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West Coast Wave Energy Planning & Assessment Framework

Assessment of Information and Approaches for Ocean Renewable Energy Siting and Planning

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Oregon Wave Energy Trust (OWET) is a nonprofit public-private partnership funded by the Oregon Innovation Council. Its mission is to support the responsible development of wave energy in Oregon. OWET emphasizes an inclusive, collaborative model to ensure that Oregon maintains its competitive advantage and maximizes the economic development and environmental potential of this emerging industry. Our work includes stakeholder outreach and education, policy development, environmental assessment, applied research and market development.

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1 Introduction

1.1 Background

The initial structure and platform of the West Coast Planning & Assessment Framework (*Framework*) were developed with funding from the U.S. Department of Energy in 2009. In 2010, the Oregon Wave Energy Trust (OWET) provided funding for the addition of Management Authorities, Phased Development, Coastal Marine Spatial Planning, and Oregon Socioeconomics to the *Framework*.[1] This work was funded by OWET as part of its efforts to support policy and regulatory framework development to advance the wave energy industry.

1.2 Approach

From 2010 - 2011, the project team researched and developed content for the Management Authorities, Phased Development, Coastal Marine Spatial Planning, and Oregon Socioeconomics sections of the *Framework*. In addition to performing literature reviews and database searches, the project team engaged in face-to-face discussions and phone conversations with key individuals in some of the topic areas. After researching and compiling information, the project team drafted individual entries for each topic area and incorporated them into the *Framework*.[2] Each entry is organized by section, including **Description of Issue**, **Key Data Gaps**, and **Information Sources**. The *Oregon Socioeconomics* entries also include a **Potential Effects** section, and the *Management Approaches* and *Marine Spatial Planning* entries have an **Initiatives** section. Similarly, the *Phased Development* entry includes a **Benefits** section.

After drafting the entries, the project team engaged with stakeholders to solicit feedback on the materials. Notification of and instructions for public comment were posted on the Advanced H_2O Power Feedback Forum[3] and announced in the May and June editions of Pacific Energy Ventures' monthly newsletter.[4] In addition, the project team conducted a webinar on June 13, 2011 to discuss the *Oregon Socioeconomics* materials with stakeholders and solicit further feedback.

At the close of the comment period, the project team reviewed the feedback and revised the materials to reflect stakeholder input. Several information sources were added, and the data gaps sections for many of the entries were expanded. After revising the materials, the project team performed an assessment of the available information and data relating to the new sections of the *Framework* for this report.

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[1] The WCGA funded the addition of the California and Washington Socioeconomics sections to the Framework in 2011 as part of their West Coast Marine Renewable Energy Planning Guide.

[2] The West Coast Planning and Assessment Framework is accessible at: http://www.advancedh2opower.com/framework/default.aspx

[3] The Feedback Forum is accessible at: http://www.advancedh2opower.com/framework/Lists/Posts/Post.aspx?List=896816ad-0d55-4f3c-96c1-242d45cd5e89&ID=31&Source=http%3A%2F%2Fwww.advancedh2opower.com%2Fframework%2FLists%2FPosts%2FAllPosts.aspx

[4] All issues of Pacific Energy Ventures' newsletters are accessible in an archive: http://www.advancedh2opower.com/Website Parts/newsletter.aspx

1.3 Purpose

During the development of the *Management Approaches*, *Phased Development*, *Marine Spatial Planning*, and *Socioeconomics* sections of the *Framework*, key gaps in the available information and data became apparent. This report provides a synopsis of those gaps, based on the project team's experience and findings in its research, subject matter discussions, and engagement with stakeholders. Options to address some of the key data gaps are also provided in this report.[5] The body of the report includes data gaps and options considered to be high priority (i.e., those that could provide measurable near-term benefit). A detailed review of data gaps and options for all the topic areas in the Socioeconomics section of the Framework is provided in Attachment A. It is important to note that these options are not explicit recommendations. Instead, they are intended to provide insight on future development of the *Framework*, as well as relevant research efforts, as appropriate.

