in 2011. This study involved analyzing and establishing site evaluation criteria, which were then applied to identify candidate sites. Utilizing resources from NNMREC-OSU and the Oregon Wave Energy Trust (OWET), industry feedback on requirements for an optimal grid connected ocean test site was gathered to inform the site evaluation criteria. Applying both the objectives of SETS and needs identified by industry, the following initial site criteria were established:

- Within 50 nautical miles of nearest deep water port;
- Within 15 nautical miles of nearest service port;
- Water depth 60-100 meters;
- Shore landing within 5 miles to 115kv transmission line;
- Soft bottom;
- Leverages existing industry activity.

These initial criteria were used to screen locations off the coast of Oregon, and four sites were identified for further evaluation: Warrenton (Camp Rilea), Newport, Reedsport, and Coos Bay. Additional information about each candidate site was collected and reviewed for each of the following criteria:

- Proximity to facilities for deployment;
- Proximity to port for service vessels capable of conducting onboard maintenance;
- Proximity to facilities for dockside repair;
- Logistical resources for staff, developers, researchers;
- Energy resources;
- Potential environmental effects;
- Potential effects to human uses;
- Proximity to interconnection points;
- Access to utilities for energy off-take.

In addition, NNMREC-OSU developed cost estimates to evaluate how each site may affect the cost of deployment and operation. Each site was evaluated to assess opportunities to leverage existing and future activities and investments, and site assessment analysis was shared with local stakeholders and other interested parties to gather additional input. Technical evaluation of candidate sites was completed in December 2011 and documented in a report, *Feasibility Study for a Grid Connected Pacific Marine Energy Center* (provided in Appendix E).

### STAKEHOLDER COORDINATION & CONSULTATION

Recognizing that community input and support are crucial to a successful project, NNMREC-OSU initiated an extensive outreach program during the technical evaluation of candidate sites. In coordination with Oregon Sea Grant, NNMREC-OSU conducted outreach in the areas being considered

for the project site (Warrenton, Newport, Reedsport, and Coos Bay) to share information about P MEC-SETS and gather feedback from the communities. In 2012, a series of public forums were held for members of the public to learn more about SETS and to identify issues of concern and interest in Newport, Reedsport and Coos Bay. Warrenton was treated somewhat differently, as the Oregon Military Department would have been the project lead had that community been selected as the location for P MEC-SETS.

Results of the outreach process were used to narrow the candidate sites to the two communities that demonstrated the most interest in and best matched the criteria for P MEC-SETS (Reedsport and Newport). In fall 2012, Reedsport and Newport each formed a Community Site Selection Team to develop proposals for the P MEC-SETS. Representatives from all stakeholder groups were directly involved in the preparation and approval of the proposals for the P MEC-SETS, including the Fishermen Involved in Natural Energy (FINE), ocean users, tribal representatives, the Central Lincoln People's Utility District (PUD), Lincoln County, the Cities of Newport and Toledo, the Ports of Newport and Toledo and the public at large.

Throughout 2012, NNMREC-OSU kept BOEM apprised of the selection process. In fall 2012, NNMREC-OSU began engaging with both BOEM and FERC in fall 2012 to share information about P MEC-SETS and to prepare for the regulatory process. NNMREC-OSU held conference calls with representatives from both agencies in November and December 2012. In early 2013, NNMREC-OSU formed a Stakeholder Advisory Team comprised of all the federal and state agencies involved in the P MEC-SETS authorization process, as well as non-governmental organizations, to collectively explore the project and to identify key regulatory and environmental considerations. Since first convening the group in January, NNMREC-OSU held meetings in March and May, and periodically scheduled will follow to ensure all parties remain engaged as the project proceeds.

NNMREC-OSU continues to work with Oregon Sea Grant to maintain ongoing communication and coordination with the Newport community, and the fishing industry in particular. The near-term focus of the outreach program is to collaboratively inform final project design, consider regulatory process options, identify baseline study needs, and develop environmental monitoring plans and mitigation measures to facilitate safe and compliant technology testing. These efforts are part of the overall outreach process that NNMREC-OSU has implemented to engage with all stakeholders throughout the development and life of the P MEC-SETS project.

## SITE SELECTION

Following the 2011 feasibility study, and in conjunction with the Community Site Selection process, NNMREC-OSU coordinated with industry partners, including the OWET, the EMEC, Aquatera, and Ecology and Environment, Inc., to develop a Conceptual Design for P MEC-SETS (see Appendix H). The development of the preliminary project plan provided the technical analysis of the four communities that, together with the community outreach process, resulted in the selection of Reedsport and Newport as final candidates for P MEC-SETS.



In developing their proposals for P MEC-SETS, the Community Site Selection Teams considered the technical criteria for SETS, community resources, economic development, marine traffic, marine debris and salvage aspects, and environmental resources. The community teams submitted their proposals in December 2012, and in January 2013 NNMREC-OSU selected Newport for the P MEC-SETS (see Appendix F: Newport Community Site Proposal for P MEC). The decision was based on a combination of community input and preferred site criteria, including physical and environmental characteristics, marine and on-shore cable routes, port and industry capabilities, impacts to existing ocean users, permitting challenges, stakeholder participation in the proposal process, and support of the local fishing communities.

### COORDINATES AND OCS LEASE BLOCKS

Initially recommended by FINE based on their broad knowledge of the local marine environment, the area selected by the Newport community, or study area, is located approximately five nautical miles off the coast of Newport on the OCS. The study area is roughly 4.5 square nautical miles, and the SETS project site would occupy about 2-square nautical miles within that; however, site-specific surveys, as well as further agency and stakeholder consultation, are needed to determine the exact location. Therefore, NNMREC-OSU is requesting a research lease for the four OCS-blocks containing the study area.

While the actual project site will be much smaller than the area contained in the four lease blocks, this approach will help ensure that there are sufficient options as the optimal location and configuration of the project structures is determined. Once the precise site is identified, NNMREC-OSU will coordinate with BOEM to remove those aliquots not encompassed by the project site from the lease.<sup>1</sup> NNMREC-OSU is requesting a research lease for the OCS-blocks listed in Table 1 below and depicted on the map in Figure 1.

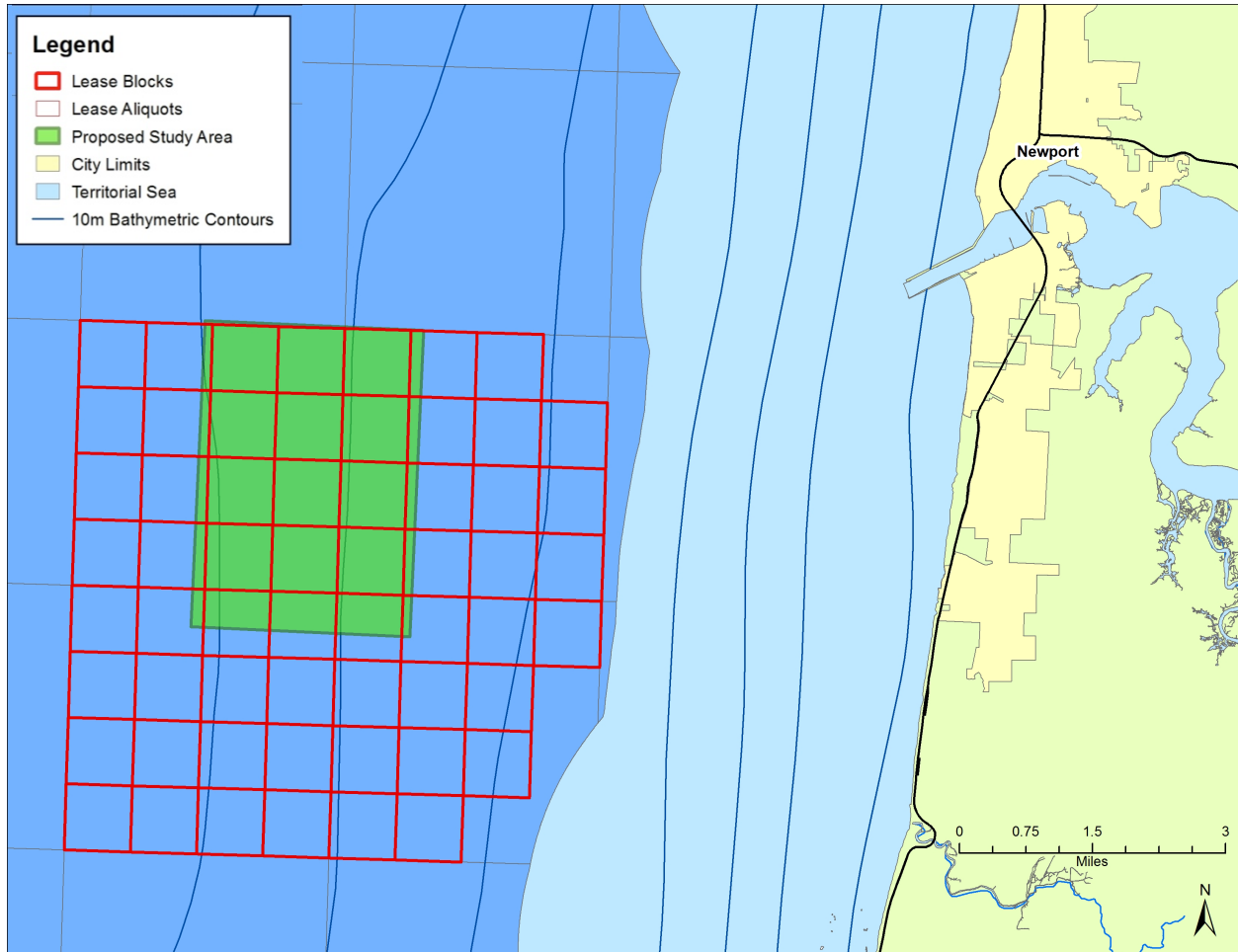
**TABLE 1. OCS BLOCKS REQUESTED FOR RENEWABLE ENERGY RESEARCH LEASE**

Protraction Diagram Name	Protraction Diagram Code	Project Structure	Block Number	Aliquots
Newport Valley	NL 10-10	WEC Berth	6481	All
Newport Valley	NL 10-10	WEC Berth	6531	All
Salem	NL 10-11	WEC Berth	6501	Excluding H, L, O & P
Salem	NL 10-11	WEC Berth	6451	Excluding D

<sup>1</sup> NNMREC-OSU anticipates that this may be accomplished by amending the lease request to include only those OCS blocks (and/or aliquots) encompassed by the final project site; alternatively, it may be addressed in the final lease terms and conditions.

### MAP OF AREA REQUESTED TO LEASE

A map of the project site is shown below in Figure 1. The GIS Shapefile for this map is included with this lease request as an attachment.



**FIGURE 1. MAP SHOWING OCS BLOCKS IN THE AREA REQUESTED TO LEASE.**

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## SITE CHARACTERIZATION

NNMREC-OSU will begin site characterization of P MEC-SETS with the procurement of a desktop study for cable routes. The study will provide important information concerning the most practical alternative cable routings, and cable design requirements. The study also will provide a comprehensive review of available site and cable route data including site-specific factors, such as the physical and geophysical environment, terrestrial considerations, environmental permitting, human factors, and infrastructure considerations. The desktop study will help to identify the specific location of the SETS within the study area. In conjunction with the cabling study, other site characterizations activities include baseline studies that are being developed in conjunction with the SETS Stakeholder Advisory Team.

### BASELINE STUDIES

NNMREC-OSU's goal is to design baseline studies in a way that informs the final location and configuration of P MEC-SETS *and* optimizes the development and implementation of the post-installation monitoring. To that end, the baseline studies are designed to characterize: 1) habitat utilization by important species and populations, including those with protections under state and federal environmental statutes; and 2) ambient signatures of two environmental stressors, electromagnetic fields and sound and noise. The preliminary baseline studies, including methodologies, locations, and timing, are described below. All survey dates are approximate and subject to change based on weather and ocean conditions and other logistical factors. In addition, sampling methods and/or frequencies may be modified slightly per coordination with and input from agencies (i.e., NMFS, USFWS, ODFW); however, the study activities will not vary significantly from what is described and considered in this document.

Associated monitoring equipment would be deployed to collect data to be used in physical and environmental studies. Most monitoring equipment would be deployed within the 2-square-nautical-mile area of interest for the P MEC-SETS facility. This equipment may include acoustic wave and acoustic Doppler current profilers, wave riders (wave measurement buoy accelerometers), acoustics data logger recovery devices, acoustic hydrophones, plankton collection plates, water quality monitoring devices (e.g., dissolved oxygen, temperature, salinity), fish tag receivers, and electromagnetic frequency monitoring equipment. However, some equipment may be deployed within a 5-nautical-mile (9.3-kilometer) radius from the area of interest to collect reference samples for comparative analyses. In all cases, equipment would be held in place by a temporary mooring and would be either floating or settled on the seafloor, without the need for fixed structures on the seafloor.

### SEDIMENTARY HABITAT & INFAUNAL INVERTEBRATES

The objectives of the sedimentary habitat and infaunal invertebrate study are to characterize and describe the presence and abundance of benthic fish and invertebrate species in the area and correlate their current distributions with measureable physical factors at the site. Because NNMREC-OSU will have conducted surveys at least three times per year for two years prior to installation of the P MEC-SETS facility, the range of variability in species composition and abundance at the site will be

determined and seasonal and inter-annual patterns will be described. These data will serve as the baseline for future monitoring studies after installation.

Sampling stations will be established at 30, 40, 50, and 70 m depth along four cross-shelf transects that are spaced ~two minutes of latitude (2 nautical miles) apart in the project area for a total of 16 box core stations. At each station a single box core will be taken (three years of data at PMEC-NETS indicated high similarity between replicate cores at a station). Sediment will be characterized and collected, and infauna will be identified and enumerated. Initial sample dates are planned to occur in June, August and October 2013.

Analysis of 2013 box core data will inform whether bi-monthly sampling needs to continue at the site or if patterns are consistent with observations from the PMEC-NETS and temporal sampling frequency can be reduced. As such, additional sampling may be conducted beyond the first year of studies to further characterize baseline conditions.

#### DEMERSED FISH/EPIFAUNAL INVERTEBRATES AND CRABS IN SEDIMENTARY HABITATS

To understand the populations of demersal fish, epifaunal invertebrates and crabs in sedimentary habitats, sampling stations will be established at 30, 40, 50, and 70 m depth along three or four cross-shelf transects that are spaced ~two minutes of latitude (two nautical miles) apart in the project area for a total of 12-16 trawl stations. Sampling 12-16 stations will require two days in each season. Sampling trips are planned for June and December 2013 and February, April, June, August, and October 2014.

Bottom trawls will be conducted with a beam trawl 2 meters wide by 70 centimeters high with a 3-millimeter (mm) mesh liner the entire length of the net and a tickler chain. Trawls will be conducted along-shore for 10 minute tows; a constant speed of ~1.5 knots will be attempted, covering a distance of ~200 to 600 m for a total area swept of ~400 to 1200 m<sup>2</sup>. A meter wheel on the sled of the trawl will provide actual measures of the distance the trawl was on the bottom. Sea stars, crabs, and elasmobranchs captured in the trawl will be identified, measured, and thrown back alive. All other collected fish will be retained for laboratory analysis where they will be identified, weighed, and measured. Gut contents of English sole, butter sole, Pacific sanddab, and speckled sanddab will be preserved for later identification. All mysid and crangonid shrimp will be sorted by species and biomass determined. Note: The beam trawl is designed to fish the bottom, with minimal incidental catch in the water column during launch and retrieval.

At the start of the first trawl day in each sampling month, nine modified (escape ring closed) crabs pots will be dropped along the 60 m depth contour. These will be left out to soak for 24+ hours and retrieved at the end of the second trawl day. All collected crabs will be sized, sexed, and released.

#### BIRDS & MAMMALS

Given the variability in the distribution and abundance of birds and mammals that are highly mobile, more frequent sampling is required to detect spatial and temporal patterns in species composition and abundance. NNMREC-OSU will attach two acoustic recording devices on the Ocean Sentinel (instrumentation buoy) during summer of 2013. One device will be in the frequency range for

monitoring bats and the other for birds. NNMREC-OSU will conduct strip transect bird and mammal surveys within and adjacent to the SETS site. Surveys will occur 1-2 times per month and will be conducted from sunrise to mid-day. An observer will be on board to conduct strip transect surveys during each cruise for benthic and epifaunal sampling described above, plus one additional survey during months when the other sampling is not occurring. The sampling should occur for 12 months, so every attempt will be made to conduct monthly surveys over the winter.

All sightings of mammals and sea turtles made from any sampling vessel outside of the jetties will be recorded on a standard observation form. When possible, a photo will be taken of the observed marine mammal. Opportunistic sightings of seabirds are of little value, as there are 10s to 100s at times as soon as you leave the jetties; thus, seabirds will be quantified with a dedicated trained observer as indicated above.

