



U.S. DEPARTMENT OF
ENERGY

PNNL-21876

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

Regulatory Assistance, Stakeholder Outreach, and Coastal and Marine Spatial Planning Activities In Support Marine and Hydrokinetic Energy Deployment

Task 2.1.7: Permitting and Planning Fiscal Year 2012 Year-End Report

Environmental Effects of Marine and Hydrokinetic Energy

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September 2012



Pacific Northwest
NATIONAL LABORATORY

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Richland, Washington 99352

Abstract

This fiscal year 2012 year-end report summarizes activities carried out under DOE Water Power task 2.1.7, Permitting and Planning. Activities under Task 2.1.7 address the concerns of a wide range of stakeholders with an interest in the development of the MHK industry, including regulatory and resource management agencies, tribes, NGOs, and industry. Objectives for 2.1.7 are the following:

- To work with stakeholders to streamline the MHK regulatory permitting process.
- To work with stakeholders to gather information on needs and priorities for environmental assessment of MHK development.
- To communicate research findings and directions to the MHK industry and stakeholders.
- To engage in spatial planning processes in order to further the development of the MHK industry.

These objectives are met through three subtasks, each of which are described in this report:

- 2.1.7.1—Regulatory Assistance
- 2.1.7.2—Stakeholder Outreach
- 2.1.7.3—Coastal and Marine Spatial Planning

As the MHK industry works with the regulatory community and stakeholders to plan, site, permit and license MHK technologies they have an interest in a predictable, efficient, and transparent process. Stakeholders and regulators have an interest in processes that result in sustainable use of ocean space with minimal effects to existing ocean users. Both stakeholders and regulators have an interest in avoiding legal challenges by meeting the intent of federal, state, and local laws that govern siting and operation of MHK technologies. The intention of work under 2.1.7 is to understand these varied interests, explore mechanisms to reduce conflict, identify efficiencies, and ultimately identify pathways to reduce the regulatory costs, time, and potential environmental impacts associated with developing, siting, permitting, and deploying MHK systems.

Project Summary

Energy generated from the world's oceans and rivers offers the potential to make substantial contributions to the domestic and global renewable energy supply. The U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE) Wind and Water Power Program supports the emerging marine and hydrokinetic (MHK) energy industry. As major players in an emerging industry, MHK project developers face challenges with siting, permitting, construction, and operation of pilot- and commercial-scale facilities, as well as the need to develop robust technologies, secure financing, and gain public acceptance.

In many cases, little is known about the potential effects of MHK energy generation on the aquatic environment from a small number of devices or a large-scale commercial array. Nor do we understand potential effects that may occur after years or decades of operation. This lack of knowledge affects the solvency of the industry, the actions of regulatory agencies, the opinions and concerns of stakeholder groups, and the commitment of energy project developers and investors.

To unravel and address the complexity of environmental issues associated with MHK energy, Pacific Northwest National Laboratory (PNNL) is developing a program of research and development that draws on the knowledge of the industry, regulators, and stakeholders and builds on investments made by the EERE Wind and Water Power Program. The PNNL program of research and development—together with complementary efforts of other national laboratories, national marine renewable energy centers, universities, and industry—supports DOE's market acceleration activities through focused research and development on environmental effects and siting issues.

Research areas addressed include:

- **Categorizing and evaluating effects of stressors** – Information on the environmental risks from MHK devices, including data obtained from in situ testing and laboratory experiments (see other tasks below) will be compiled in a knowledge management system known as *Tethys* to facilitate the creation, annotation, and exchange of information on environmental effects of MHK technologies. The *Tethys* will support the Environmental Risk Evaluation System (ERES) that can be used by developers, regulators, and other stakeholders to assess relative risks associated with MHK technologies, site characteristics, waterbody characteristics, and receptors (i.e., habitat, marine mammals, and fish). Development of the *Tethys* and the ERES will require focused input from various stakeholders to ensure accuracy and alignment with other needs.
- **Effects on physical systems** – Computational numerical modeling will be used to understand the effects of energy removal on water bodies from the short- and long-term operation of MHK devices and arrays. Initially, PNNL's three-dimensional coastal circulation and transport model of Puget Sound will be adapted to test and optimize simulated tidal technologies that resemble those currently in proposal, laboratory trial, or pilot study test stages. This task includes assessing changes to the physical environment (currents, waves, sediments, and water quality) and the potential effects of these changes on the aquatic food webs) resulting from operation of MHK devices at both pilot- and commercial-scale in river and ocean settings.