2 Coastal Marine Spatial Planning

Spatial analysis of ocean and coastal uses and resources can provide strategic support to ocean renewable energy planning and siting processes. In order for spatial analysis to effectively support siting and planning on the West Coast, it is advantageous for all West Coast states to utilize consistent data collection, data format, and user-interface methods.

West Coast MarineMap

Efforts are underway in each of the West Coast states to characterize and develop spatial displays of ocean and coastal uses and resources. California and Oregon have the most advanced tools with California *MarineMap* [6]and Oregon *MarineMap*,[7] which are web-based decision support tools for open and participatory spatial planning in the marine environment. In addition, the California Ocean Uses Atlas[8] maps the "full range of significant human uses of the ocean in state and federal waters off the coast of California" (National MPA Center). Washington has a process underway to develop similar spatial analysis tools.

OPTIONS TO ADDRESS DATA GAPS:

- **Support coordinated development of a regional *MarineMap* that encompasses each of the West Coast states.**
- **Coordinate development of Oregon's *MarineMap* with California and Washington to ensure consistent data collection methods and displays.**

[5] Because this report is a summary assessment, options are not provided for every data gap identified.
[6] http://marinemap.org/
[7] http://oregon.marinemap.org/
[8] http://www.mpa.gov/dataanalysis/atlas_ca/

3 Phased Development

Phased development involves starting with a small-scale project that is expanded through a series of build-outs over time to enable developers and regulators to better understand and manage the performance and potential effects of projects. For example, if the long term objective is to build a 100 MW wave energy facility, the initial phase might be the deployment of a 10 MW pilot-project. Data and information collected during the initial pilot phase would then be used to inform expansion of the project to a 20 MW facility. This incremental information collection and build-out would continue until the 100 MW commercial facility is complete.

Phased development can help meet business needs and regulatory requirements by providing a progressively better understanding of the technology, the environment, and project effects. Early development and regulatory experience indicates that developers, agencies, and stakeholders support a phased development approach for ocean renewable energy because it enables effective, informed management of device performance and environmental effects.

At present, neither federal nor state regulatory processes are structured to support an incremental approach to development. Under current regulatory processes, each phase of development must be separately licensed or permitted.

OPTION TO ADDRESS DATA GAPS:

- **Support the development of a comprehensive framework to facilitate phased development of ocean renewable energy projects that includes phase thresholds, study & monitoring approaches, adaptive management, and regulatory strategy.**

4 Management Approaches

4.1 Adaptive Management

Because ocean renewable energy technologies are relatively new and the associated potential effects are not well understood, the success of early projects will likely depend upon the successful implementation of an adaptive management plan. However, the precise means of implementing adaptive management in the context of ocean renewable energy development is still fairly vague.

The US Department of the Interior (DOI) published a broad policy statement on Adaptive Management in 2008, followed by a Technical Guide in 2009. An adaptive management plan was developed for the OPT Reedsport Wave Energy Project Settlement Agreement, and a principal author of that plan discussed the general doctrine of adaptive management in the context of ocean renewables in an article published in the 2009 issue of *Oceanography* (Oram and Marriott 2009). The Cape Wind Final Environmental Impact Statement (FEIS) also describes the use of adaptive management, but only in the context of possible avian strikes.

Guidance from the U.S Department of Interior and lessons learned from early projects like Reedsport and Cape Wind provide a good starting point for utilizing adaptive management in ocean renewable energy projects. However, given the importance of adaptive management in managing the uncertainties inherent in new energy technologies, further development of this approach is needed to effectively apply it to ocean renewable energy development.

OPTION TO ADDRESS DATA GAPS:

- **Coordinate with BOEMRE and WCGA to collectively fund or conduct a project to amend DOI's adaptive management guidelines to the specific application of ocean renewable energy development.**

4.2 Integrated Ecosystem Assessments (IEAs)

The Integrated Ecosystem Assessment (IEA) is the evolving process identified by NOAA to implement ecosystem-based management at the scale of the large marine ecosystem (LME). This is relevant to ocean renewable energy because IEAs will be used to develop ecosystem indicators and targets which will be the basis for monitoring and adaptive management.