#### PASSIVE ACOUSTICS

NNMREC-OSU is beginning monitoring to obtain background acoustic levels at the P MEC-SETS site. The overall objective of the acoustic study is to obtain continuous and adaptive long-term passive measurements of ambient sound levels across a broad frequency range. This work is currently underway and not completed; however, preliminary results from the P MEC-NETS indicate that the ambient noise levels in and around the project site are relatively high due to breaking waves, wind, vessel traffic, marine mammals and fish. NNMREC researchers also expect the SETS to be noisier than the NETS because it is closer to ship traffic entering and exiting Yaquina Bay.

Autonomous drifting underwater hydrophone (ADUH) recordings will be collected at the study area beginning in 2013 on at least a quarterly basis. The hydrophone system will sample continuously at 32 kHz with a 13 kHz cutoff and a target depth of 10m below the sea surface. The instrument package will be deployed upstream of the predominant current, recovered and redeployed for a series of drifts through the area.

NNMREC-OSU will deploy two lander moorings equipped with upgraded (AUH) hydrophones to sample at 32 kHz with a 13 kHz cutoff. Continuous recording will occur in alternating 10 minute intervals on a 50% duty cycle. The moorings will be recovered and redeployed every 4 months. Moorings will be located “inshore” and “offshore” at TBD depths that span the bathymetric range of the P MEC-SETS project. In addition to ambient noise level measurements obtained from acoustic recordings by the hydrophones, a C-POD© will also be mounted on one of the lander systems. Acoustic detections and species identification from the C-POD instrument will provide important time series information regarding the vocal presence of marine mammals at frequencies above the 13 kHz cutoff of the hydrophones up to 180 kHz. Species common to the greater project area that will be monitored by the C-POD include Cuvier’s beaked whales, orca whales, false killer whales, short-finned pilot whale, common dolphin, Pacific white-sided dolphin, Risso’s dolphin, and harbor porpoise. The moorings will be recovered and redeployed every 4 months. Moorings will be located “inshore” and “offshore” at TBD depths that span the bathymetric range of the SETS.

#### ACTIVE ACOUSTICS

The deployment of WEC devices in the P MEC-SETS facility will have effects of local waves and currents. In order to establish baseline conditions, it is necessary to measure these ambient waves and currents in the SETS facility area continuously for at least one annual cycle. This will be accomplished with landers or moorings that utilize acoustic Doppler Current profilers (ADCPs).

The ADCP for currents would operate in that range 300-400 kHz for the 58-75m depth range of P MEC-SETS. Two specific ADCPs are being considered for use in the site characterization. The Nortek AWAC's typical duty cycle would be for 40 minutes of every hour, and would ping at 1.5s intervals. Then for the other 20 minutes of every hour, it will ping at 1-2 Hz to sample for waves. The AWAC transmits at a sound power level of 195 dB re: 1 $\mu$ Pa @ 1m. The TRDI ADCP would also sample at 1.5s intervals and would be on for 1 minute (40 pings), then off for 1 minute. The TRDI transmits at a sound power level of 216.3 dB re: 1 $\mu$ Pa @ 1m. Pulse lengths may vary from 0.4 to 25 milliseconds. Batteries could need to be changed every 2-4 months depending on how many external battery packs are used. If necessary, a 600 kHz or 1 MHz AWAC may be mounted in a subsurface buoy mounted looking up at the sea surface from about 20 meters down, with the same duty cycle as above.

#### ELECTROMAGNETIC FIELDS

Monitoring electromagnetic fields (EMF) for marine renewable energy is a newly emerging application, and mission-specific instrumentation is needed. WECs and marine cables associated with the P MEC-SETS facility will produce EMF that may have an effect on marine life. Because there is a lack of scientific knowledge about EMF and its effects, baseline monitoring will be conducted as part of the Proposed Action to determine the ambient level of EMF.

NNMREC, in coordination with Science Applications International Corporation (SAIC) under an Oregon Wave Energy Trust (OWET) funded project, developed a prototype instrumentation system for measuring EMF associated with WEC devices. This 1<sup>st</sup> generation system uses a high definition wideband EM receiver, capable of detecting ocean wave/swell frequencies, as well as power line frequencies and harmonics (see Figure 1). The receiver has three electric field and three magnetic field channels, 32-bit resolution, and 1 kHz sampling. It also has separate compass, tilt sensors. ZongeANT2 induction coil magnetic field sensors are also included, which provide a frequency passband <0.1 Hz -> 1 kHz, noise ~ 50 ft./VHz at 10 Hz, and flat response from 1 Hz -1 kHz within  $\pm$ 50 mdB. In addition, short-span electric field dipole receivers, silver-silver chloride electrodes, Polyamp PA3004 high gain differential preamps providing 66 or 86 dB gain, <1 nV/VHz at 1 Hz sensitivity, -180 dB noise relative 1V at 1Hz are included.

NNMREC has also developed an advanced, 2<sup>nd</sup> generation monitoring system to characterize ambient EMF and measure EMF during an energized WEC test. While both EMF systems have nearly identical sensing capabilities, the 1<sup>st</sup> generation instrumentation is designed only to carry out "spot measurements" of EMF on the seafloor for short periods of time to establish baseline field levels over a grid of survey locations on the seafloor. The 2<sup>nd</sup> generation system can also carry out sustained time series observations at fixed locations on the seafloor, while also accommodating higher sampling rates

(4 kHz vs 1 kHz), due to the addition of a seismic sensor and a modest improvement in the magnetic field sensor noise ceiling.

EMF surveys performed under the Proposed Action would likely be performed with 2<sup>nd</sup> generation system described above; however, it is possible that the 1<sup>st</sup> generation system would be used as well. The EMF study may comment in 2013; however, the EMF surveys may not start until 2014 because the survey equipment is being used in Hawaii. Regardless, baseline EMF surveys will be performed well in advance of installation and operations of the P MEC facility. The results of this study will be used to characterize the ambient EMF levels in the area and inform post-installation monitoring design for P MEC-SETS.

## OBJECTIVES AND PROPOSED FACILITIES

As a full service, grid connected test facility, SETS will provide the opportunity to optimize WECs and arrays, refine deployment, retrieval, operations and maintenance procedures, increase system reliability and survivability, and learn about potential environmental effects. NNMREC will provide assistance through each stage of testing: Deployment; Testing Plans, Protocols and Procedures; Research and Monitoring Plans (including IP plans); Device Monitoring; Environmental Monitoring; Data Analysis; Demobilization; and Removal and Decommissioning. By offering numerous WEC testing options in conjunction with transmission and grid interconnection infrastructure, SETS will facilitate wave energy technologies' progress from early-stage, ocean testing through final commercial demonstration. A sample depiction of the PMEC-SETS is shown in Figure 2.

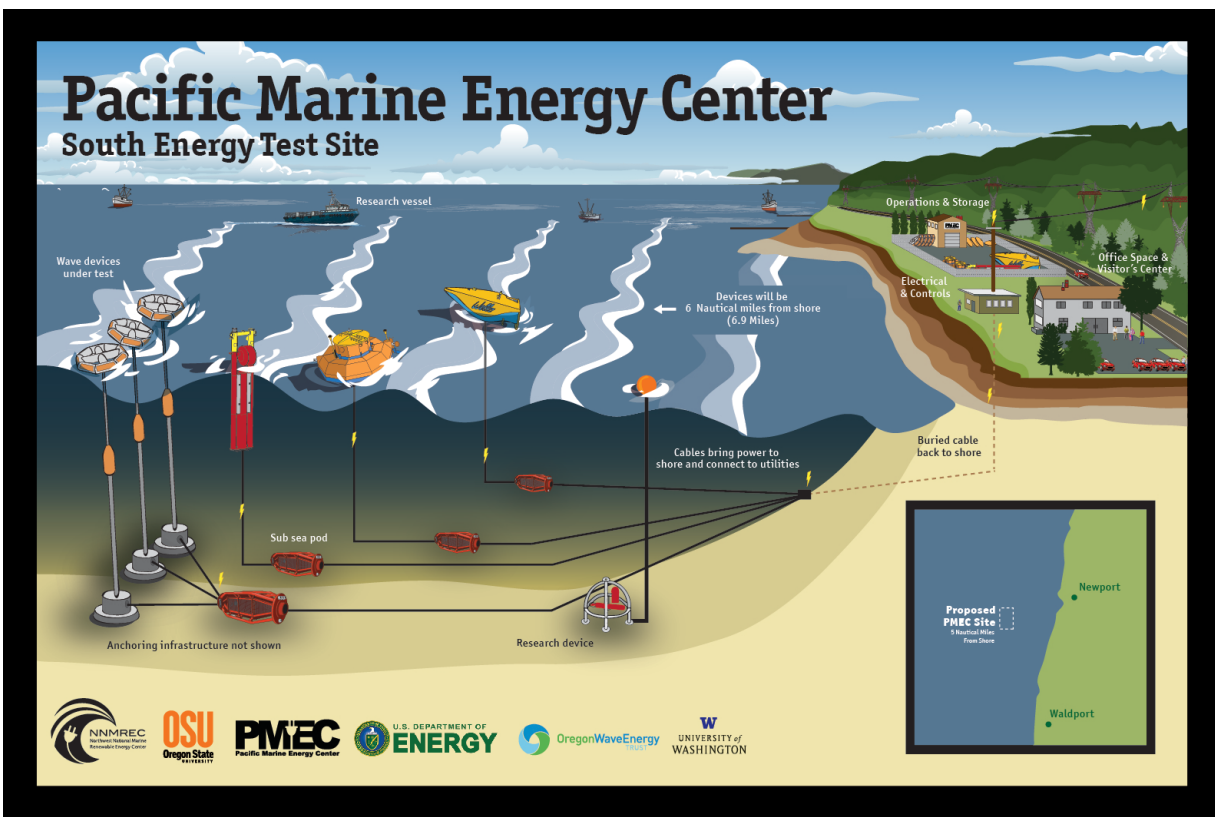


FIGURE 2: SAMPLE DEPICTION OF PMEC-SETS FACILITY

### OFFSHORE FACILITIES

Primary project components would include the test berths (WECs, moored and anchored to the ocean floor), marine transmission cables, and an onshore control center to transfer power to grid. A total of four grid-connected test berths are planned, each with its own buried subsea transmission line. It is anticipated that each berth could test up to five WECs of the same type to enable array testing; however, no more than ten WECs would be deployed at SETS at one time. The maximum capacity of



SETS is anticipated to be 10 MW; the cables will vary in capacity with the largest cable expected to be 5 MW. Final project design and analysis will determine the capacity of each test berth and marine transmission cable.

### **WAVE ENERGY CONVERSION DEVICES**

Over the lifetime of the P MEC-SETS, a number of types of WEC devices are expected to be tested. Because wave energy generation is in the early stages of development, a wide variety of technology designs are currently being conceptualized, designed, and tested. The U.S. DOE's Marine and Hydrokinetic (MHK) Technology Database, which also includes tidal, current, and thermal devices, lists over 250 different MHK technologies.<sup>2</sup> This lease request does not describe every possible WEC technology type or category known; instead, it focuses on those general WEC technology types that are reasonably expected to be tested at P MEC-SETS, including four types of WEC devices capable of operating in water depths of approximately 60 meters.

More specific technical details regarding the devices expected to be tested will be developed during the regulatory process. To this end, NNMREC-OSU is working with OWET to gain information directly from developers interested in testing at P MEC-SETS. Such details will be included in the technical and environmental documentation developed to support lease review, approval and issuance. A general description of the anticipated types of WEC designs is provided below; examples are included in Appendix G.

- **Pitching/surging/heaving/sway devices** are any of several device designs that capture wave energy directly without a collector by using relative motion between a float, flap, or membrane and a fixed reaction point. The float, flap, or membrane oscillates along a given axis depending on the device and mechanical energy is extracted from the relative motion of the body part relative to its fixed reference.
- **Oscillating water columns (OWC)** are partially submerged structures in which water enters a chamber through a subsurface opening. Wave action causes the captured water column to move up and down like a piston, forcing the air trapped above the water column to move through an opening connected to a turbine. No water travels through the turbine blades during the operation of this type of WEC device. Although there are shore-based and floating OWC designs, only floating types could be tested at SETS.
- **Point absorbers** are floating or submerged structures with components that capture energy from the vertical motion of waves, which drives electromechanical or hydraulic generators. Point absorbers may be fully or partly submerged, floating or rigidly anchored, and are relatively small compared to the wave length.
- **Horizontal Pendulum** WECs have structural hulls that contain all moving parts, thus no components are exposed to the ocean. Inside, the device will have a pendulum that rotates with pitch, roll and sway of the ocean waves.

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<sup>2</sup> Available online at: <http://www1.eere.energy.gov/windandhydro/hydrokinetic/default.aspx>

## **MOORING SYSTEMS**

Because a number of different WECs could be tested at the project site, the specific anchors and mooring configurations will vary somewhat. However, because the physical and environmental conditions within the project site are relatively uniform, it is unlikely that the types of anchoring and mooring systems would vary significantly. Anchoring systems could include gravity-based anchors (GBAs), drag anchors, deadweight anchors, suction-installed pile anchors, and/or plate anchors. It is possible that some devices could utilize the same anchors, and possibly mooring lines; for example, if an incoming WEC device could utilize an anchor and/or mooring configuration already in place, then the system could be left in place between tests to limit bottom disturbance.

Little information on WEC mooring designs is available to the public; however, it is expected that all mooring configurations at SETS would require relatively taut lines capable of tensioning large devices. While three- to four-point anchoring layouts could be used, NNMREC is researching the feasibility of single point moorings, a configuration which is desirable for both stakeholders, such as fisherman, as well as device developers.

It is anticipated that WEC devices, mooring buoys, and any subsurface floats would be coated with an antifouling paint to prevent marine life from colonizing on these project components; however, NNMREC-OSU would require that all WEC devices to be tested at SETS use only TBT-free antifouling paints and coatings. Details specific to anchoring and mooring systems will be provided in the technical and environmental documentation developed to support lease review, approval and issuance.

## **CONSTRUCTION & INSTALLATION**

No on-site construction activities in the area requested for lease would be associated with the PMEC-SETS. All project components would be constructed at land-based facilities prior to being installed at the project site. Existing pier facilities (described in the Port and Marine Infrastructure section) would serve as mobilization sites. The marine transmission cables, WECs, mooring and anchor systems, navigational buoys, and monitoring equipment, would be staged at mobilization sites for the installation vessels to pick up and transport to the project site.

Installation of the mooring systems would occur prior to WEC deployment. The Oceanus<sup>3</sup>, a mid-sized research vessel which accommodates a crew of 12 and a scientific party of 19 for up to 30 days at sea, is one candidate vessel for deploying the mooring systems. Once the anchors and mooring systems are in place, the WECs would be deployed. The WECs would be transported by truck, barge, or marine tow transport to Newport for deployment. Identification of applicable permits required for shipment would be the responsibility of the WEC developer. If transported from a foreign build location, proper permits and licenses would be required to enter the U.S. Prior to deployment, pier-side tests would be performed to check the operation and integration of all equipment to verify the readiness of systems for mooring, connection, power transmission, and shore communications.

WEC deployment plans would be unique to each device; however, it is anticipated that the WECs would be towed or barged to the site, configured, and attached to the mooring system. An example vessel

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<sup>3</sup> Specifications for OSU Research Vessels can be found at <http://ceoas.oregonstate.edu/ships/>.

likely to be used for this task is The SEACOR QUEST, a 160-foot vessel out of Astoria. Once the WEC is attached to its mooring system, it is anticipated that a trunk cable would be attached to the WEC device to connect it to the subsea transmission cable. A detailed plan would be developed by NNMREC in coordination with the device developer to address each WEC installation and connection to the subsea transmission cable.

Each test berth at P MEC-SETS will include a subsea power and communications cable and connector system. The design is expected to be similar to the connectors utilized by the EMEC. Each WEC will require a technology-specific cable design for the portion of cable connecting to their device. The WEC cable design must comply with the cable and connector requirements of P MEC in order to ensure compliance. A subsea connector that will rest on the seabed; a mooring line and marker float would be used to hoist the connector to the deck of an operations vessel, where the P MEC connector would be mated to the WEC connector. Once the connection is made, the mated connectors would be lowered to the seabed.

### **OPERATIONS & MAINTENANCE**

NNMREC-OSU will require that the technology developers submit formal plans for review and approval prior to the installation of any WEC. In addition to Installation/Removal Plans and Anchor/Mooring Plans, each developer will be required to provide plans for Operations and Maintenance, Spill Contingency and Response, Emergency Response and Recovery, Safety Management Plan, and Navigational Lighting. All WEC device tests would also be subject to the conditions identified in the Lease Agreement, FERC License Order and Final NEPA documentation for the P MEC-SETS. Details specific to Operations and Maintenance procedures will be provided in the required technical and environmental documentation to support project approval and lease issuance from the BOEM.