- **Effects on aquatic organisms** – Testing protocols and laboratory exposure experiments will be developed and implemented to evaluate the potential for adverse effects from operation of MHK devices in the aquatic environment. Initial studies will focus on electromagnetic field effects, noise associated with construction and operation of MHK devices, and assessment of the potential risk of physical interaction of aquatic organisms with devices. A variety of fish species and invertebrates will be used as test animals, chosen due to their proximity to and potential susceptibility to MHK devices.
- **Permitting and planning** – Structured stakeholder communication and outreach activities will provide critical information to the project team to support execution of other project tasks. Input from MHK technology and project developers, regulators and natural resource management agencies, environmental groups, and other stakeholder groups will be used to develop the user interface of the *Tethys*, populate the database, define the risk attributes of the ERES, and communicate results of numerical modeling and laboratory studies of exposure of test animals to MHK stressors. This task will also include activities to promote consideration of renewable ocean energy in national and local coastal and marine spatial planning activities.

The team for the Environmental Effects of Marine and Hydrokinetic Energy Development project is made up of staff, faculty, and students from

- Pacific Northwest National Laboratory
 - Marine Sciences Laboratory (Sequim and Seattle, Washington)
 - Risk and Decision Sciences (Richland, Washington)
 - Knowledge Systems (Richland, Washington)
- Oak Ridge National Laboratory (Oak Ridge, Tennessee)
- Sandia National Laboratories (Albuquerque, New Mexico; Carlsbad, California)
- Oregon State University, Northwest National Marine Renewable Energy Center (Newport, Oregon)
- University of Washington, Northwest National Marine Renewable Energy Center (Seattle, Washington)
- Pacific Energy Ventures (Portland, Oregon).

Acronyms and Abbreviations

AOP	Annual Operating Plan
BOEMRE	Bureau of Ocean Management, Regulation and Enforcement
CMSP	coastal and marine spatial planning
DOE	U.S. Department of Energy
ERES	Environmental Risk Evaluation System
MHK	marine and hydrokinetic energy
NGO	nongovernmental organization
NOAA	National Oceanic and Aeronautic Administration
NOC	National Ocean Council
PNNL	Pacific Northwest National Laboratory
<i>Tethys</i>	PNNL's Knowledge Management System

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1 Introduction to 2.1.7

For the marine and hydrokinetic (MHK) industry to move forward, communication with affected stakeholders about concerns, uncertainties, and emerging information will be critical. Ongoing research into the environmental effects and other barriers to deploying of MHK devices are beginning to provide information that can be useful in resolving uncertainty and addressing regulatory risk. Communicating the results of research and engaging in on going policy and planning activities can inform and potentially influence regulatory agencies, stakeholder groups, and MHK project developers and investors as they plan for, site, license and deploy the first generation of MHK technologies

Success of the current Pacific Northwest National Laboratory (PNNL) MHK project depends on developing products and tools that meet the needs of strategic stakeholders. Timely outreach will connect laboratory findings regarding the effects of MHK devices on physical systems and aquatic organisms to key stakeholders. Engagement with key stakeholders throughout the project will guide the development of strategies to categorize and evaluate the effects of MHK-related stressors on the marine environment. Elicitation of stakeholder views informs products related to the MHK planning and permitting processes.