IEA efforts are ongoing in Puget Sound, and the third report focusing on the northern California Current (the LME on the west coast) was released this year (Levin and Schwing 2011). In fall 2010, the WCGA responded to a call for proposals from the Regional Ocean Partnership Funding Program (ROPFP) for regional ocean governance and its relationship to Coastal and Marine Spatial Planning (CMSP). The WCGA responded, in part, with a proposal that included the initiation of sub-regional IEA efforts that would scale up to the level of the California Current LME. However, federal funds for the ROPFP have not yet been secured.

OPTION TO ADDRESS DATA GAPS:

- **Fund and initiate a sub-regional IEA focused on the Reedsport Wave Energy Project and immediate vicinity, extending along- and off-shore as feasible.**

4.3 Cumulative Impact Assessments

Federal and state regulatory processes applicable to ocean renewable energy development require a cumulative effects assessment to be conducted for each project under consideration. Although the specific federal and state requirements vary somewhat in their definitions, a cumulative effects assessment is essentially an evaluation of potential effects of various actions (i.e., multiple projects) that cannot be assessed in the analysis of a single proposed action. Cumulative impacts must be addressed through the integration and synthesis of multiple project-specific assessments. This is a significant undertaking for a new industry.

OWET has supported multiple years of work on a soon-to-be-completed Cumulative Effects Analysis Framework, the final product of which will be a GIS Tool for assessing various development scenarios and the potential impacts and benefits. This tool is expected to play a significant role in Coastal and Marine Spatial Planning (CMSP) in Oregon.

OPTIONS TO ADDRESS DATA GAPS:

- **Design and implement targeted stakeholder outreach to evaluate how the Cumulative Effects Assessment Framework and GIS Tool may be applied to cumulative impact assessments of ocean renewables, the evolving Coastal and Marine Spatial Planning context, and the development of Section 5 of Oregon's Territorial Sea Plan. (Specifically, what the tool does do, doesn't do, and how it overlaps with other tools.)**
- **Utilize the results of the stakeholder outreach to formalize future updates and maintenance of the Tool and how it will be funded.**

5 Socioeconomics

5.1 Support and Coordinate Data Collection

As part of this project, summaries of socioeconomic resources potentially affected by ocean renewable energy were added to the *Framework*. As stated previously, there are gaps in the availability and accessibility of information for most socioeconomic resources. This section addresses data collection needs that the project team has identified as important to near-term siting and planning processes.

Cultural Resources

Although comprehensive information for properties listed on the National Register is readily available, it is not readily accessible. Cultural survey documents are inventoried by the State Historic Preservation Office (SHPO) and the data is added to an archaeological database, but information on known archaeological sites may only be accessed by qualified archaeological researchers who make an appointment with the SHPO Archaeologist to search the files. Also, the information is not generally available in a format that can be used in geospatial analysis. Similarly, information and data for submerged archeological sites and traditional cultural properties is not readily accessible, nor is it typically formatted for use in geospatial analysis. However, the Oregon Survey Program is in the process of adding a GIS component to its historic sites information system, which will provide the spatial information needed to describe the locations of many cultural resources in Oregon's coastal zone.

OPTIONS TO ADDRESS DATA GAPS:

- **Utilize data from the "Inventory and Analysis of Coastal and Submerged Archaeological Site Occurrence on the Pacific OCS" study to generate GIS layers that spatially identify historic and archeological sites on the OCS.**

5.2 Support Key Potential Effects Studies

The collection of existing information for the new sections of the *Framework* included searching for studies and data on potential effects to socioeconomic resources from the development of ocean renewable energy. Potential effects evaluations in the following topic areas will further support siting and planning decisions for ocean renewable energy.

Commercial/Recreational Fishing

In the absence of commercial-scale ocean renewable energy facilities in the U.S., the extent to which fishing vessels could be restricted from certain areas is unclear, and the potential effects of restricted access are largely unknown.