### **REMOVAL & DECOMMISSIONING**

In addition to the plans noted previously, NNMREC-OSU will require each technology developer to submit Removal and Decommissioning Plan for each WEC device tested at P MEC-SETS. In addition, NNMREC-OSU will develop a Removal and Decommissioning Plan for SETS as part of the final project design, which will be provided as part of the technical documentation to support project authorization.

Anchors could be retrieved by a vessel with adequate assets and load-handling capabilities or decommissioned on site if they would be used for the next WEC test. If being removed completely, the anchors and mooring lines would likely be retrieved by attaching a recovery line to the anchor and then winching it to the surface. This may be accomplished using a remote-operated vehicle (ROV). It may be possible to recover the anchors by using the mooring lines; if this is the case, the ROV would not be needed. Suction-installed pile anchors could be retrieved by pumping water into the anchor chamber, creating positive pressure that forces the embedded anchor out of the sediment. If decommissioned on site, embedment anchors such as plate or pile anchors could also be cut off at the ocean floor using underwater acetylene torches, leaving the buried portion of the anchor in place.

As mentioned previously, the intent would be to limit removal of the anchors to the greatest extent possible to limit bottom disturbance; however, anchor removal and replacement could occur

periodically consistent with the terms of the lease agreement and other project authorizations. If the WECs are to be disposed of after the testing period, NNMREC-OSU would require that all device and all associated materials are disposed of in accordance with federal, state, provincial, and local environmental control regulations and at permitted facilities. Throughout this process, NNMREC-OSU would coordinate with the WEC developers to ensure conformance with any conditions identified in the Lease Agreement, FERC License Order and/or Final NEPA documentation to ensure a smooth and orderly removal.

Although a variety of WECs would be tested at SETS, it is likely that the equipment and procedures employed in removal and decommissioning of each test would be very similar to those employed in the removal and decommissioning of the 2012–2013 WET-NZ test at the P MEC-NETS. A detailed removal and decommissioning plan would be prepared for each WEC device tested at the SETS site. In general, when a WEC test is complete, the device would be de-energized and vessel of opportunity would be used to disconnect the subsea cable. With the cable detached, the WEC device and its mooring system would be removed from the test site.

## **POWER TRANSMISSION & GRID INTERCONNECTION**

The P MEC Conceptual Design Report was completed in March 2013 and can be found in Appendix H; much of the detail for this section of the application can be found in that report. Various alternatives concerning power transmission, cable routings, and grid infrastructure were considered, as well as cost. This study will be used as a core input to the P MEC-SETS design process. The “Newport Site Proposal for P MEC” (provided in Appendix F) also includes information about possible cable landing points for electrical grid interconnection.

## **MARINE TRANSMISSION CABLES**

Marine transmission cables would transmit energy, as well as performance and environmental data, from the SETS test berths on the OCS through the Territorial Sea to an onshore connection point. Four marine transmission cables are planned, one for each test berth. Marine transmission cable alternatives (e.g., voltage, materials, lengths, etc.) were considered in detail P MEC Conceptual Design Report. The P MEC-SETS design will include a comprehensive set of engineering and operational requirements that minimize risks to equipment and personnel. In addition, each deployed project will undergo a thorough review process in order to ensure compliance with P MEC requirements.

As noted previously, conceptual plans for offshore power cables was considered in detail in the P MEC Conceptual Design Report (Appendix H). The report provides preliminary guidance for how to design specific aspects of P MEC-SETS. This topic will be fully developed during SETS design. TE Subcom’s Global Sentinel, stationed in Portland, Oregon may be capable of installing the SETS subsea cables. Since the final design of the cables has not yet been determined, precise vessel requirements are unknown. Vessels might be commissioned between other larger projects, a possibility that will be pursued for cost savings potential. Cable crossings are not anticipated at this time. Considerations for cable crossings, including cable protection requirements, will be developed in the desktop study and cable survey, if applicable.

In addition to evaluating marine cable options, NNMREC-OSU is coordinating with resource agencies on the environmental characteristics of the area that cables would transit to help determine the best configuration for SETS. While coral reef interactions are not anticipated for this project, rocky reefs or other geophysical features could be affected by the cable installation process. Potential effects will be identified during the cable routing survey, and should coral reef interactions be identified, mitigation measures will be developed prior the further progression of the cable routing design. NNMREC-OSU is also consulting with the U.S. Army Corps of Engineers and the Environmental Protection Agency in regards to their activities and jurisdiction over, respectively, dredging activities and ocean disposal sites. Additional information about the marine transmission lines and cable routes is being developed as part of the final project design and will be provided in the technical and environmental documentation to support lease review, approval and issuance from the BOEM.

### **ONSHORE CABLE LANDING OPTIONS**

Six marine cable landing options were identified and studied by the Newport community siting team; the three preferred options identified by the community are listed below:

- **Lost Creek State Park:** 6.5 NM distance from ocean site, public ownership (Oregon State Park), mid-range marine cable run, shortest PUD cable run, fewer rocky reef issues.
- **South Beach State Park:** 5.5 NM distance from ocean site, public ownership (Oregon State Park), multiple landfalls, existing infrastructure and access, rocky reef issues.
- **Yaquina Bay South Jetty:** 6 NM distance from ocean site, public ownership (Oregon State Park), P-2/Public Recreation zoning, existing infrastructure and access, close to ship channel, rocky reefs, highest cost.

Additional on-shore cable options identified in the Newport community site proposal for P MEC (Appendix F) include Don Davis Park/Nye Beach, Lighthouse State Park, and Thiel Creek. Preliminary evaluation indicates that Lost Creek State Park is the only landfall option without rocky reef issues. In addition, it has the shortest on-shore cable run and is the most southerly option, which could be advantageous if the P MEC-SETS site is located in the southern portion of the project area. South Beach State Park was also identified as a preferred option by the Newport site team, as it has multiple landfalls, existing infrastructure and access, and it is the closest to the PUD South Beach Power substation. However, there are potential issues with the marine cable routes to this landfall location because of nearby rocky reefs and dredge spoil areas. Similarly, the proximity of the Yaquina Bay South Jetty site to rocky reefs, dredge spoil areas, and the commercial shipping channel limit the options for marine cable routes and increases the costs of shore-connection. While this option has existing infrastructure and access, it may be subject to additional restrictions because it is zoned as a Public Recreation area.

As part of the final project design process, NNMREC-OSU is conducting further analysis to determine optimal onshore-cable landfall locations and grid-interconnection points for SETS. NNMREC-OSU is also coordinating with resource agencies to ensure all relevant environmental information is considered, including seafloor substrate, rocky reefs, biological resources, cable routes, and other issues. Information about the onshore cable landing point will be provided to the BOEM as soon as the location

is determined, and further details will be included in the technical and environmental documentation developed to support project review.

### **GRID-INTERCONNECTION**

The Central Lincoln Public Utility District (CLPUD) has high capacity (12.5 kV) distribution lines along Highway 101 from Newport to Seal Rock, close to potential cable landing sites for SETS. NNMREC-OSU began coordinating with PUD representatives in 2012, and they have confirmed that grid interconnection for SETS is viable anywhere on the coast adjacent to the proposed project site. Connection of P MEC to the local grid will require standard grid connection equipment typical for industrial users. Power conditioning and other electrical operations will be integrated into the onshore facility prior to being connected to the grid infrastructure. In addition, the CLPUD has experience installing and operating SCADA, ION metering, Distribution Automation, Smart Grid technologies and fiber optic communications. This expertise, along with the CLPUD's proven track record of operating a highly reliable system, will facilitate a successful test facility operation at SETS.

NNMREC-OSU is also coordinating with Bonneville Power Authority (BPA) in regard to power transmission and grid-interconnection for SETS. The CLPUD has existing telemetering with BPA's Toledo substation, which would allow metering as required to meet federal interconnection requirements. In addition to power transmission and grid-connection, NNMREC-OSU is also exploring power purchase options with the CLPUD and BPA.

Grid integration and transmission feasibility studies have not yet been developed. Once the cable routing survey and desktop study are completed, the application for grid interconnection will be developed and submitted to BPA, in collaboration with CLPUD. The application submittal will place the SETS project into the BPA project queue and will result in the development of a grid interconnection study by BPA. This study will help to ensure that the proper design requirements are developed during SETS design.

### **TERRESTRIAL INFRASTRUCTURE**

Alternatives for terrestrial infrastructure were developed in detail in the attached P MEC Conceptual Design Report (Appendix H) and the Newport Site Proposal for P MEC (Appendix F). Each of the potential grid connection locations for P MEC-SETS subsea cables (as described above) calls for a directionally drilled casing that would house the cables through the transition from sea to land. The subsea cables would be terminated and transitioned to terrestrial-based cabling technologies. It is anticipated that this would occur in a small onshore structure where electrical switchgear and conditioning equipment, as well as monitoring and communications equipment, will be located. This is expected to require a new structure with a relatively small footprint, since primary data acquisition, controls, monitoring and other equipment will be located at a separate site. The existing fiber optic infrastructure available at the land-based connection location will enable this configuration.

CLPUD has stated that they can handle additional capacity of up to 6.5 MW; NNMREC-OSU will coordinate with both CLPUD and Bonneville Power Administration on upgrades necessary to

accommodate the planned 10MW generating capacity of P MEC-SETS. Details of grid connection will be determined with CLPUD once on-shore connection location is specified.

Since Newport, Oregon was selected as the location for P MEC-SETS, NNMREC plans to leverage the Hatfield Marine Science Center (HMSC) facilities for office space. In addition, HMSC is home to a visitors' center that reaches over 150,000 visitors per year; NNMREC will work with HMSC to provide outreach to the broad community about marine energy.

## **ONSHORE SUPPORT FACILITIES & STAGING AREAS**

Maritime vessels will be used for a multitude of activities related to the lifecycle of P MEC-SETS. Specialty vessels are often utilized for specific activities such cable routing surveys, cable installations, and WEC project deployments. The actual vessels that will be utilized for some specialty activities have not yet been identified. Vessel requirements for SETS installation will be developed during final design, including the indication for needed vessel capabilities. Future vessel requirements for utility-scale WEC devices must have significant lifting capabilities, which cannot be currently met by existing vessels. Vessels currently available in the region for operational activities include typical tug boats, simple barges and fishing vessels. Rigid-hulled inflatable boats (RHIBs) are often used for everyday observation and survey activities. The UNOLS vessels staged in the Newport area are available for OSU activities, including the R/V Oceanus and the R/V Pacific Storm. Privately held companies such as NRC Environmental Services regionally operate vessels, which stages vessels in Astoria, Oregon.

A key benefit of the Newport area is that it has the necessary infrastructure, services expertise, and maritime capability to support the needs of the development of offshore wave energy projects. Stakeholders in this supply chain include ports, boat yards, maritime services, fabrication and welding. NNMREC-OSU and Northwest Energy Innovations (NWEI) successfully leveraged this regional supply chain for the successful deployment of the WET-NZ device in summer 2012. An extensive supply chain analysis is forthcoming, which is being procured as part of NNMREC's P MEC pre-design process.

The Ports of Newport and Toledo would likely serve as the primary staging areas for P MEC-SETS. In addition to the resources available in Newport and Toledo, NNMREC-OSU has identified facilities and services in and around Yaquina Bay to support installation, operations and maintenance, and removal/decommissioning activities.

### **PORT OF NEWPORT**

The Port of Newport is one of only three deep draft ports on the Oregon coast, and its facilities includes the Newport International Terminal, a commercial fishing vessel marina, and a recreational vessel marina (the South Beach Marina). It has traditionally serviced the forest product industry and is served by Land – Sea – Air – Rail. As a commercial shipping port, there will be ample opportunity for inbound and outbound freight needed to support SETS activities, and the nearby municipal airport can handle jet traffic and daily air shipping. The Newport International Terminal is a crucial link between Oregon's central coast highways and the movement of marine commerce. The International Terminal includes two docks, warehousing, and administrative offices, and an on-site customs agent for international freight. The Port of Newport recently expanded the International Terminal facilities with refurbishments

and upgrades, and additional moorage and support facilities were added after the Port of Newport was selected for NOAA's Marina Operations Center-Pacific Homeport in 2009.

#### NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION MARINE OPERATIONS CENTER

In August 2009, the National Oceanic and Atmospheric Administration (NOAA) signed a 20-year lease with the Port of Newport for the Marine Operations Center-Pacific (MOC-P). On August 20 and 21, 2011, NOAA celebrated the construction of the MOC-P in the Port of Newport with a 2-day dedication event. The Newport facility includes a 1,300 foot-long pile-supported berthing pier in Yaquina Bay, a small boat dock, and a group of upland facilities, including buildings and site improvements. The facilities can support six NOAA vessels, 60 shore side personnel, and 110 crew members.

#### OCEAN OBSERVATORIES INITIATIVE

The Ocean Observatories Initiative (OOI) is a National Science Foundation – Division of Ocean Sciences program that focuses the science, technology, education, and outreach of an emerging network of science-driven ocean observing systems. The OOI will conduct ocean science using an integrated ocean observatory with a network of interactive nodes studying interrelated ocean processes on coastal, regional, and global spatial scales. The Endurance Array is a multi-scale array utilizing fixed and mobile assets to observe cross-shelf and along-shelf variability in the coastal upwelling region of the Oregon and Washington coasts. This array will consist of six observation sites—three off the coast of Newport and three near Grays Harbor, Washington—and a network of surface moorings, seafloor platforms, and undersea gliders. However, none of the OOI components off the coast of Newport would be located within the SETS project site. Construction and instrument testing began in 2011, and installation is planned to begin by mid-2013.

#### **PORT OF TOLEDO**

In addition to the Port of Newport, the nearby Port of Toledo provides important marine services and infrastructure that can support the SETS facility. The Port of Toledo, which is located approximately 5 miles in-land from Newport harbor, features 25-ton and 85-ton mobile boat lifts, a 200-ton floating dry dock, a 15-ton hydro-crane, and man-lifts and forklifts. As an open boatyard, outside marine service vendors are licensed to work through the port facilities and all aspects of vessel maintenance can be performed through either boatyard staff or local service providers. Marine electricians, welders, fitters, hydraulic specialists, sandblasting and painting services are readily available, and these capabilities and experience will serve wave energy developers. Toledo is served by rail that loops through the city and serves several locations, connecting inland along the Yaquina River toward Corvallis. Regular dredging maintains the channel for barging or towing out to sea.

The Port of Toledo's land, buildings, equipment and infrastructure provide an excellent staging area for WEC assembly and maintenance of wave energy devices in a protected environment, and the fully functioning docks and lifts can support WEC deployment and removal activities. NNMREC-OSU has already established a close working relationship with the Port of Toledo, and the boatyard supported the staging, outfitting, launch, and retrieval of the Ocean Sentinel instrumentation buoy and the WET-NZ wave energy device in 2012. In addition to having demonstrated capability to support wave energy development, the Port of Toledo recently completed and adopted a Strategic Business Plan that



highlights its Boatyard Build-Out Plan. The permits for the in-water portion of the project have been filed, and construction is set to commence in November 2013. With the expansion of the boatyard to include a 300-ton mobile lift and a covered high-bay work area, the Port of Toledo could easily support existing and future SETS service and storage needs.

### **REGIONAL MARINE AND INDUSTRIAL INFRASTRUCTURE PORT OF TOLEDO**

In addition to the resources available in Newport and Toledo, NNMREC-OSU has identified sites and services in and around Yaquina Bay to support SETS installation, operations and maintenance, and removal/decommissioning activities.

- *American Bridge Manufacturing* – Located on Bolon Island on the main Umpqua Channel, a heavy manufacturer of structural steel buildings, bridges, and complex structures. ABM has a 32 acre industrial site directly served by rail, with 150 ton lift capacity and direct water access.
- *Fred Wahl Marine* – Fishing and utility shipbuilder located in Reedsport, with marine rail access to the main Umpqua Channel.
- *Reedsport Machine and Fabrication* – Located in the Winchester Bay Marina, Reedsport Machine and Fabrication specializes in boat repair, machining, and specialty fabrication with 80 ton haul out capacity.
- *ORCA Divers* – Industrial diving and marine construction business in Winchester Bay; experience with underwater construction, demolition and salvage; participated in the 2012 WET-NZ deployment at the NNMREC-OSU Non-Grid Test facility in summer 2012.
- *Port of Umpqua Dock* – Commercial dock at the Winchester Bay Marina that supports the local fishing and marine businesses. The dock has a crane capacity of 3,200 pounds, and dockside storage available.
- *Knife River Graving Dock* – Located on the east side of Bolon Island, the Knife River Graving dock facility includes a tide served graving dock with access to the main Umpqua Channel on a 4 acre industrial site.
- *Knife River / LTM Gravel Yard* – Located at the east entrance to Reedsport along Highway 38, the yard is an approximately 10-15 acre industrial site with access to the main Umpqua Channel.
- *International Paper Gardiner Mill Site* – The International Paper Gardiner Mill Site is 330 acres of industrial property with dock access to the Umpqua side channel and turning basin.
- *Oregon International Port of Coos Bay* – Oversees maintenance and development of the Coos Bay deep water channel and channel-served industrial properties. The Port owns and operates many dock and marine properties along the channel, and is a conduit to the other marine industries in the area.