In the PNNL project, Permitting and Planning (2.1.7) is a task under Environmental Impacts and Siting (2.1) for which the FY12 Annual Operating Plan (AOP) identifies four objectives (Table 1). There are three subtasks under task 2.1.7. These include:

- 2.1.7.1 Regulatory Assistance
- 2.1.7.2 Community and Stakeholder Outreach
- 2.1.7.3 Spatial Planning

Table 1. Permitting and Planning task objectives and related subtasks.

Permitting and Planning Task 2.1.7 Objectives	Related Subtask
A. To work with stakeholders to streamline the MHK regulatory permitting process	2.1.7.1 (Regulatory Assistance)
B. To work with stakeholders to gather information on needs and priorities for environmental assessment of MHK development	Secondarily 2.1.7.2 (Community and Stakeholder Outreach)
C. To communicate research findings and directions to the MHK industry and stakeholders	Primarily 2.1.7.2 (Community and Stakeholder Outreach)
D. To engage in spatial planning processes in order to further the development of the MHK industry	2.1.7.3 (Spatial Planning)

This year-end report summarizes activities carried out in fiscal year 2012 to meet the objectives of task 2.1.7. Effort was focused primarily in tasks 2.1.7.2 and 2.1.7.3. No additional funds were allocated to 2.1.7.1 actions in 2012—carryover funds were used to present project results of the regulatory assessment to interested agencies at the Federal Renewable Ocean Energy Working Group (FROEWG). Work under 2.1.7.2 focused on planning and executing two webinars on environmental effects of MHK technologies, preparing outreach materials and attending the Global Marine Renewable Energy Conference in Washington DC, as well as planning and attending the IEA-OES Annex IV workshop in Dublin, Ireland.

2 Regulatory Assistance

2.1 FROEWG Presentation

In 2011, PNNL completed an assessment of existing regulatory priorities and cost drivers for siting and permitting MHK projects, through surveys and interviews with project developers. A summary of that study was included in the 2011 year-end report for 2.1.7 activities. In 2012, with a small amount of carryover funds (4k), PNNL worked with the Water Power Team to pull thematic findings from that report (sanitized to remove information that could be linked to individual developers) and present those findings to the FROEWG at its April meeting.

Members of the FROEWG were interested in reading the actual report, which due to sensitive information provided by study participants had not been released. PNNL and DOE agreed to work with industry to synthesize report findings in a manner that could be publicly consumable. Members of the FROEWG also expressed interest in participating in a similar study, but from the perspective of regulatory agencies.

PNNL is working with the Ocean Renewable Energy Coalition to review the 2011 report, refine the report and release findings at a future FROEWG meeting. In the future, PNNL and DOE will determine if there is utility and interest in updating the report on a bi-annual basis in order to track industry and regulatory community progress in address regulatory challenges.

3 Stakeholder Outreach

3.1 Subtask Introduction

Recognizing the importance of strategic and timely stakeholder engagement, subtask 2.1.7.2 addresses the concerns of a wide range of stakeholders with an interest in the development of the MHK industry, including regulatory and resource management agencies, tribes, nongovernmental organizations (NGOs), and industry. Potential environmental effects of MHK devices and operations lead the list of issues of concern for many stakeholders; conflicts with existing and planned beneficial uses are also of importance. This subtask assists with information collection for development of the *Tethys* and ERES tools (subtasks 2.1.1.1 and 2.1.1.2, respectively) and provides outreach and dissemination of materials developed under tasks 2.1.2 (Effects on the Physical System) and 2.1.3 (Effects on Aquatic Organisms) in a manner accessible to stakeholders. Both internal (PNNL) and Water Power programmatic outreach needs are targeted through 2.1.7.2 activities. Objectives of subtask 2.1.7.2 are to

- Develop a process for gathering input from stakeholders that will assist in defining the needs and parameters of *Tethys* and ERES.
- Develop project outreach materials and convene opportunities for dissemination of project information and outcomes to interested stakeholder groups.
- Work with industry stakeholders to determine the environmental study needs for specific MHK technology types and to compare those needs to the research directions of the national laboratories and the DOE MHK program.