OPTIONS TO ADDRESS DATA GAPS:

- **Conduct a review of studies on the effects of restricted access in offshore areas (e.g., military exclusion zones, marine reserves), with a focus on the productivity of commercial and recreational fisheries. Analyze the study results to gain insight on the potential effects of restricted access related to ocean renewable energy facilities.**
- **As pilot-scale marine renewable energy projects are developed, design and implement studies to monitor effects on the productivity of commercial and recreational fisheries in the project area.**

Ocean Renewable Energy

In the absence of operational ocean renewable energy facilities, economic effects analysis of these projects is largely dependent on models. A recent study funded by OWET examines the economic impacts of wave energy development for both the coastal economy and the state economy. However, the study relies on model assumptions and will need actual data to validate the assumptions.

OPTION TO ADDRESS DATA GAPS:

- **Form a regional partnership to track the economic impacts of initial marine renewable energy projects as they are developed.**

6 Streamlining Information Access

As stated previously, the addition of new sections to the *Framework* involved researching information needed to support ocean renewable energy siting and planning decisions. Through the research process it became apparent that much of the relevant resources are scattered across various places, making it difficult to assimilate information. To maximize the value of investments in data and information to support ocean renewable energy, it is important that the products of these investments are easily accessible. Therefore, the following option focuses on streamlining and improving access to available information and resources for all the topic areas associated with ocean renewable energy.

West Coast Wiki

Internet search engines provide virtually instant access to a vast amount of information on any topic imaginable, and ocean renewable energy is no exception. However, the sheer number of online resources can actually hinder access to relevant information. Access to and use of information is further

encumbered by a lack of coherence, comprehensiveness and context among the various sources. Because it is not easily accessible, much of the available knowledge is not applied. Development of a Knowledge Management System for ocean renewables would facilitate access to and use of information needed to inform ocean renewable energy development.

Recent experience with and research on different types of information systems suggests that a wiki would be the most effective platform for an ocean renewable energy Knowledge Management System.[9] A "West Coast Wiki" would contain large body of relevant, coherent information on ocean renewable energy development on the west coast, enabling practitioners, policymakers and general stakeholders to easily access, share and gain knowledge. Information from existing resources could provide initial content for the West Coast Wiki. In particular, the *West Coast Planning and Assessment Framework* and the *Tethys* would provide a strong foundation for content in the West Coast Wiki.

OPTIONS TO ADDRESS DATA GAPS:

- **Support the development of a West Coast Wiki for ocean renewable energy on the west coast, with the objective of seamlessly integrating all relevant information from the various existing resources into a central, collective knowledge management system.**
- **Provide financial support for the Oregon-related components of the West Coast Wiki, including the initial wiki set-up, content transfer, and future development content and system development.**

[9] A complete list of wiki features and functionality is presented in Attachment B.

Attachment A: Socioeconomics Data Gaps & Options

Commercial and Recreational Fishing

The commercial and recreational fishing entries address the economic value of commercial and recreational fishing, which includes information on number of fish caught, number of anglers/vessels, and number of fishing trips per year. These entries do not include shore-based fishing; that activity is included in the Ocean Recreation section.[10]

Existing Information

Information and data on commercial and recreational fishing in Oregon are now available in geospatial format within Oregon *MarineMap*, a web-based decision support tool for open and participatory spatial planning in the marine environment. The data used to generate fishing maps was derived as part of the ***Oregon Fishing Community Mapping Project***, a public-private partnership implemented to compile comprehensive maps illustrating the commercial, charter, and recreational fishing use patterns and values along the Oregon coast.[11] Most commercial and recreational fishing grounds on the Oregon Coast have been mapped, and the information is being integrated into Oregon *MarineMap* for use in ocean renewable energy siting and CMSP initiatives. This data supports both planning and siting decisions by providing a baseline for monitoring and evaluation of spatial management measures and identifying sites for wave energy projects which minimize impacts to fishing.

Potential Effects

In the absence of commercial-scale marine renewable energy facilities in the U.S., the extent to which fishing vessels could be restricted from certain areas remains largely unknown. Also, potential effects of restricted access are unknown.