- *Knutson Towboat* – Knutson Towboat Company provides ship assist services, barge towing, dock services, fabrication and repair, and shipbuilding services in the Coos Bay area.
- *Sause Brothers Ocean Towing* – Provides ocean towing, cargo handling, ship assist, and marine construction and repair services; owns and operates fleet of towboats and cargo serving West Coast U.S.
- *Coos Bay Towboat* – Ship assists and pilot services.
- *Southern Oregon Marine* – Constructs, modifies, and maintains tugs, barges, and other marine vessels. SOMAR has large dockside cranes and dry-dock capacity.
- *DB Western* – DB Western is a pressure vessel and processing equipment fabricator with access to the Coos Bay main channel through a port owned dock; has performed vessel repair and marine equipment fabrication at its North Spit location.
- *Giddings Boat Works / Tarheel Aluminum* – Located in Charleston near the Coos Bay entrance, builds, modifies, and repairs commercial fishing vessels and workboats.

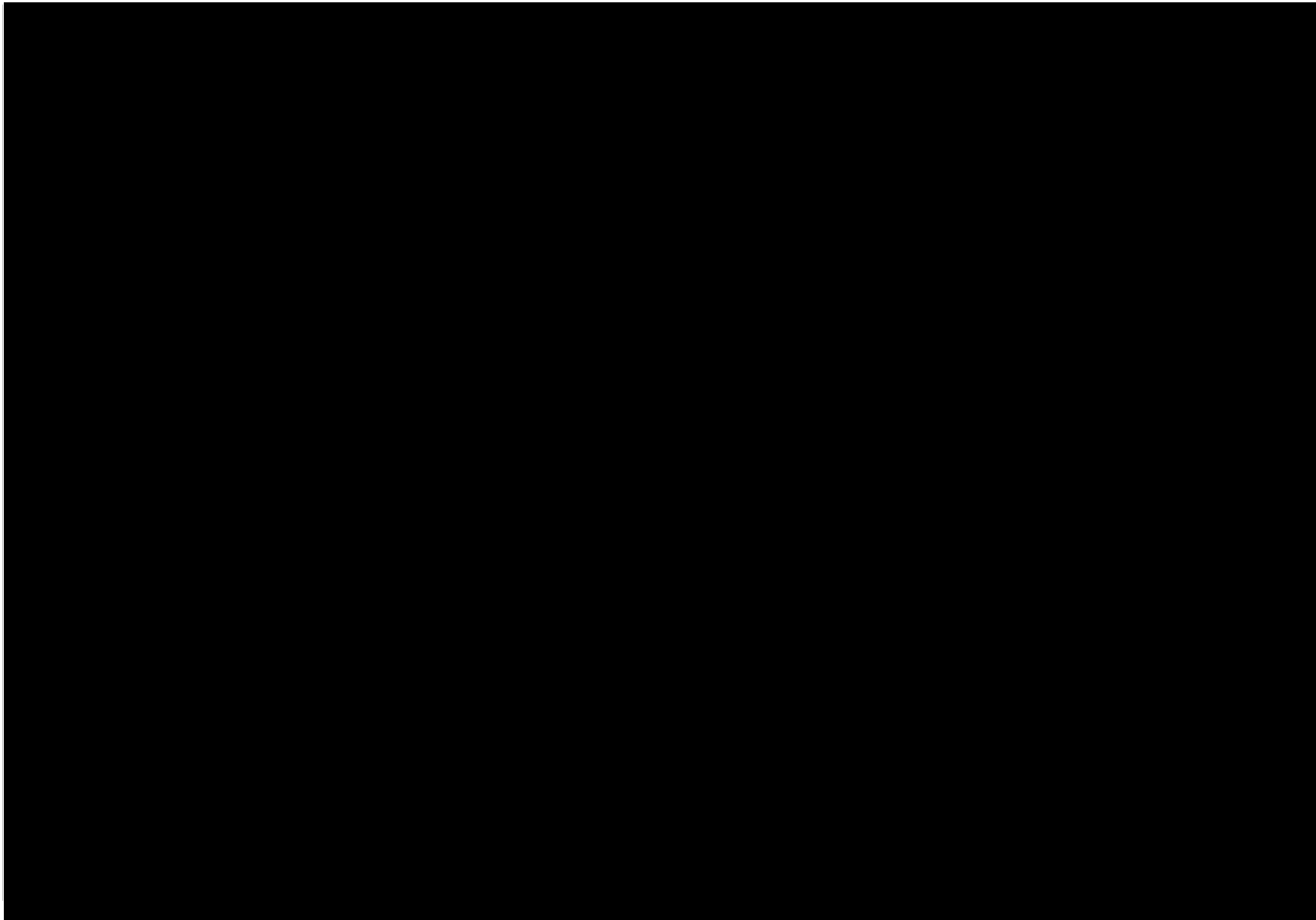
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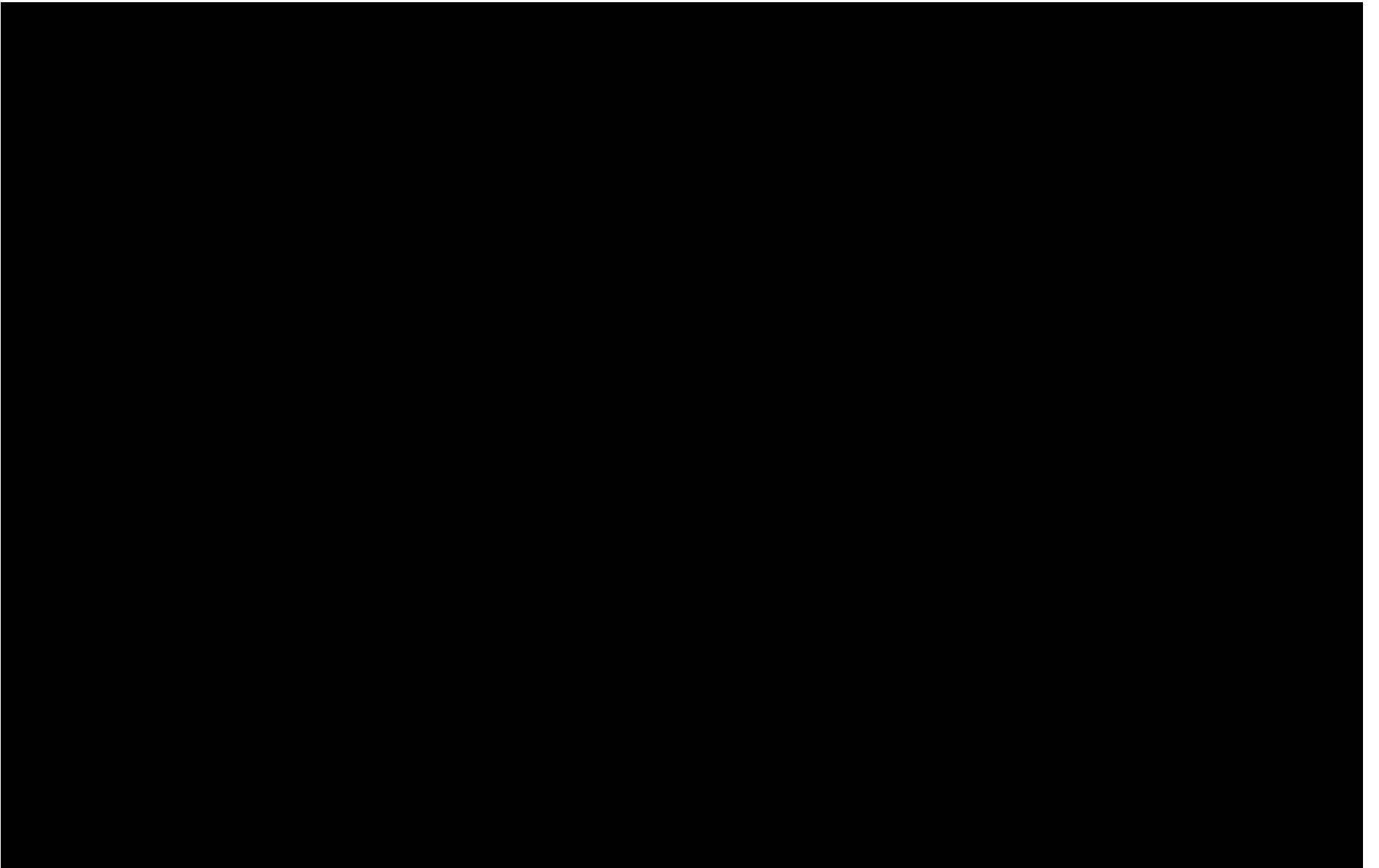
## GENERAL SCHEDULE OF ACTIVITIES

The PMEC-SETS site selection process was completed in January 2013, and the submittal of this lease request marks the initiation of the BOEM leasing process. NNMREC-OSU plans to initiate the Federal Energy Regulatory Commission (FERC) Licensing Process this summer [REDACTED]. Pre-design of the SETS project is also underway and will be completed prior to the submission of the License Application to FERC, which is expected to occur in [REDACTED]. The precise sequence of the overall regulatory process will depend on a variety of factors, but NNMREC-OSU anticipates completing the regulatory process in [REDACTED].

Upon completion of the regulatory process, the project will enter the installation phase, and NNMREC-OSU expects to begin installation activities [REDACTED]. The subsea cables and test berths (e.g., mooring systems, monitoring equipment, and navigational aids) will likely be installed at the same time, but it is possible that the infrastructure will be installed in stages. Regardless, NNMREC-OSU plans to commence SETS operations in [REDACTED] with the deployment of the first WEC(s) at the facility. It is expected that each WEC deployed will be tested for one – three years, although this duration will depend on specific technology developer’s needs. Based on experiences of other renewable energy test facilities, such as the National Renewable Energy Laboratory and the EMEC, PMEC-SETS is expected to operate for up to 25 years; as such, NNMREC-OSU is seeking a 25 year term for this research lease, with final lease terms to be negotiated with BOEM at a future date and identified through the regulatory process.

[REDACTED]





## OCS LEASING TIMELINE

As part of the development of the regulatory strategy for the P MEC-SETS, NNMREC-OSU has implemented a collaborative process involving the relevant agencies and stakeholders to collectively explore the project and identify key regulatory and environmental considerations. NNMREC-OSU began engaging with BOEM and the Federal Energy Regulatory Commission (FERC) in fall 2012 to share information about P MEC-SETS and prepare for the regulatory process. In January 2013, NNMREC-OSU formed the P MEC Regulatory Work Group, which is comprised of the primary federal and state agencies involved in the permitting process. In coordination with this group, NNMREC-OSU has identified the various authorizations that will be needed for the P MEC-SETS facility. These authorizations are shown in Tables 2 and 3 below.

### REQUIRED AUTHORIZATIONS, APPROVALS & PERMITS

The primary authorizations required for P MEC-SETS are listed in the table below; as noted, the precise process sequence and authorization instruments will depend on a variety of factors.

**TABLE 2: REQUIRED AUTHORIZATIONS, APPROVALS & PERMITS**

<i>Agency</i>	<i>Authorization</i>
<b>Federal Energy Regulatory Commission</b>	Hydroelectric License
	Small Grid Interconnection Approval
	NEPA Compliance
<b>Bureau of Ocean Energy Management</b>	Renewable Energy Research Lease
	NEPA Compliance
<b>U.S. Army Corps of Engineers</b>	Nationwide Permit 52
<b>U.S. Department of Energy</b>	NEPA Compliance (for funding action)
<b>U.S. Coast Guard</b>	Private Aids to Navigation Permit
	Notice to Mariners
<b>U.S. Fish and Wildlife Service</b>	Migratory Bird Treaty Act Compliance
	Endangered Species Act Section 7 Consultation
<b>National Marine Fisheries Service</b>	Endangered Species Act Section 7 Consultation
	Magnuson-Stevens Act Consultation
	Marine Mammal Protection Act Consultation
<b>Environmental Protection Agency</b>	Section 401 Water Quality Certification (Federal Waters)

<i>Agency</i>	<i>Authorization</i>
<b>Oregon Department of Environmental Quality</b>	Section 401 Water Quality Certification (State Waters)
<b>Oregon Department of Land Conservation &amp; Development</b>	Coastal Zone Management Consistency Determination
<b>Oregon Department of Fish &amp; Wildlife</b>	Compliance with State fish and wildlife management mandates and conservation goals
<b>Oregon Department of State Lands</b>	Easements for Cables in Territorial Sea
<b>Oregon Parks &amp; Recreation Department</b>	Ocean Shore Permit
<b>State Historic Preservation Office (OPRD)</b>	Cultural Resources Review
<b>Lincoln County Planning Commission</b>	Land-Use Compatibility Statement
<b>Bonneville Power Administration</b>	Interconnection Approval

**ADDITIONAL AUTHORIZATIONS**

Depending on the final project design, additional authorizations may be needed, which may include (but are not limited to) the following:

**TABLE 3: POTENTIAL AUTHORIZATION, APPROVALS AND PERMITS**

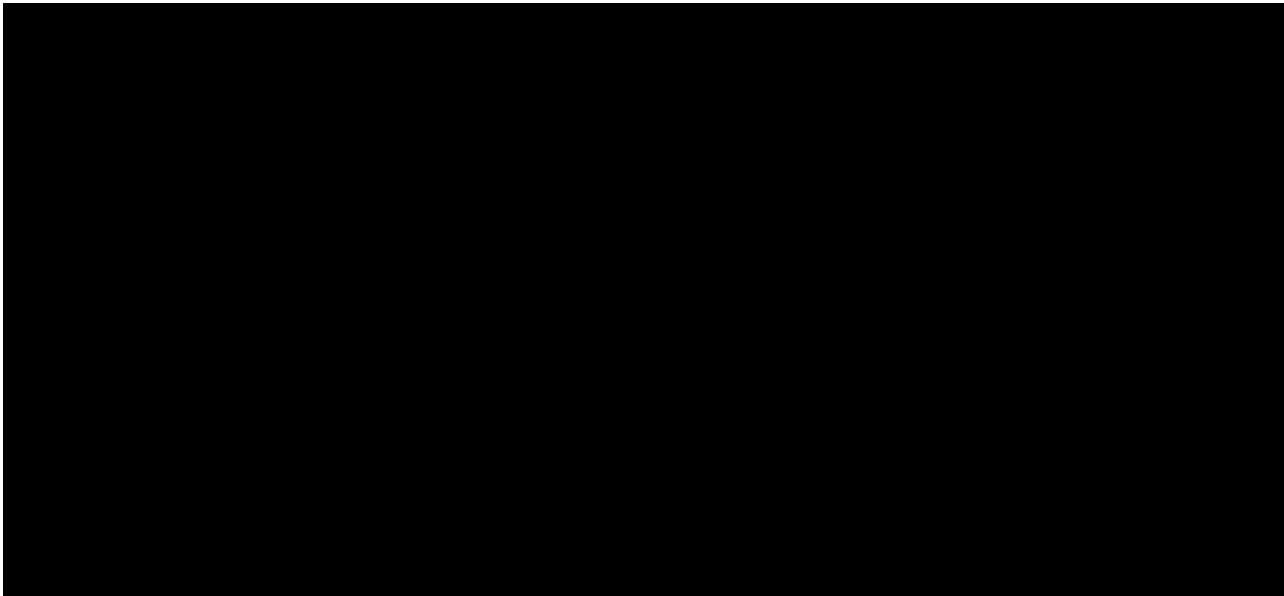
<i>Agency</i>	<i>Authorization</i>	<i>Project Structure/Activity</i>
<b>U.S. Army Corps of Engineers</b>	National Pollution Discharge Elimination System Permit	construction on onshore facilities (if discharge meets thresholds)
	Wetlands Permit	Placement/construction of onshore facilities in wetlands area
<b>Oregon Department of State Lands</b>	State Removal/Fill Permit	Marine transmission cables within state waters, (if meet thresholds)
	Right-of-Entry Authorization	Site assessment Studies (e.g., geophysical surveys)
<b>Lincoln County</b>	Wetlands Permit	Placement/construction of onshore facilities in wetlands area

<i>Agency</i>	<i>Authorization</i>	<i>Project Structure/Activity</i>
<b>U.S. Coast Guard</b>	Restricted Navigation Area	WEC berths, cable corridor
<b>Oregon Fish &amp; Wildlife Commission</b>	Fishing Closure	Marine Transmission Cable Corridor (within state waters)
<b>National Marine Fisheries Service</b>	MMPA Permit/Incidental Take Statement	Installation/O&M/Removal Activities; presence of WECs, cables (if meet thresholds)
<b>Environmental Protection Agency</b>	Water Pollution Control Facilities Permit	onshore storm water management system
	Air Quality Permit	Installation/O&M/Removal Activities (if meet threshold)
<b>State Historic Preservation Office (OPRD)</b>	Cultural Resources Management Plan	If cultural/historic resources at project site
<b>Property Owner</b> <i>(State or Private)</i>	Interconnection Easement	cable landfall/grid interconnection infrastructure

**LEASE REQUEST PROCESS**

The P MEC-SETS regulatory process will officially commence with the lease request process. Upon receipt of this lease request, BOEM will conduct an internal review and share the lease request with the Oregon Interagency Task Force. BOEM will then publish a Request for Interest (RFI) in the Federal Register (FR), followed by public comment period (likely 45 days). After reviewing and addressing any comments, BOEM will publish a Determination of No Competitive Interest (DNCI) in the FR. [REDACTED]





Within 60 days of the DNCI, NNMREC plans to submit a Request for Departure from the SAP Requirements to BOEM. Shortly thereafter, NNMREC-OSU plans submit a Notice of Intent (NOI) and Preliminary Application Document (PAD) to FERC. Coordinating the timing of the Request for Departure with the NOI/PAD could better enable BOEM and FERC to conduct Joint NEPA Scoping. During the Joint NEPA Scoping, NNMREC-OSU will provide draft environmental monitoring plans with the agencies for their review and feedback.