OPTIONS TO ADDRESS DATA GAPS:

- **Conduct a review of studies on the effects of restricted access in offshore areas (e.g., military exclusion zones, marine reserves), with a focus on the productivity of important commercial and recreational fisheries. Analyze the study results to gain insight on the potential effects of restricted access related to marine renewable energy facilities.**
- **As pilot-scale marine renewable energy projects are developed, design and implement studies to monitor effects to productivity of commercial and recreational fisheries in the project area.**

[10] Commercial and recreational fishing are described separately in the Planning Guide, but they are addressed together here because the extent of available information and data is consistent for both.
[11] Details on the Oregon Fishing Community Mapping Project are available at http://www.oregonwave.org/oregon-fishing-community-mapping-project/.

Tourism

Tourism includes the number of visitors and expenditures on recreational activities like diving, surfing, sightseeing and wildlife viewing, as well as lodging, meals, and entertainment.

Existing Information

Economic data on tourism is derived from varying methods of data collection and analysis and across a broad range of scales, which creates inconsistencies between information sources and economic analyses. For example, some economic assessments measure the "Travel" industry, while others look at "Tourism and Recreation." In addition, Oregon has a long coastline, so the tourism data often encompasses broad geographic areas. Another limitation to the presently available economic data on tourism is that it is generally not available GIS format. As a result, information and data on tourism is usually not spatially explicit enough to quantify the level of economic activity associated with tourism within communities on the west coast.

OPTIONS TO ADDRESS DATA GAPS:

- **Define specific parameters of tourism that will provide relevant and consistent evaluation criteria for use in CMSP and marine renewable energy siting.**
- **Assess existing data and, where possible, extract information that falls within the established parameters into data sets that can be used to inform decision-making.**
- **Examine international examples of CMSP and renewable energy siting for insight on how to best collect baseline information on the tourism industry.**

Marine Infrastructure & Services

Ocean renewable energy development will utilize port and navigation resources for construction and deployment activities and, to a lesser degree, operations and maintenance of the energy facilities. This topic explores the capability of current port facilities to support ocean renewable energy.

Existing Information

In 2008, OWET funded a wave energy infrastructure assessment for Oregon.[12] This project was conducted to help Oregon understand the needs of wave energy developers, determine the capabilities and limitations of the existing infrastructure, and provide a path to resolve identified issues so that Oregon can provide the infrastructure and services needed for wave energy development.

OPTIONS TO ADDRESS DATA GAPS:

[12] The project report is available at http://www.oregonwave.org/coastal-infrastructure-inventory-wave-energy-infrastructure-assessment-in-oregon/.

- **As additional information on maritime infrastructure and operations is collected, update the data in Oregon *MarineMap*.**

- **Continue to implement actions in the public and private sectors of the marine infrastructure and services industry to provide the necessary support for marine renewable energy development.**

Ocean Renewable Energy

As the ocean renewable energy industry advances, there may be new and/or increased demands for products and services. The types of increased or new demands will depend on many factors, including the type of ocean renewable energy technology and the scale of the project. This category addresses the potential economic impact of the new in*dustry.*

Potential Effects

In the absence of operational marine renewable energy facilities, economic effects analysis of these projects is dependent on models. A recent study funded by OWET examines the economic impacts of wave energy development for both the coastal economy and the state economy.[13]

OPTION TO ADDRESS DATA GAPS:

- **Form a regional partnership to track the economic impacts of initial marine renewable energy projects as they are developed.**

Demographics

Demographics information can be used to describe the characteristics of a community. Demographics are often described using population size, density, growth rate, employment/unemployment rate, gender, race, age, education attainment, income sources, and political orientation. A community's demographics can change in response to transitions in industrial sectors of the community's economy.

Existing Information

Although a large amount of demographic information for coastal communities in Oregon exists, the data collection methods are not consistent in each community and the information is collected across a variety of scales, which makes it difficult to compare data. For example, demographics data for one area may represent the town, while the information in another area represents the entire county. Also, demographics data are generally not available GIS format.

[13] Information on this project is available at http://www.oregonwave.org/wp-content/uploads/Economic-Impact-Study-FINAL-mod.pdf.

Demographics evaluations are also important to the regulatory and permitting processes for marine renewables. Evaluating a population's the demographics can help identify minority and low-income communities that could be affected by marine renewable energy development, which federal action agencies are required to do to ensure Environmental Justice compliance.[14] Communities located in rural areas of the west coast have traditionally relied on natural resource-based industries like timber and commercial fishing as sources of income, while some of the more urban communities in the region depend largely on tourism and recreation. It is possible that marine renewable energy development could alter the demographics of coastal communities; however many other factors can also influence community demographics, making it difficult to identify sources of demographic changes.

OPTIONS TO ADDRESS DATA GAPS:

- **Define specific parameters of demographics that will provide relevant and consistent evaluation criteria for use in CMSP and marine renewable energy siting.**
- **Explore whether mapping demographic trends in coastal communities of interest would help inform management and regulatory decisions.**
- **Review work conducted by the Sustainable Coastal Communities ACT to identify efforts that could also inform the demographics section of the Planning Guide. Examine international examples of CMSP and renewable energy siting for insight on how to evaluate potential impacts to coastal community demographics.**

Ocean Recreation

Ocean Recreation includes activities both onshore and in the ocean. Level of use for ocean recreation is evaluated by Number of Participants and Number of Participation Days. Primary recreational activities include Land Based (i.e., Beach Visitation, Walking, Hiking, Viewing or Photographing Scenery, and Wildlife Viewing) and Ocean Based (i.e., Swimming, Snorkeling, Scuba Diving, Surfing, Motorboating, Sailing, Canoeing, and Kayaking.)

Existing Information

Researchers at Oregon State University (OSU) recently conducted a study on non-consumptive ocean uses, including sailing, power boating, personal water crafts, windsurfing, kite boarding, charter trips, and tow-in surfing.[15] Non-consumptive ocean users were interviewed to find out "what they require for recreation, their values and opinions, and where they are recreating" (Eardley and Conway, 2011). Results from these interviews were summarized and integrated into Oregon *MarineMap*.

[14] Under U.S. Executive Order 12898 all Federal agencies are required to ensure that their actions will not cause disproportionately high or adverse human health or environmental impacts to low-income, minority, or tribal populations.

[15] The study is available online at http://www.oregonwave.org/wp-content/uploads/OWET-OSU-OSG-Non-Consuptive-Rec-Ocean-User-Comm-Final-Report-.pdf

OPTION TO ADDRESS DATA GAPS:

- **Add the information gathered in this report to the Oregon Ocean Recreation section of the Planning Guide.**

Tribal Lands & Practices

This entry identifies the historic range of Native American Indian tribes. This information is important because it provides the basis for present day tribal access; specifically reserved rights and access to usual and accustomed places and it will also determine where culturally important archeological, ceremonial and burial sites exist. Although the historic events and specific details of each tribe's situation vary considerably, tribes retain unique rights in such areas as hunting, fishing, and water use.

Existing Information

Information on the spatial and temporal nature of tribal resources and activities on the west coast is not readily available. Involving tribal authorities in CMSP initiatives and marine renewable energy projects can help ensure that tribal uses and resources are accurately represented and considered in planning and siting decisions.

OPTIONS TO ADDRESS DATA GAPS:

- **Engage tribal leaders in CMSP and marine renewable energy siting processes to help ensure that tribal uses and resources are accurately represented and considered in planning and siting decisions.**
- **As these activities move forward, coordinate and communicate with tribes to monitor potential effects to tribal uses and resources.**

Cultural Resources

Cultural resources can include places, properties, structures, or objects with historic, religious, or archeological significance, and they can be found in both terrestrial and marine environments. Cultural resources may also include community practices, historic properties, archeological resources, and tribal cultural practices and properties.