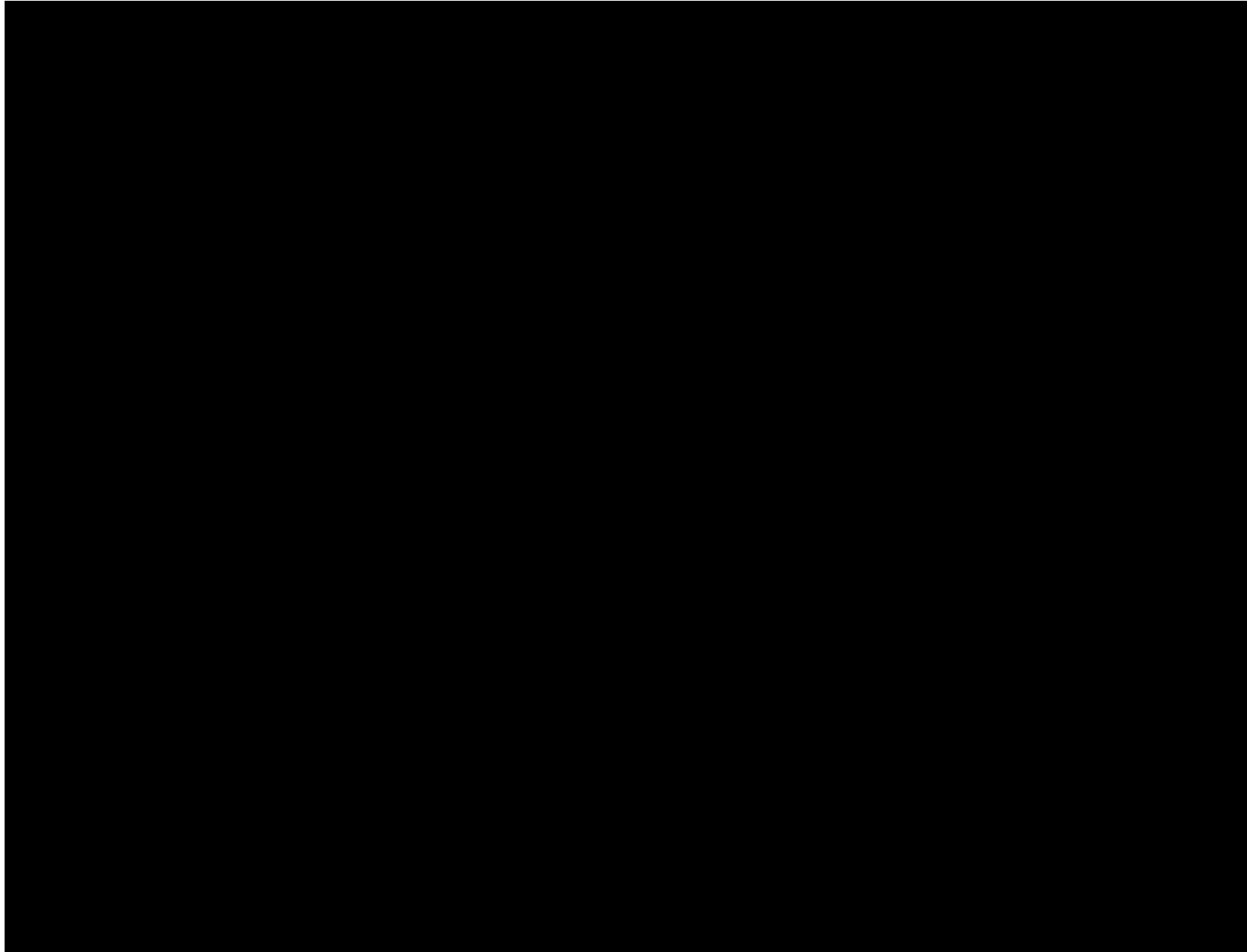
In conjunction with the NEPA Scoping process, NNMREC-OSU will prepare a Draft License Application (DLA), which will in information needed to support review and decision-making for both the Lease and License. After submitting the DLA, a comment period will follow to provide an opportunity for agencies and stakeholder to review and provide feedback on the proposed project. Input from the NEPA Scoping and DLA comments will help to inform the final project design and environmental monitoring plans, as well as the Draft EA/EIS and Biological Assessment (BA). The revised project description and environmental monitoring plans will be submitted as part of the Final License Application (FLA) that NNMREC-OSU will submit to FERC and BOEM.

Shortly after submittal of the license application, NNMREC-OSU will request a Land Use Compatibility Statement (LUCS) from the Lincoln County Planning Department. Once the LUCS is issued, NNMREC-OSU will submit a Joint Permit Application to the Corps of Engineers (the Corps) and the Department of State Lands (DSL) for a Nationwide Permit (NWP) and Removal-Fill Permit, respectively. In addition, NNMREC-OSU will include a Statement of Consistency with the federal permit applications to support the Department of Land Conservation and Development (DLCD) in its CZMA Consistency Determination for the FERC License, BOEM Lease and Corps Permit. Similarly, NNMREC-OSU will include documentation to inform the Department of Environmental Quality's Water Quality Certification (WQC) review for the License, Lease and NWP.

After completing their internal agency reviews, it is anticipated that FERC and BOEM will publish a Draft EA/EIS, which will commence a public comment period. Next, NNMREC-OSU will provide a Biological Assessment to the National Marine Fisheries Service (NMFS) and US Fish and Wildlife Service (USFWS) to support consultation with the Corps, FERC and BOEM under their respective statutory authorities (i.e., ESA, MMPA, etc.). At the same time, NNMREC-OSU will submit an application to DSL for the Cable Easement, as well as Ocean Shore Permit application to the Oregon Parks and Recreation Department (OPRD). Finally, NNMREC will submit a Private Aids to Navigation (PATON) Permit application to the US Coast Guard.

Upon completion of the NEPA analysis and internal agency reviews, FERC and BOEM will publish a Final EA/EIS with responses to agency and stakeholder comments. Consultation with NMFS and USFWS will conclude around the same time, at which time NMFS and USFWS will issue their determinations and conditions for the FERC License, BOEM Lease and NWP. Once DLCD, DSL, DEQ, and the OPRD will complete their reviews and issue the respective state permits, DLCD will issue its Determination of Consistency. The WQC and PATON Permit will also be issued around this time.

Once all the environmental compliance determinations have been made and the state permits are in place, the Corps will issue the NWP and BOEM will issue the Lease. Finally, FERC will issue the License Order, along with any conditions required by NMFS and USFWS. [REDACTED]



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## WAVE ENERGY RESOURCE DATA

In 2011, the U.S. Department of Energy released a technical report on the wave energy resources, titled Mapping and Assessment of the United States Ocean Wave Energy Resource.<sup>4</sup> This report, created by the Electric Power Research Institute, assesses ocean wave energy potential along the U.S. coasts. Researchers at Virginia Tech and DOE's National Renewable Energy Laboratory supported the report and data validation. According to the report findings, the total annual available wave energy along the Outer Continental Shelf off the coast of Oregon is 116 TW/h per year. In addition, NREL integrated data from the report into the "MHK Atlas, an online atlas that maps U.S. wave energy resources. A recent query of the MHK Atlas for wave energy resources in the area of interest showed Annual Average Significant Wave Heights (SHs) are 2.15 meters at 8 - 9 second energy periods, with an Annual Average Wave Power Density of 31.1 kW/meter.<sup>5</sup>

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## ENVIRONMENTAL RESOURCES

The marine environment off the coast of Newport, OR has been characterized in a large number of studies, due largely to research and sampling programs performed by OSU's School of Earth, Atmospheric and Oceanic Sciences (CEOAS) and local presence of the Hatfield Marine Science Center (HMSC). The following section provides an overview of the environmental conditions and attributes of the proposed research lease area, including ESA-listed species and designated critical habitats.<sup>6</sup> Site-specific studies, along with additional stakeholder engagement, will be conducted as part of the site characterization activities to establish environmental baseline conditions. Results of these activities will help inform final project design, potential effects analysis, and post-installation monitoring plans for the PMEC-SETS.

*NOTE: The environmental information provided here is intended to serve as a starting point, as this unsolicited request for a research lease is an initial component of the overall regulatory process. Additional information will be provided to inform future NEPA analysis for specific components of the authorization process (e.g., Lease Issuance, FERC Licensing), as well as through subsequent environmental documentation for other aspects of the regulatory process (e.g., Biological Assessment).*

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<sup>4</sup> Available at: <http://www1.eere.energy.gov/water/pdfs/mappingandassessment.pdf>

<sup>5</sup> Source: [http://maps.nrel.gov/mhk\\_atlas](http://maps.nrel.gov/mhk_atlas); accessed January 29, 2013.

<sup>6</sup> Much of this information has been adapted from the Final Environmental Assessment prepared in 2012 for the PMEC-NETS, given its close proximity to the area requested for lease. The Final EA is available at <http://energy.gov/nepa/downloads/ea-1917-final-environmental-assessment>.

## AIR QUALITY

Air quality throughout the state is regulated by the Oregon Department of Environmental Quality (ODEQ). Baseline ambient air quality in the vicinity of Newport, Oregon is acknowledged to be good, and Lincoln County, Oregon is in attainment<sup>7</sup> for all air pollutant criteria measured by the U.S. Environmental Protection Agency (EPA; EPA 2012). Population density throughout Lincoln County is low and there are few major industrial facilities within a few miles of the coast. ODEQ does not operate any air quality monitoring stations in Lincoln County, acknowledging the limited potential for local air quality concerns. The Proposed Project would emit only small amounts of air pollutant emissions, as discussed below.

Air pollutant emissions from the Proposed Project would be generated primarily during installation, removal and decommissioning activities, when support vessels would be used to deploy and retrieve anchors and WEC devices. During the operational and maintenance phases, occasional air pollutant emissions would also be generated by support vessels traveling to and from the project site. It is expected that these vessels would burn low-sulfur diesel fuels that would emit some level of sulfur oxides. These vessels would generate most of their emissions at the test site and in transit, which would occur approximately at least 5.0 miles from any onshore sensitive receptor locations. There would be little potential for marine vessel emissions to degrade onshore air quality; therefore, anticipated impacts to air quality are expected to be minimal.

## MARINE GEOLOGY & BOTTOM SEDIMENTS

The Oregon coastal region has been influenced by regional tectonic uplift and glacial sea level fluctuations over the past several million years (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency 2001). During the last glacial maximum, sea level was approximately 400 feet (122 meters) lower than at present. Marine terrace deposits that are less than 1 million years old and consist primarily of sand and silt that were deposited over a sequence of much older Miocene siltstones, mudstones, and sandstones. Yaquina Head and the nearby offshore reefs were formed from a layer of basalt that intruded on the marine sedimentary rocks. Recent marine sands cover the older bedrock on the continental shelf.

Oregon's present-day continental shelf is relatively narrow and extends about 10 to 46 miles off the coast (Electricity Innovation Institute 2004). A rocky submarine bank (Stonewall Bank) begins about 15 miles offshore of Yaquina Bay and extends southwest offshore the Siuslaw River, where the shelf is about 30 miles across (Electricity Innovation Institute 2004; U.S. Army Corps of Engineers and U.S. Environmental Protection Agency 2001). The bottom sediments shoreward of Stonewall Bank are mostly fine sand to depths of 300 feet (91 meters), with little silt and clay (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency 2001). Sandy sediments extending 3 to 10 miles offshore are typical of much of the Oregon coast, with small variations in the concentration of fine-sized particles in the seafloor sediments due to local currents.

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<sup>7</sup> A designated attainment area, as defined by the EPA, is an area that meets the national primary or secondary ambient air quality standard for the pollutant in question. In this case, Lincoln County is in attainment for all EPA criteria pollutants.

Data collected at Ocean Dredged Material Disposal Sites (ODMDS) off Yaquina Bay indicate that local sediments near the PMEC project site are consistent with those found on much of the Oregon shelf, consisting predominantly of medium-grained sand with some shell debris and a minor amount (less than 2%) of silt and smaller material (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency 2011). There is little silt or clay in nearshore sediments of this region, as a result of winnowing by wave energy. As noted previously, site-specific surveys will be conducted to further characterize environmental baseline conditions and help inform final project design, potential effects analysis, and post-installation monitoring plans.

## OCEANOGRAPHY & METEOROLOGY

The high wave energy flux on the Oregon coast is due to prevailing western winds and the large fetch<sup>8</sup> of the North Pacific Ocean (Boehlert et al. 2008). Wave energy on the coast varies considerably by season, such that the wave energy flux is approximately eight times greater during winter than summer offshore of Douglas County, Oregon (Bedard 2005). Episodic winter storms bring large waves from the west and southwest. Currents generated by these waves are uniform throughout the water column, and may have a substantial influence on the transport of fine sediments (silt and clay) at depths of greater than 37 meters (120 feet) (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency 2001).

The circulation of ocean surface waters on Oregon's continental shelf varies seasonally with changing wind stress patterns. During the summer, offshore high pressure systems and associated northerly or northwesterly winds drive upwelling of deep, dense, cold water toward the ocean surface. At present, circulation of surface waters on the continent shelf is dominated by the southward-flowing California Current (U.S. Army Corps of Engineers 2001). In contrast, low offshore pressure systems during winter drive southwesterly storm winds that result in surface circulation dominated by the northward-flowing Davidson Current.

On the inner continental shelf (depths less than about 37 meters [120 feet]), bottom sediments are transported by a combination of wind-driven currents, wind waves, tidal currents, and estuarine-induced currents (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency 2001). Bottom currents on the inner continental shelf are capable of transporting sand-sized sediment. On the middle continental shelf (depths of 37 to 91 meters [120 to 300 feet]), water circulation is mainly influenced by wind-driven currents, whereas on the outer continental shelf (depths of 91 to 183 meters [300 to 600 feet]), shoaling waves and regional currents control water circulation seasonally (U.S. Army Corps of Engineers 2001). The net direction of bottom currents on the mid- to outer continental shelf is northward, because the subsurface part of the Davidson Current is believed to flow northward year-round. Bottom currents along the mid- to outer continental shelf are capable of transporting silt and finer-grained sediments (U.S. Army Corps of Engineers 2001).

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<sup>8</sup> Fetch is defined as the area over a water body in which the wind blows in an essentially constant direction. Longer fetch lengths are associated with the size of the waves produced.

## ACOUSTIC ENVIRONMENT

The area off the coast near Newport already experiences considerable commercial marine vessel traffic from the Port of Newport, which is home to one of Oregon's largest commercial fishing fleets. The project site is close enough to shore to possibly be affected by surf sound. Therefore, existing underwater sound levels in the project area are expected to be moderate to high (Oregon Wave Energy Trust 2009).

In 2010, Haxel et al. (2011) collected baseline acoustic data for the P MEC-NETS. Specifically, the study team deployed two acoustic recording devices on the ocean floor in and near the project site in March 2010. The devices recorded continuously, monitoring underwater sound generated at frequencies of 1 Hz to 2 KHz. The underwater sound pressure levels recorded during the monitoring period ranged from a low of 95 dB RMS re: 1  $\mu$ Pa to 136 dB RMS re:1  $\mu$ Pa, with a time-averaged sound pressure level for the monitoring period of 113 dB RM re:1  $\mu$ Pa; a histogram of hourly RMS values shows a normal distribution. The spectrum during periods of above-average underwater sound intensity was dominated by low frequency noise associated with wave action, primarily surf along the shoreline. As noted previously, this information is intended simply to inform existing conditions at the SETS, and NNMREC-OSU anticipates conducting site-specific monitoring for the SETS project as described above in the Site Characterization section of this application.

## WATER QUALITY

Water quality on the Oregon coast varies seasonally. During winter, temperatures of nearshore surface waters are about 9 to 10°C and salinities are about 30 to 32 practical salinity units (Boehlert et al. 2008, Landry et al. 1989). Light transmission is higher during winter, and decreases with the transition to summer during upwelling conditions and when phytoplankton bloom (Boehlert et al. 2008). During summer, upwelling brings colder, more saline water onto the inner shelf. Summer surface temperatures are about 12 to 14°C and salinities are about 30 to 32 practical salinity units (Boehlert et al. 2008, Landry et al. 1989). Wind and wave conditions are relatively calm during the spring (March and April) and fall (September and October) transitions between oceanographic regimes (Boehlert et al. 2008).

Principal sources of information for water quality in the project area include water quality data from the Oregon Department of Environmental Quality (ODEQ) Laboratory Analytical Storage and Retrieval Database (LASAR) (Oregon Department of Environmental Quality 2010), and sediment quality data reported during studies performed prior to designation of the dredged disposal area in Yaquina Bay, which is located near the SETS project site (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency 2001).

Water quality data were collected at Site 30244 (located at latitude 44.6851 N, longitude 124.1684 W) on June 11, 2003, by lowering a sonde<sup>9</sup> from the surface to the sea floor and back, collecting water samples at depths of 2, 30, and 60 meters (6, 98 and 197 feet). Results across a water column of about 60 meters (197 feet) showed a steady decline in chlorophyll a and dissolved oxygen with increasing depth. At the time of sampling, there was no apparent thermocline; temperatures declined gradually

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<sup>9</sup> A sonde is a water quality monitoring device that measures a number of variables in the water column.

from the surface to about 30 meters (98 feet) in depth, and were fairly uniform below that depth. Nutrient availability increased with depth, presumably reflecting highest uptake rates in the euphotic zone (Oregon Department of Environmental Quality 2010).

Sediment samples for quality assessment have been recovered from outside Yaquina Bay during sampling performed in various years from 1984 to 2000, mostly in summer and fall (U.S. Army Corps of Engineers 2001). The 18 sample locations are in the open waters off Yaquina Bay, an area that, like the PMEC project site, has a uniform fine sand bottom. Metals concentrations detected in all samples were far below the screening levels outlined in the Corps' Sediment Evaluation Framework (SEF) for the Pacific Northwest (SEF 2009). All detected concentrations of organic compounds were either below SEF screening levels or laboratory reporting limits.

## VEGETATION AND ALGAE

Marine plants off the coast of Newport, Oregon include phytoplankton and sessile algae. Phytoplankton are comprised of simple free-floating uni- and multi-cellular organisms like cyano-bacteria, diatoms, dinoflagellates, silicoflagellates, and coccolithophorids. Sessile algae, commonly termed seaweeds, include many species of large brown and red algae. Sessile algae occur in rocky intertidal and sub-tidal areas of the coast within the photic zone (water depths to which sunlight can penetrate). The largest such algae include several species of brown kelp, that along the Oregon coast consist almost exclusively of bull kelp (*Nereocystis luetkeana*), which grows sub-tidally. This species has special legal status because of its value as a commercial raw material and habitat for protected fish species (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency 2001, 2008).

No hard or rocky substrate is known to occur within the vast majority of the PMEC-SETS study area; however, a small amount of rocky reef exists in a narrow area in approximately 40 meters (131 feet) of water a few miles northeast of the study area (off Yaquina Head). Bull kelp was not observed on this rocky area during videographic surveys in 2010, likely because water depths (i.e., lack of sufficient light) preclude the growth of any bull kelp (Henkel pers. comm. 2010).

## ZOOPLANKTON, CRAB LARVAE & FISH LARVAE

The zooplankton community inhabiting offshore central Oregon consists of small invertebrate organisms that either spend their entire life cycle in the water column (holozooplankton) or spend only a brief developmental time in the water column before a metamorphosis to an adult life in a nektonic or benthic habitat (merozooplankton). Species composition changes and is influenced by various periodic and episodic factors including prevailing ocean currents, coastal upwelling, and offshore wind direction. The Corps and the U.S. Environmental Protection Agency (EPA 2008, 2009, citing Keister and Peterson 2003) describe the coastal zooplankton community inhabiting central Oregon as being dominated by copepods. In total, 58 copepod species are reported being present in these waters, of which eight occur throughout the year, seven occur only during the summer, and six occur only in the winter. Species composition is seasonally dependent. Overall biomass population and individual species abundance are typically lower in the winter than in the summer months. During the summer months, when the offshore winds blow predominantly from the northwest, surface waters move southward and offshore



due to Ekman drift, allowing the colder, more saline, and nutrient-rich waters from deeper water depths to upwell along the coast. Between January and May, the megalopae larvae of the Dungeness crab (*Cancer magister*) are abundant inshore.

Three species assemblages of fish larvae have been described as inhabiting the coastal waters of Oregon: coastal, transitional, and offshore. The coastal assemblage occurs in the P MEC-SETS area and is typically dominated by smelts (*Osmeridae*), which account for 50% of the population, and English sole (*Parophrys vetulus*), sandlance (*Ammodytes hexapterus*), sanddab (*Citharichthys sordidus*), starry flounder (*Platichthys stellatus*), and Pacific tomcod (*Microgadus proximus*). The highest fish larvae abundance is reported to occur between February and July (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency 2001). Auth et al. (2007) reported northern anchovy (*Engraulis mordax*), slender sole (*Lyopsetta exilis*), rockfish (*Sebastes spp.*), northern lampfish (*Stenobranchius leucopsarus*), and blue lanternfish (*Tarletonbeania crenulairs*) as the dominant taxa along the Newport hydrographic line (43°39'N).

## BENTHIC INVERTEBRATES

Benthic invertebrate communities inhabiting the nearshore marine environment provide important secondary production in marine food webs and are integral to the breakdown and recycling of organic material in the marine ecosystem. They also provide a key food source for important commercial and recreational fish and macroinvertebrate species like Dungeness crab, as well as for other protected or managed fish species. In 2010 and 2011, the Hatfield Marine Science Center (HMSC) conducted surveys in and around the P MEC-NETS to document the presence of a number of demersal fishes and benthic invertebrate species. Although this research was not conducted to identify species at the P MEC-SETS, a review of the observations may provide insight as to species presence and abundance within the area.

Benthic habitats at and near the P MEC-NETS were characterized by Henkel (2011), reporting results of box cores, trawls, and videography performed on 10 occasions between May 2010 and December 2011. Six sampling stations were located within the NETS; three sampling stations were located outside of the Site to the north and three stations were located outside of the Site to the south (between the project site and the north Newport jetty), at water depths of 30 to 50 meters. Sample frequencies and sizes were designed to be large enough to detect potential changes in the future. Principal findings from this monitoring included (Henkel 2011):

- Two distinct sediment types: silty sand at approximately 30 meters, and potentially shallower; and nearly pure sand at 40 meters and deeper.
- Distinct infaunal invertebrate assemblages occur in the two sediment types.
- Distinct infaunal invertebrate assemblages occur north and south of Yaquina Head at the deeper stations.
- Mysid and Crangonid shrimp are highly abundant and likely form the basis of the food web in this nearshore zone, as opposed to the krill-supported food web further offshore.

- Videography observations are more effective than trawls for sampling large invertebrate species such as crabs, sea stars, and sea pens.

## FISH

The nearshore and offshore regions of the Yaquina Head area encompass both rocky and soft bottom sub-tidal habitats and the open water pelagic environment. This area, therefore, supports a variety of fish species that typically inhabit all three habitats with frequent movement of fish between them. Typical fish species that inhabit these areas are discussed below. Although very little hard bottom substrate is known to be present in the project site, natural sub-tidal reefs closer inshore at Yaquina Head support pelagic and benthic fish communities that associate with rocky, rather than soft, substrate.

Fish species commonly observed in sandy bottom areas offshore Yaquina Head include English sole (*Parophrys vetulus*), butter sole (*Isopsetta isolepis*), Pacific sanddab (*Citharichthys sordidus*), speckled sanddab (*Citharichthys stigmatæus*), and starry flounder (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency 2010; Henkel 2011). Sampling by Henkel (2011) found that the fish assemblage varies with season. High densities of flatfish characterized the catch in summer, and speckled sanddab, were usually the dominant species. In October, flatfish densities were significantly lower but prickle breast poachers (*Stellerina xyosterna*) were abundant. In February, a variety of smelt (*Osmerus* spp.) were in high abundances.

Rocky sub-tidal, or hard bottom, habitats typically experience a wide variety of wave and current regimes, substrate, depths, and food sources, producing diverse biological communities (Oregon Department of Fish and Wildlife 2006). The rocky reefs off Yaquina Head provide important habitat for fish species that include sculpins (*Cottidae*), surf perch (*Embiotocidae*), and rocky reef fishes. Shallow reefs up to 20 meters (66 feet) in depth are dominated by black rockfish (*Sebastes melanops*), while deeper reefs are dominated by lingcod (*Ophiodon elongates*), black-and-yellow rockfish (*Sebastes chrysomelas*), and black rockfish (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency 2001; Henkel pers. comm. 2011). Although these areas of rocky sub-tidal habitat are located outside the P MEC-SETS, juvenile lingcod and rockfish will likely use pelagic and soft bottom habitats, and older mature fish typically associated with rocky sub-tidal habitats will often be found swimming in the deeper soft bottom regions. As a consequence, these taxa may be present in the vicinity of the project.

A number of environmental factors affect the fish species present in the pelagic zone, including light penetration, water temperature, proximity to river plumes, and underwater currents (Oregon Department of Fish and Wildlife 2006). Pelagic species commonly found in the area include Pacific herring (*Clupea pallasii*), northern anchovy, and Pacific Ocean perch (*Sebastes alutus*). The area is also utilized by salmon, steelhead, and shad that migrate alongshore; including those stocks that migrate through the Yaquina Bay estuary to spawn upriver (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency 2001).

ESSENTIAL FISH HABITAT

The Pacific Fisheries Management Council (PFMC) manages, under federal Fishery Management Plans (FMP), four groups of fish along the West Coast of the United States: groundfish, salmon, highly migratory species and coastal pelagic species. The groundfish FMP includes more than 80 species of fish and the salmon FMP includes all species of salmon occurring along the west coast of the United States that are commercially fished. The highly migratory species FMP includes the tunas, some shark species and billfish. The coastal pelagic FMP includes five taxa: (northern anchovy (*Engraulis mordax*), market squid (*Loligo opalescens*), Pacific sardine (*Sardinops sagax*), Pacific (chub) mackerel (*Scomber japonicas*), and jack mackerel (*Trachus symmetricus*). As required under the Magnuson-Stevens Act, EFH has been designated for each of these groups except highly migratory species, and all waters within and adjoining the PMEC project area constitute EFH. Specifically, EFH has been designated as follows (Pacific Fisheries Management Council 2010):

- **Groundfish** Water depths less than or equal to 11,483 feet (3,500 meters) to the mean higher high water level or the upriver extent of saltwater intrusion, defined as upstream and landward to where ocean-derived salts measure less than 0.5 parts per thousand during the period of average annual low flow; seamounts in depths greater than 11,483 feet (3,500 meters) as mapped in the EFH assessment geographic information service (GIS) data; areas designated as habitat areas of particular concern not already identified by the above criteria.
- **Salmon** All waters of the United States between the Canadian border and the Mexican border and out 200 miles (370 kilometers) to the western extent of the Exclusive Economic Zone.
- **Pelagic** All waters of the United States from the Canadian border to the Mexican border and out 200 miles (370 kilometers) to the western extent of the Exclusive Economic Zone.

DESIGNATED CRITICAL HABITAT

Critical habitat has been designated for some of the listed species identified in Table 4. Vertebrate species listed under the ESA may include infraspecific taxa described as Distinct Population Segments (DPS), some of which have been described by the NMFS as Evolutionarily Significant Units (ESU). Designated critical habitat (DCH) for the following species occurs in or near the PMEC project area:

- **Coho salmon** On February 11, 2008, NMFS listed the Oregon coast coho salmon ESU as threatened and DCH. Critical habitat for Oregon coast coho salmon includes riverine and estuarine areas within 80 occupied watersheds in 13 associated sub-basins. Critical habitat for coho salmon includes the waters of Yaquina Bay, but does not extend out to the offshore waters of the PMEC project site.
- **Green sturgeon** In October 2009, NMFS designated all nearshore waters to a depth of 60 fathoms (360 feet or 110 meters) offshore Oregon as critical habitat for the southern DPS of the green sturgeon (National Marine Fisheries Service 2009). As such, the green sturgeon DCH includes the PMEC project area.

## SEA TURTLES

Pacific leatherback sea turtles (*Dermochelys coriacea*) are known to occur in offshore waters of the central Oregon coast (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1998a, 2007). Green sea turtles in the Pacific Ocean are generally found south of San Diego, California; however, they have been found from Baja, California to Alaska (National Marine Fisheries Service 2011). Loggerhead sea turtles (*Caretta caretta*) also have been seen as far north as Alaska, but most U.S. sightings have been made off the California coast. The olive Ridley sea turtle is also more commonly seen in California waters, although there is at least one case of a hypothermic olive Ridley sea turtle washing ashore off the coast of Newport, Oregon (Hanson 2009).

### DESIGNATED CRITICAL HABITAT

Critical habitat for the leatherback sea turtle was previously designated only in the Atlantic Ocean (44 FR 17710), but on January 26, 2012, NMFS designated critical habitat in the Pacific Ocean off areas of Washington, Oregon, and California (77 FR 4170). The area designated includes the offshore waters between Cape Flattery, Washington, and Cape Blanco, Oregon, out to the 2,000-meter depth contour and a similar area offshore California (National Oceanic and Atmospheric Administration 2010b). As such, the leatherback sea turtle DCH occurs within the PMEC-SETS.

## MARINE BIRDS

Bird species commonly observed inhabiting and using the coastal waters of central Oregon near Yaquina Bay include shearwaters, storm petrels (*Hydrobatidae*), gulls (*Laridae*), common murres (*Uria aalge*) and Cassin's auklets (*Ptychoramphus aleuticus*) during the late spring and early summer months. Phalaropes (*Phalaropus spp.*), fulmars (*Fulmarus spp.*), and California gull (*Larus californicus*) predominate during the fall months. During the winter months, phalaropes, California gull, fulmars, other assorted gulls, murres (*Uria spp.*), auklets (*Aethia spp.* and *Ptychoramphus spp.*), and kittiwakes (*Rissa spp.*) are common. Western (*Aechmophorus occidentalis*), red-necked (*Podiceps grisegena*), horned (*P. auritus*), and eared (*P. nigricollis*) grebes, Caspian tern (*Sterna caspia*), three other species of tern, three species of cormorant, pigeon guillemot (*Cephus columba*), and red-throated (*Gavia stellata*), Pacific (*G. pacifica*), and common or great northern (*G. immer*) loons also frequent the region (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency 2001).

Brown pelicans (*Pelecanus occidentalis*) are present in the summer and fall as post-breeding transients. Western snowy plovers (*Charadrius alexandrinus nivosus*), an Oregon-listed threatened species, are known to forage on shorelines of the coast of Newport (U.S. Fish and Wildlife Service 2007b). Other protected species that may forage in or near the area include short-tailed albatross (*Diomedea albatrus*) and marbled murrelet (*Brachyramphus marmoratus*) (U.S. Army Corps of Engineers and U.S. Environmental Protection Agency 2001).

## MARINE MAMMALS

Marine mammal species potentially present in the PMEC-SETS area include cetaceans (whales, dolphins, and porpoises) and pinnipeds (seals and sea lions). The most common year-round inhabitants are the pinnipeds: Pacific harbor seal (*Phoca vitulina*), and Steller sea lion (*Eumetopias jubatus*). Male California

sea lions (*Zalophus californianus*) and northern elephant seals (*Mirounga angustirostris*) are occasionally observed foraging in southern and central Oregon coastal areas but are not regular inhabitants (Oregon Department of Fish and Wildlife 2010).

Cetaceans potentially present in the project area include transient killer whales (*Orcinus orca*), which appear along the Oregon coast in April, in conjunction with the California gray whales’ northward migration. Killer whales of the southern resident group occasionally pass by during migrations from their principal range in Washington and British Columbia, en route to foraging grounds off central California, where they seasonally feed on migrating Chinook salmon (Northwest Fisheries Science Center 2007). Other whales observed offshore of the Oregon coast include blue whale (*Balaenoptera musculus*), finback whale (*Balaenoptera physatus*), sei whale (*Balaenoptera borealis*), Pacific right whale (*Balaena glacialis japonica*), humpback whale (*Megaptera novaeangliae*), and sperm whale (*Physeter catodon*).