Existing Information

Oregon has numerous cultural resources, many of which are central to the sense of identity and history of coastal communities. Oftentimes, cultural resources are not documented in a manner conducive to establishing baseline conditions for the purposes of informing CMSP and ocean renewable energy decision-making. Further, the complex nature of the socioeconomic environment makes it difficult to determine the exact cause(s) for changes in cultural resources.

OPTION TO ADDRESS DATA GAPS:

- **Upon completion of the BOEMRE funded study regarding ocean renewable energy and space-use conflicts, assess the output results for utility in CMSP decisions and ocean renewable energy development. Design future research in this area to address unanswered questions.**

Although comprehensive information for properties listed on the National Register is readily available, it is not readily accessible. Cultural survey documents are inventoried by the State Historic Preservation Office (SHPO) and the data is added to an archaeological database, but information on known archaeological sites may only be accessed by qualified archaeological researchers who make an appointment with the SHPO Archaeologist to search the files. Also, the information is not generally available in a format that can be used in geospatial analysis. Similarly, information and data for submerged archeological sites and traditional cultural properties is not readily accessible, nor is it typically formatted for use in geospatial analysis. However, the Oregon Survey Program is in the process of adding a GIS component to its historic sites information system, which will provide the spatial information needed to describe the locations of many cultural resources in Oregon.

OPTIONS TO ADDRESS DATA GAPS:

- **Utilize data from the "Inventory and Analysis of Coastal and Submerged Archaeological Site Occurrence on the Pacific OCS" study to generate GIS layers that spatially identify historic and archeological sites on the OCS.**[16]
- **Utilize cultural and historical resource GIS data in siting and planning decisions to avoid and/or mitigate potential effects to submerged cultural resources.**

Aesthetics

Aesthetics refers to the natural or physical beauty of an area. Evaluations of aesthetic resources generally consider the significance of aesthetic resources to surrounding communities and public vantage points for viewing natural features.

Existing Information

Aesthetic resources in Oregon are fairly well-documented, but high-resolution spatial data on these resources is not readily accessible. Also, a standard method of measuring the relative value of these resources is not presently available. In the absence of commercial-scale marine renewable energy facilities in the U.S., predictive models are the best available tool for evaluating potential effects to aesthetic resources.

OPTIONS TO ADDRESS DATA GAPS:

- **Establish a standard method for measuring the value of aesthetic resources, and utilize that method in aesthetic resources evaluations related to CMSP and marine renewable energy siting.**

[16] This study is expected to be completed in 2012. Details are available online at http://www.boemre.gov/omm/pacific/enviro/Enviro-Studies/PC-11-01.pdf.

As CMSP efforts advance on the west coast, collect more detailed data on the locations of coastal and marine aesthetic resources, and generate GIS layers for aesthetic resources.

- **Employ the "Visual Impact Evaluation System for Offshore Renewable Energy" to assess potential effects of marine renewable energy development on aesthetic resources.**

  *BOEM is funding the development of a **Visual Impact Evaluation System for Offshore Renewable Energy** that allows users to design the spatial layout and content of an offshore facility, import and prepare geospatial data that will affect visibility, run a series of sophisticated visual analyses, define atmospheric, lighting and wave conditions, and generate one or a series of realistic visualizations from multiple viewpoints. The system will also accept three-dimensional computer models of facilities submitted by project applicants or available from third parties, and will include pre-built models of many facilities. Output will be in the form of maps, tabular reports and high-quality rendered images. All of this will be accomplished within a familiar ArcGIS interface. This project began 2010, and it is expected to be complete in three years.*[17]

- **Review study methods used in the "Visual Effects Analysis for the Cape Wind Energy Project" for applicability to analysis of potential effects of marine renewable energy to aesthetic resources on the west coast.**

  *The **Cape Wind Energy Project - Visual Effects Analysis** provides detailed analysis of potential visual effects of the proposed Cape Wind Energy Project. While the report is specific to the geographic location and technology type proposed, the study methods may be applicable to other areas and technologies.*[18]

[17] Information on this project is available at: http://www.nopp.org/funded-projects/fy2010-projects/topic-2-developing-environmental-protocols-and-monitoring-to-support-ocean-renewable-energy-and-stewardship/

[18] The full report is available at: http://www.boemre.gov/offshore/PDFs/CWFiles/31.pdf

Attachment B: Wiki Features

HIGHLY FUNCTIONAL, EASY-TO-USE INTERFACE Wiki pages can be organized into sections that are directly accessible through a "clickable" table of contents at the top of the page, enabling users to quickly access information within their particular area of interest and at their desired level of detail. Just like the references tool in a Word document, wiki pages can automatically generate tables of contents and footnotes lists based on the page content.