California gray whales (*Eschrichtius robustus*) occur along the central Oregon coast throughout the year with a small population of resident whales present between May and October. Migrating gray whales occur between March and June on their northward migration, and between December and March on their southward migration. Ortega-Ortiz and Mate (2008) report that in 2008, gray whales were observed offshore of Yaquina Head transiting the area during both southward and northward migrations. Gray whales migrated southward through the area beginning in mid-January, with the peak of the migration occurring in late January. Northbound migrating gray whales were observed as early as late February, with the peak migration occurring between late March and mid-April. Ortega-Ortiz and Mate (2008) further reported observing gray whale movements predominantly occurring in parts of the ocean where water depths are between 10 and 70 meters (33 and 230 feet).

**FEDERAL & STATE PROTECTED SPECIES**

Protected species potentially present in the PMEC-SETS project area during all or part of the year are listed in the table below, which is adapted from the Final Environmental Assessment prepared in 2012 for the U.S. Department of Energy’s funding of the PMEC-NETS. As the project authorization process moves forward, NNMREC-OSU will coordinate with appropriate state and federal resources agencies to review and modify (if needed) this list for applicability to the SETS project.

**TABLE 4: PROTECTED SPECIES POTENTIALLY PRESENT AT PMEC-SETS**

Common Name	Scientific Name	State Status	Federal Status
<i>E = Endangered; T = Threatened</i>			
<b>BIRDS</b>			
Marbled murrelet	<i>Brachyramphus marmoratus</i>	T	T
Western snowy plover	<i>Charadrius alexandrinus nivosus</i>	T	T
Short-tailed albatross	<i>Phoebastria albatrus</i>	E	E

Common Name	Scientific Name	State Status	Federal Status
<i>E = Endangered; T = Threatened</i>			
Brown Pelican	<i>Pelecanus occidentalis</i>	E	
<b>FISH</b>			
Chinook salmon, lower Columbia River ESU	<i>Oncorhynchus tshawytscha</i>	E	T
Chinook salmon, upper Willamette River ESU	<i>Oncorhynchus tshawytscha</i>		T
Chinook salmon, upper Columbia River spring-run ESU	<i>Oncorhynchus tshawytscha</i>		E
Chinook salmon, Snake River spring/summer run ESU	<i>Oncorhynchus tshawytscha</i>		T
Chinook salmon, Snake River fall-run ESU	<i>Oncorhynchus tshawytscha</i>	T	T
Chinook salmon, Central Valley spring-run ESU	<i>Oncorhynchus tshawytscha</i>	T	
Chinook salmon, Sacramento River winter-run ESU	<i>Oncorhynchus tshawytscha</i>		E
Chinook Salmon, California coastal ESU	<i>Oncorhynchus tshawytscha</i>		T
Coho salmon, Southern Oregon/ Northern California coast ESU	<i>Oncorhynchus kisutch</i>		T
Coho salmon, Oregon coast ESU	<i>Oncorhynchus kisutch</i>		T
Coho salmon, lower Columbia River ESU	<i>Oncorhynchus kisutch</i>		T
Green sturgeon, southern DPS	<i>Acipenser medirostris</i>		T
Eulachon	<i>Thaleichthys pacificus</i>		T
<b>HERPETILES</b>			
Leatherback sea turtle	<i>Dermochelys coriacea</i>	E	E
Green sea turtle	<i>Chelonia mydas</i>	E	T
Loggerhead sea turtle, Pacific DPS	<i>Caretta caretta</i>	T	T
Olive (Pacific) Ridley sea turtle	<i>Lepidochelys olivacea</i>	T	T
<b>MAMMALS</b>			
Steller sea lion, eastern DPS	<i>Eumetopias jubatus</i>		T
Killer whale, Southern Resident DPS	<i>Orcinus orca</i>		E
Humpback whale	<i>Megaptera novaeangliae</i>	E	E
Blue whale	<i>Balaenoptera musculus</i>	E	E
Fin whale	<i>Balaenoptera physalus</i>	E	E
Northern Pacific Right Whale	<i>Eubalaena japonica</i>	E	E
Sei Whale	<i>Balaenoptera borealis</i>	E	E

Common Name	Scientific Name	State Status	Federal Status
<i>E = Endangered; T = Threatened</i>			
Sperm Whale	<i>Physeter macrocephalus</i>	E	E
Gray Whale	<i>Eschrichtius robustus</i>	E	

**RECREATION**

As noted previously, aids to navigation (e.g., marker buoys) would be installed somewhere within the project site and a Local Notice to Mariners would be published to minimize potential vessel collisions or entanglement in mooring lines. Aids to navigation would be in place for the operational lifetime of the Proposed Project and could result in reduced or restricted marine navigational access in a small area within the project site. NNMREC-OSU would hold meetings with the Oregon Marine Board, USCG, the FINE committee, ODFW, and Oregon State Police to identify the appropriate uses of the project site during and between WEC device test periods. This would not be expected to substantially reduce the number of boating days spent in the vicinity of the project area. Boaters intending to use the project area may need to adjust their navigation plans or navigate around the project site infrastructure.

Sport fishing occurs in all regions along the Oregon Coast and offshore areas and is conducted via multiple trip types, including by shore, pier, small craft, and charter boat. The recreational vessel marina (South Beach Marina) includes 450 moorage slips, a fuel dock, and a paved boat ramp (Port of Newport 2010). Roughly 10,000 boating days<sup>13</sup> originate at this facility each year (Fisherman Involved in Natural Energy 2008; Nielsen pers. comm.) For recreational fishing catch data, information from the Pacific States Marine Fisheries Commission and reported through the Pacific Recreational Fishing Information Network from the years 2004 to 2009, was reviewed. Predominant species collected by sport fishers in ocean waters outside of Yaquina Bay and to the immediate north and south, are various species of rockfish, salmon, lingcod, tuna, and Dungeness crab. Halibut and salmon fishing are the most popular recreational fishing activities.

The main direct recreation impact of a limited access within the project site would be a reduction in halibut fishing opportunities. However, a reduction in the quality of anglers’ fishing experiences resulting from the loss of a small amount of navigational access within productive fishing waters in the project site is a more anticipated impact than a reduction in fishing days. As with boating, disruptions resulting from changes to navigational access are not expected to deter people from fishing in the project vicinity. The main indirect recreation impact would be a reduction in the quality of ocean viewing (including whale watching) experiences primarily by visitors to Yaquina Head Outstanding Natural Area resulting from placement of WEC devices offshore. As discussed in Visual Resources below, the proposed structures could potentially detract from the existing unobstructed ocean views; however, it is expected that the Proposed Project would be nearly imperceptible to viewers.

During scoping for the P MEC-NETS off the coast of Newport, commenters raised the concern that the installation and operation of that project could result in adverse impacts on surfing through altered

wave characteristics. For an EA of a proposed installation of up to six 40 kW offshore PowerBuoys in Hawaii, the Office of Naval Research concluded that the PowerBuoys® would have only localized impacts on currents and wave direction. For example, the impacts on currents would not extend more than the diameter of a few PowerBuoys® (Department of the Navy 2003). A sediment transport study published by the Oregon Wave Energy Trust (2009b) that included wave modeling for the Reedsport wave energy project determined that wave height variations up to 15% are possible within approximately 0.6 mile (1 kilometer) of a WEC device, but wave variations decrease to 3% over distance up to 2.5 miles (4 kilometers).

As described previously, the P MEC-SETS would be located approximately 5 miles from the coast of Oregon. Based on the studies and modeling referenced above, wave attenuation associated WEC devices at this distance is not expected to discernibly affect the quality of waves used by surfers. However, site-specific effects analysis, along with additional stakeholder engagement, will be conducted for the P MEC-SETS as part of the regulatory process to characterize and, if needed, mitigate impacts to recreation.

## COMMERCIAL FISHING

Many important commercial fish species along the Oregon coast are known to spend a portion of their life history around and within the Yaquina Bay Estuary. Some commercially important species landed at Newport reside predominantly as adults in the ocean waters beyond Yaquina Bay, but spend their juvenile phase or a portion of their adult life stage within the estuary itself (e.g., Dungeness crab). Others spend their entire life history in the deeper offshore areas of the Oregon coast (e.g., albacore tuna), and are not normally found within the project area.

Eight ports along the Oregon coast support commercial fishing vessels, and Newport is among the most important of these. The commercial fishing vessel marina supported 393 commercial fishing vessels in 2000. The primary fisheries exploited by boats out of the Port of Newport, Oregon, in terms of ex-vessel landing values, were groundfish, crab, shrimp, highly migratory species, and salmon (National Oceanic and Atmospheric Administration 2007). In the Newport area, crabbing and salmon fishing are the most popular commercial fishing activities.

The species, including both fish and invertebrate species, that comprised at least 1% of either the total catch value or total weight landed in Newport in 2010 were collected both in the nearshore and offshore environment, as well as within Yaquina Bay itself. In reviewing the catch totals for Newport against those reported for the landing regions immediately to the north and south, Depoe Bay and Florence, respectively, the landings reported for Newport were at least an order of magnitude greater than either of the two adjacent ports (Oregon Department of Fish and Wildlife 2010).

Commercially important species in the Newport area inhabit a variety of positions in the water column and are caught with a variety of techniques. Key species are typically caught using traps (e.g., Dungeness crab), long-lines (e.g., sablefish and albacore), or trawling at different locations within the water column (e.g., mid-water trawls for Pacific whiting and bottom trawls for sole species). While some species are landed only seasonally (e.g., Dungeness crab and albacore tuna), others are landed



fairly consistently throughout the year. For example, the short spine thorny head catch ranged from about 2 – 44 tons per month over the course of the year, but typically fell within the 20 – 30 ton range.

Newport and South Beach flank the Port of Newport, the focus of the area’s commercial fishing and recreation and tourism industries. In 2000, a total of 393 vessels delivered commercial fish landings to Newport. In that year, Newport and South Beach residents owned 90 and 19 active commercial fishing vessels, respectively. The main fisheries exploited by these boats, in terms of ex-vessel landing values, were groundfish, crab, shrimp, highly migratory species, and salmon; these species accounted for more than \$24 million in Newport landings in 2000. Newport prides itself on having a “working waterfront,” and recognizes that the seafood industry is at the core of its history and culture (National Oceanic and Atmospheric Administration 2007).

The activities associated with the installation and removal of the Proposed Project could limit the use of the immediate vicinity for commercial and recreational fishing and navigation. Similarly, the operation of the Proposed Project may result in a small loss of navigational access in the project site if navigational restrictions are necessary to minimize potential vessel collision with project structures. This localized impact would be short in duration and would be anticipated to result in negligible impacts on socioeconomics and environmental justice. Further, the commercial fishing users in the project area are represented by FINE, which participated on the Newport Community Siting Team and thoroughly vetted the community’s proposal and project site. In fact, the PMEC-SETS location was initially recommended by FINE based on their broad knowledge of the regional ocean. The FINE representatives who approved this site have said, "We're willing to give up good fishing assets because we're staunchly for natural energy research" (see letter from FINE to Governor of Oregon in Appendix YY).

## MARINE TRANSPORTATION & NAVIGATION

Marine navigation is defined as the movement of ships and other watercraft in oceans, inlets, and bays. This section describes existing conditions and applicable regulations related to marine navigation extending between Newport Bay and the project site, as well as potential impacts on marine transportation safety associated with PMEC-SETS. For the purposes of this discussion, the study area for marine navigation is defined as the project site (i.e., the 2-square-nautical-mile area of the OCS), as well as the area between the project site and the onshore landfall location for the marine cables.

The main shipping lane into the Yaquina Bay deep-water port runs across the northern boundary of the area identified by the Newport Community Siting Team, which is also partially located within a tugboat lane. However, the siting team, which included Port commissioners to represent maritime commerce, consulted with an expert in marine operations who stated that neither of these issues poses a problem as the lanes are not strictly used once vessels are out on the open ocean. There are no known state or local navigational laws or regulations specific to the project area.

Pursuant to the Ports and Waterways Safety Act (33 U.S.C. et seq.), the U.S. Coast Guard (USCG) is responsible for providing the lead NEPA agencies for the Proposed Project (i.e., BOEM and FERC) with an evaluation of the potential impacts on the safety of navigation and the traditional uses of the waterway and other USCG missions. During that evaluation, the USCG will take into account all possible uses of

the waterway to reconcile the need for safe access routes with the needs of other waterway uses. The USCG also establishes systems and designations to protect and provide additional safe navigational access, including special anchorage areas (33 U.S.C. 2030[g]); vessel traffic service areas (33 CFR 161), safety or security zones (33 CFR 165), traffic separation schemes (33 CFR 167), or shipping safety fairways (33 CFR 166) within or near the study area. As part of the final design and authorization process for PMEC, NNMREC-OSU will coordinate with the USCG to determine which of these designations apply to the project area.

As the federal agency responsible for marine safety, the USCG is also responsible for maintaining federal aids to navigation (e.g., LORAN<sup>10</sup> stations, lighthouses, buoys, and structures), permitting private aids to navigation, and keeping the boating community abreast of changes in the navigational system. The 13th District of the USCG, Waterways Management Branch, assumes these responsibilities for Oregon. NNMREC-OSU will coordinate with the USCG to ensure that PMEC structures are marked and maintained appropriately, as documented in an approved Private Aids to Navigation (PATON) permit. The PATON application requires an assessment of the appropriate onsite aid, including the shape, dimensions, information and regulatory marks, and lighting characteristics of the marker.

## NATURAL HAZARDS, HAZARDOUS MATERIALS, OFFSHORE DUMP SITES, UNEXPLODED ORDINANCES

The actively used Yaquina Ocean Dredged Materials Disposal Site (ODMDS) includes two areas approximately 1.75 miles (2.82 kilometers) offshore from the Yaquina Bay Entrance Channel. Each site occupies an area of 597 acres (2.4 square kilometers) of sea floor and has the capacity to receive dredged materials for some 20 years. These areas are used to dispose of materials dredged in order to maintain safe deep-draft navigation through federal channels and permitted actions. Since the ODMDS sites began receiving dredged material in 1928, approximately 21,465,000 cubic yards of dredged material has been deposited there. The Yaquina ODMDS is located northeast of the project site and anticipated cable routes, so the proposed project is not expected to have any impacts to the disposal sites or activities. However, NNMREC-OSU has and will continue to coordinate with the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency with regards to PMEC structures and activities to ensure they do not interfere with the disposal sites.

## MILITARY USES

The waters offshore Newport, Oregon are designated as U.S. Navy Operation Areas, which are areas used by the Navy Fleet Forces for training and weapons systems testing. NNMREC-OSU is not aware of any Operation Subdivision Areas, military Danger Zones, or other military Restricted Areas located in or near the project site. NNMREC-OSU will coordinate with the appropriate government agencies as the site characterization and permitting phases proceed to ensure there are no conflicts with or impacts to military uses from the project.

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<sup>10</sup> LORAN is the acronym for Long Range Navigation, a terrestrial radio navigation system using low-frequency radio transmitters that uses multiple transmitters to determine the location and speed of the receiver.

## CULTURAL & HISTORIC RESOURCES

NNMREC-OSU is unaware of any cultural resource survey of the PMEC area at this time. As part of the regulatory process, however, notice of the proposed project will be provided to the State Historic Preservation Office (SHPO), interested Native American tribes, and other interested parties to confirm that no cultural resources are located near or would be affected by the project. If any historical, cultural, and/or archeological resources are encountered during any phase of the project (e.g., site assessment, installation, operations, removal/decommissioning), then activities would immediately cease and the SHPO would be contacted.

## VISUAL RESOURCES

The visual perception of the PMEC-SETS and its potential impacts on sensitive visual resources in the vicinity will determine effects to aesthetic resources. Aesthetic impacts can result from a number of activities, including the permanent or temporary obstruction of scenic views, the addition of an undesirable element to the visual landscape, or the removal or degradation of an aesthetically pleasing visual element. The PMEC-SETS would introduce new, human-made elements to the visual landscape which have the potential to create visual contrasts that could affect the integrity, unity, or perceived quality of the visual landscape. Because visual impacts are subjective and linked to human experience, potential adverse impacts will depend on the context and sensitivity of viewers affected, as well as the duration of the impacts.

It is anticipated, however, that most project structures activities would be outside of the visual range of beach areas adjacent to the project site. For an average adult standing on the shore near sea level, the distance to the horizon on flat terrain is approximately 3.0 miles (Nautical Know How 2009). The PMEC-SETS is approximately 5 nautical miles from shore; as such, project structures and activities would be near or beyond the limit of visual perception. However, it is possible that on clear days with calm or flat seas, the tops of the WEC devices (particularly larger models) would be silhouetted against the sky.

Installation and removal activities would involve approximately the same number of vessels and a similar intensity of activity, so effects on the visual landscape are anticipated to be similar during these phases. Operations and maintenance would involve fewer vessels and a lower level of activity, so effects are anticipated to be smaller during this phase. Overall, negligible impacts on aesthetic resources are anticipated; however, site-specific effects analysis, along with additional stakeholder engagement, will be conducted to characterize and, if needed, mitigate impacts to visual resources.

## SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Lincoln County, Oregon includes the communities of Newport (an incorporated city), South Beach (an unincorporated area partially located within the Newport city limits), and the surrounding lands and waters. Their combined population in 2000 was estimated at 10,641. Approximately 90% of the population was white, while the next largest group identified with two or more races. In 1999, Per-capita income was approximately \$20,400, while median household income was approximately \$32,000. In comparison, the national per-capita and median household incomes in 1999 were \$21,587 and \$41,994, respectively. Roughly 14% of the population had income below the poverty level. The area's

main employment sectors are government; education, health, and social services; and entertainment, recreation, accommodation, and food. The area's main industries are tourism, fishing, and wood products (National Oceanic and Atmospheric Administration 2007).

Activities associated with the installation and removal of the project structures could result in short-term, temporary limitations in commercial and recreational fishing and navigation within the P MEC-SETS and immediate vicinity. Similarly, the project operations may result in a small loss of navigational access within the project site if navigational restrictions are necessary to minimize potential vessel collision with project structures. These temporary, localized impacts would be short in duration and are anticipated to result in negligible impacts on socioeconomic and environmental justice.

The design, installation and operations of the P MEC-SETS could create a few new local jobs and would result in a minor beneficial employment impact. Additional local economic activity would result from the ongoing personnel and local services associated with project operations and maintenance. Based on the small number of minorities and the moderate income levels in the study area, minimal impacts on environmental justice populations are anticipated.

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## CONFORMANCE TO STATE & LOCAL ENERGY PLANNING

### STATE

On December 14, 2012, Governor Kitzhaber released the 10-Year Energy Action Plan for Oregon, which is a central component of the Governor’s overall strategy to position Oregon to be more competitive in the global economy. The 10-Year Energy Action Plan emphasizes the importance of the state’s Renewable Portfolio Standard that directs Oregon utilities to meet a percentage of their customers’ energy needs through renewable resources, which include wave energy. Goal 2 of the Plan, Enhance Clean Energy Structure, highlights wave energy as an important component of the energy resource mix that Oregon will capitalize on to meet the state’s power supply needs. Specifically, it states that:

*Responsibly sited wave energy has significant potential not only to provide additional resources to power Oregon, but to create a business cluster and models that can be exported to other states and countries around the world. The state is committed to developing a regulatory structure that is useful and provides clear guidelines for developing wave energy facilities off of the Oregon coast.*

In addition to highlighting the wave energy industry in Oregon, the Governor’s plan underscores the importance of the NNMREC-OSU wave energy testing facility and its role in accelerating the development of wave power in Oregon.

The P MEC-SETS project site was identified through a comprehensive a site selection process that involved environmental review and extensive consultation with stakeholders and other interested parties. While the wave energy devices and mooring systems associated with the SETS project would be located on the OCS, the subsea transmission lines would be located within the Territorial Sea of the State of Oregon and are therefore subject to review for consistency with Statewide Planning Goal 19 (Ocean Resources) and Oregon’s Territorial Sea Plan (TSP) Part IV. Because the project site was selected in close coordination with stakeholders and the purpose is to better understand the ecological, economic and social impacts and benefits of wave energy, the proposed project is consistent with the Territorial Sea Plan and Goal 19.

### LOCAL

The CLPUD serves the Newport area and will manage the transmission of energy from P MEC-SETS to the electric grid. NNMREC-OSU began coordinating with the CLPUD prior to the final site selection in 2012, and PUD representatives have confirmed that grid interconnection for the SETS wave energy test facility is viable. The CLPUD has existing telemetering with BPA’s Toledo substation which will allow metering as required to meet federal interconnection requirements. NNMREC-OSU is also coordinating with Bonneville Power Authority (BPA) in regards to power transmission and grid-interconnection for SETS.

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# QUALIFICATIONS DOCUMENTATION

## LEGAL

NNMREC is a research center at OSU, and it is OSU that is the official legal entity owning and operating the P MEC-SETS facilities. OSU is a public university in the state of Oregon, and is an agency of the state. Documentation of OSU’s legal status in the form of a letter from the Oregon Governor’s office can be found in Appendix A. There have been no legal or regulatory actions taken against NNMREC-OSU since it’s formation in 2009.

## TECHNICAL

### **ORGANIZATION PROFILE & STRUCTURE**

Oregon State University was founded in 1868 as Oregon State’s [Land Grant](#) university. OSU is one of only two universities in the U.S. to have [Sea Grant](#), [Space Grant](#) and [Sun Grant](#) designations. Oregon State is also the only university in Oregon to hold both the Carnegie Foundation’s top designation for research institutions and its prestigious Community Engagement classification.

As Oregon’s leading public research university, with \$281 million in external funding in the 2012 fiscal year, Oregon State’s impact reaches across the state and beyond. With [12 colleges](#), [15 Agricultural Experiment Stations](#), 35 county [Extension](#) offices, the [Hatfield Marine Sciences Center](#) in Newport and [OSU-Cascades](#) in Bend, Oregon State has a presence in every one of Oregon’s 36 counties, with a statewide economic footprint of \$2.06 billion.

Oregon State has a diverse student body of over 26,000 students from across Oregon, all 50 states and more than 100 countries. They can choose from more than 200 undergraduate and more than 80 graduate degree programs, including over 30 degrees online offered through [Oregon State Ecampus](#). Oregon State increasingly attracts high-achieving students, with nationally recognized programs in areas such as conservation biology, agricultural sciences, nuclear engineering, forestry, fisheries and wildlife management, community health, pharmacy and zoology.

NNMREC, a partnership between OSU and the University of Washington (UW), was established through the U.S. DOE Water Power Program and local funding to support wave and tidal energy development for the United States. The collective NNMREC activities facilitate commercialization of wave and tidal energy devices, inform regulatory and policy decisions, and close key gaps in marine renewable energy understanding with an emphasis on student learning.

Since its establishment in 2008, NNMREC has made great strides to assist and guide the development of the wave energy industry in the U.S. through technology testing and validation, environmental study and analysis, and understanding the human dimensions of the emerging ocean energy industry. One of NNMREC’s primary roles is to serve as an integrated, standardized test center for US and international wave energy developers, and it has quickly become a “one stop shop” for the wave industry, providing comprehensive testing facilities for all technologies from early TRL (e.g. wave tank) to advanced TRL (e.g. open ocean testing).

## LABORATORY AND FIELD FACILITIES

NNMREC-OSU is home to world-class research facilities, including the O.H. Hinsdale Wave Lab, the Wallace Energy Systems and Renewables Facility in Corvallis, OR and the Hatfield Marine Science Center in Newport, OR. With the ability to leverage existing world class research facilities both on land and in the ocean, P MEC is the final component that is needed to position the US West Coast as truly competitive in the international market for the ocean energy industry.

- [Wallace Energy Systems & Renewables Facility](#) The WESRF provides research, testing and services related to machines and drives, power electronics, hybrid electric vehicles, power systems and renewables. WESRF is the home of the  $\mu$ , an instrument that creates the relative motion between a spar and heaving buoy to simulate wave action. Eleven wave energy device prototypes have been tested on the Linear Test Bed.
- [O. H. Hinsdale Wave Research Laboratory](#) The O.H. Hinsdale Wave Research Laboratory (WRL) is one of the largest and most sophisticated laboratories for education, research and testing in coastal and ocean engineering and related areas. Projects include: tsunami research, wave energy, wave-structure interaction, near shore hydrodynamics and environmental fluid mechanics. A leading center for research and education in coastal engineering and nearshore science, the WRL facilities include a Large Wave Flume (104 m long), Tsunami Wave Basin with multi-directional wave maker, and Control Room for on-site researchers. The Large Wave Flume is the largest of its kind in North America. Tsunami Wave Basin is equipped with a large-stroke, directional wave maker with active wave absorption. These facilities have been used to test 1:15 and 1:33 scale wave energy converters, respectively.
- [Hatfield Marine Science Center](#) HMSC plays an integral role in marine and estuarine research and instruction, as a unique laboratory facility serving resident scientists and graduate students, and as a base for oceanographic research.

## PRIOR/CURRENT PROJECTS

In addition to its land-based facilities, one of NNMREC-OSU's most distinguishing attributes is its proximity to the ocean itself. The ocean waters just north of Newport Harbor have as served as a primary testing ground for the wave energy industry in the US. In addition to testing various energy generation technologies, significant investment has been made in understanding ecosystem interactions and socioeconomic effects of this new industry. After four years of laboratory study and analysis, NNMREC-OSU became home to the nation's first ocean test berth in 2012, capable of testing a variety of ocean energy technologies while monitoring interactions with the local ecosystem.

This open ocean test facility, P MEC-NETS, is located approximately 2.0 miles (3.2 kilometers) off the coast of Newport, encompassing an area of approximately one square nautical mile that ranges in depth from 45 – 55m. Significant wave heights (SWH) average 1 - 2.5m during summer months at 6 - 9 second energy periods. During winter months these increase to SWH averaging 2 - 5m at 8 - 12 second energy periods, with maximum significant wave heights of 7 - 14m. In 2012, NNMREC-OSU completed

construction of its novel Ocean Sentinel, an instrumentation buoy that enables off-grid scaled testing of wave energy converters (WECs).

The Ocean Sentinel is a surface buoy based on the 6-meter NOMAD (Navy Oceanographic Meteorological Automatic Device) design that facilitates open-ocean, stand-alone testing of WECs with average power outputs of up to 100 kW, providing power analysis and data acquisition, environmental monitoring, as well as an active converter interface to control power dissipation to on-board electrical loads. In 2012, the Wave Energy Technology-New Zealand (WET-NZ) device was the first WEC device deployed and tested at the open-ocean test site with the Ocean Sentinel. In addition to device testing, NNMREC-OSU has conducted a significant level of baseline and potential effects monitoring at the non-grid test site, focusing on benthic habitat, marine mammals, electromagnetic frequency (EMF), and acoustics.

The NETS site is available for WEC testing on a year round basis if the WEC stands alone with self-contained data acquisition instrumentation. WECs can be connected to the Ocean Sentinel for testing during the months of May through October. The NETS site is fully permitted for Ocean Sentinel deployment; WECs to be tested require a US Army Corps permit. In addition to being used for WEC testing, the NETS site will be used for research investigations related to WEC deployments at P MEC-SETS. For example, plans are underway to test a variety of anchoring options at NETS that will inform design decisions at SETS.

#### **PROJECT PERSONNEL**

*Include key personnel directly involved w/management of the proposed project and site. Include names, titles, description of relevant experience, credentials/training.*

Belinda Batten is the NNMREC Director, and a Professor of Mechanical, Industrial, and Manufacturing Engineering (MIME) at OSU. She has over ten years of program management and leadership experience, having been the School Head of MIME, and a the Program Manager for Dynamics and Control for the Air Force Office of Scientific Research. She holds a PhD in Mathematical Sciences from Clemson University and serves on the Oregon Wave Energy Trust Board. She is responsible for the overall direction of the P MEC-SETS project, and is the primary lead for fundraising.

Sean Moran, PE, MS, MBA is the NNMREC Ocean Test Facilities Manager and in this capacity was responsible for bringing P MEC-NETS online in summer 2012. He has broad experiences as a consultant for large civil engineering projects, as well as experience with city planning? He is responsible for the Engineering Design aspects of the P MEC-SETS project.

Sarah Henkel, PhD is NNMREC-OSU's Director of Environmental Research and is an Assistant Professor of Zoology at the Hatfield Marine Science Center. She is a Benthic Ecologist and was responsible for benthic characterization at the P MEC-NETS. She is responsible for coordinating the scientists and engineers performing baseline studies for site characterization at P MEC-SETS, and is a primary liaison for the Stakeholder Committee concerned with permitting and adaptive monitoring and mitigation for P MEC-SETS.



Dan Hellin, MS is NNMREC’s Environmental Compliance Manager, responsible for overall adherence to agreements established within permitting and licensing processes. He has over 20 years of experience in coastal and ocean management and has been involved in multi-disciplinary research projects focused on a wide range of issues including marine spatial planning; port and harbor management; waterfront planning; offshore renewable energy; watershed management; the application of GIS technologies; assessments of marine facilities; studies of recreational boating and fishing; regulatory and policy analysis and development; and economic analysis. He is responsible for coordinating compliance with adaptive management plans for testing at P MEC-NETS. This entails communicating requirements to WEC developers, working with the environmental scientists and ocean test facilities manager to ensure that all monitoring plans are carried out per agreements. He is responsible on reporting on monitoring outcomes to all pertinent stakeholders. These responsibilities will carry over to the P MEC-SETS once that facility is operational.

Greg McMurray, PhD has over thirty years’ experience working in the arena of ecological risk assessment in marine and coastal environments. This experience has fostered a unique skill set with which to address the environmental and regulatory challenges of renewable ocean energy development. Chief among these skills are project management, scientific integration and synthesis, and the thoughtful and deliberate use of science to inform policy decisions, especially as applied to the evolving ecosystem-based management and marine spatial planning paradigms. He assists NNMREC with advice around environmental protocols relating the regulatory framework, and will work in NNMREC in this role until permits and licenses for P MEC-SETS are obtained.

#### **TECHNICAL CONSULTANTS**

*Include key consultants directly involved w/management of the proposed project and site. Include names, titles, description of relevant experience, credentials/training.*

Pacific Energy Ventures (PEV) specializes in project management of early stage technologies, regulatory and policy analysis, and developing public-private partnerships in the emerging renewable energy sector. PEV’s expertise lies in project coordination, regulatory strategy, strategic marketing, and securing public and private funds for renewable energy development.

Oregon Wave Energy Trust (OWET) leads economic development activities for wave energy technology in Oregon, and is a key partner to NNMREC and WEC developers. They provide funding for research and testing, and are leaders in supporting and developing the supply chain for marine energy in Oregon State University.

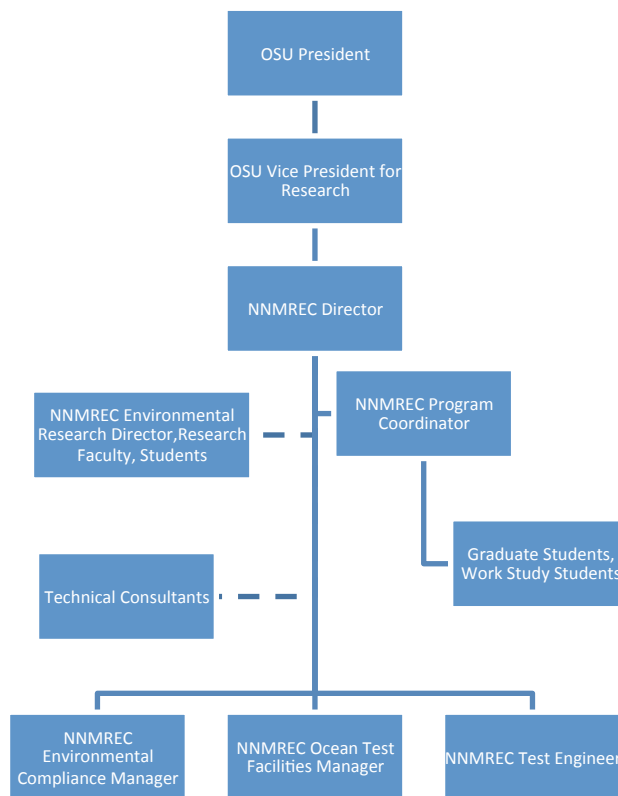
European Marine Energy Center (EMEC) in Orkney Scotland led a team to provide the preliminary concept design for P MEC-SETS. As the global “gold standard” in wave and tidal testing, their knowledge and insights about best practices for a grid connected test center have been a key piece of the design process thus far for SETS. EMEC continues to assist NNMREC with advice and consulting services.

Aquatera, also in Orkney Scotland, is an environmental and products consultant that has been engaged in marine renewable energy. They provide information that aids in management of potential impacts of projects such as P MEC-SETS on the environment, and the environment on the project. They provide

integrated support for the full lifecycle of renewables projects from initial concepts through to decommissioning.

Central Lincoln Public Utility District will provide engineering and construction services for the land-based infrastructure design related to grid connection for P MEC-SETS.

Requests for proposals will be released for contractors to propose to assist NNMREC in the various aspects of P MEC-SETS design and construction, including: environmental document preparation for regulatory and permitting; cable routing; engineering design of land-based infrastructure (e.g., switch gears, data acquisition equipment, grid connection elements—working with CLPUD); engineering design services for subsea cable power and communications connector system; cable design; sea-based infrastructure, including directional drilling; SETS construction.



**FIGURE 7: NNMREC ORGANIZATIONAL CHART WITHIN OREGON STATE UNIVERSITY**

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## ACQUISITION FEE

There is no acquisition fee for a research lease, as indicated by 30 CFR, Part 285, Section 238, paragraph (g).

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# CERTIFICATION

[Redacted]

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