CONTENT IS SEAMLESSLY CONNECTED Each page within the West Coast Wiki would focus on a particular topic, and relevant guidance documents, articles, research results, workshop summaries, and technical reports can be included (either as links or attachments) in each wiki page. In addition, groups of pages with similar content can be easily created from keywords used to describe page content. These groups can be inserted into the navigation panel, or directly into a wiki page, to give easy access to all pages with related information.

DIRECT ACCESS TO MORE COMPREHENSIVE INFORMATION Supporting documents and footnote references can be inserted into wiki pages to give users access to more in-depth information. Access to the most detailed, technical information can be provided by linking references to the original sources in external websites and databases.

MEMBERSHIP The wiki platform gives site managers the option of allowing stakeholders to become members of the site, enabling them to do things like contribute to and monitor discussions, create personalized lists of "favorite" pages, and/or contribute to page content. The membership feature is easy to use and manage, as it allows people to register as a member on their own (as opposed to a site manager needing to create an account for everyone who wants to be a member).

- **Permissions*:*** Group permissions can be used to manage how much (or little) certain members can contribute. For example, "general" members might be restricted from making certain types of edits, or their contributions might require approval from a site manager. Similarly, unique permissions can be set for any page in the wiki, enabling the site manager to choose which pages members can (or cannot) access. Also, pages that are under development can remain private until they are ready for release.

- **Notification*:*** Members can subscribe to receive notifications of changes made to pages that they are interested in. This feature facilitates stakeholder discussions about content in the topic areas they are particularly interested in, and it keeps users informed of updates in content.

- **Favorites:** Members can add pages to their "favorites" list to provide quick access those pages. The favorites list is part of the main navigation panel, so when a member signs in to the wiki, their unique favorites list will appear.

DISCUSSION BOARDS Each wiki page can have its own discussion board, enabling stakeholders to collectively communicate about topics of interest. Similar to a blog, the discussion page allows users to post questions and comments about the content of a particular wiki page. In addition, users can "follow" discussions, meaning that they will be notified when someone replies to or comments on the discussion.

EDITING The wiki editing functionality enables simple, yet extensive page edits. In addition to formatting text, the editing tool can be used to easily insert images, navigation buttons, calendars, spreadsheets, PDF files, videos, maps, discussion areas (within a page as opposed to viewing the discussion on a separate page), lists of top contributors, polls, etc.

HISTORY All changes to each wiki page are tracked and maintained in the page's history, showing the date of the change, the author, and any comments about the change. The history is available to all users. It also enables comparison the current version of the page with previous versions. Also, a previous version of a page can be restored, if needed.

REFERENCES Just like the references tool in a Word document, wiki pages can automatically generate tables of contents and footnotes lists based on the page content.

NAVIGATION/TAGS Tags are keywords used to describe the type of content in a page, and tags enhance navigation by organizing wiki pages into groups based on their tags. For example, pages with content on biological, physical and socioeconomic baseline information could all have the tag "baseline." The tag tool can automatically generate a list of all pages with the "baseline" tag, and the list can be inserted into a wiki page and/or navigation panel to give easy access to pages with baseline information.

EXPORT TO PDF Any wiki page can be exported to a PDF file making it easy to use site content in reports, presentations, websites, etc.

USAGE TRACKING Usage statistics are automatically tracked and can be viewed at any time. Several indicators are applied to give detailed analyses of *how the site is being used* and *by whom*. The usage analysis and statistics can help inform content development by showing which pages are the most popular, which pages are not being visited, etc.