The overall approach of Community Stakeholder Outreach (2.1.7.2) activities is to bring together regulators, MHK device and project developers, and engaged stakeholders to ensure that all parties have the same information about proposed projects and regulatory pathways. Although the stakeholder group is broad and varied and, in some areas, not well defined, two separate groups are identified: 1) the MHK industry, which includes technology developers, project developers, and some instrumentation manufacturers; and 2) regulatory and resource management agencies at the federal, state, and local level; tribes; NGOs; university researchers; and interested members of the public. Where appropriate, the two overall stakeholder groups are brought together, usually focused on a site-specific project or region; however, in general, information has been and will continue to be sought from the two groups separately to ensure that there is an open and free exchange of information. Further divisions within the second group can be useful to better deliver information to target audiences. For example, based on the level of engagement in the topic and likely interests, we have found it useful to meet separately with regulatory and resource management agencies and the environmental NGO community.

3.2 FY 2012 Stakeholder Outreach Activities

DOE identified three objectives for the Community and Stakeholder Outreach task in the FY12 Annual Operating Plan (objectives 1-3 in Table 2). In addition to objectives in the AOP, DOE has expressed a need to better coordinate, collaborate, and disseminate the products of our environmental

research to other national laboratories, federal agencies, industry, and interested stakeholders (Objective 4 in Table 2).

Table 2. FY12 objectives and planned PNNL activities.

Subtask 2.1.7.3 Objectives		PNNL Activities
Objective 1	Continue outreach in support of <i>Tethys</i> , ERES and Annex IV. Outreach will help project outputs that best meet the needs of agency, industry, and DOE in delivering environmental research knowledge and risk management.	Develop outreach plan Develop outreach materials describing project outcomes Attend GMREC and present outreach materials to industry and agencies Coordinate with Pacific Energy Ventures on Assessment of <i>Tethys</i> and AdvancedH2Opower user needs—update and add content accordingly
Objective 2	Plan and carry out two environmental research webinars in coordination with Water Power staff and an interagency planning group.	Two Webinars: Acoustic effects and Annex IV international data sharing.
Objective 3	Coordinate with DOE and the Annex IV team to plan and carry out an expert’s workshop in Dublin Ireland to solicit feedback and input on the Annex IV database and Case Studies. This task will be the primary focus of outreach activities in 2012.	Plan and execute workshop and cover travel expenses for US attendees.

3.2.1 Objective 1—Inform Development and Use of *Tethys* and ERES

Activities to address objective 1 carried out in fiscal year 2012 include the following:

- **Developed a FY 2012 Stakeholder Communication and Outreach Plan to focus and guide activities throughout FY 2012.** The completed plan was submitted to the DOE Water Power Team in March.
- **Developed communication materials for Environmental Research:** PowerPoints, one-pagers, and posters, were displayed and presented in April at GMREC in Washington DC. Three PNNL staff traveled to GMREC, with one staff dedicated to sharing materials at the booth. All three staff met with agencies and industry to share information on PNNL research products.
- In partnership with Pacific Energy Ventures, PNNL **evaluated the effectiveness of *Tethys* and AdvancedH2Opower.com in reaching desired audiences with targeted information.** Following this assessment PEV assisted PNNL in adding content to *Tethys* and changed the user interface of Advanced H2O Power. As of the end of the FY, PNNL and PEV are working through an existing subcontract to improve integration between the two websites.

3.2.2 Objective 2—Environmental Webinars

IN 2011, PNNL and the Water Power Team initiated a series of environmental webinars intended to encourage strategic and efficient application of DOE-funded environmental research to address the major deployment barriers facing the MHK industry and stakeholders. The webinar series continued in FY 2012 with two additional webinars, each attended by approximately 150 stakeholders from agencies, the research community, industry, and other interested parties:

- December 14, 2011—Acoustic Impacts: Anthropogenic noise production in the marine environment is a known stressor to many different aquatic species. However, the impacts of MHK generated noise to marine life are uncertain and whether this noise will result in harmful effects has yet to be determined. This webinar focused on current research efforts to determine the potential impacts of MHK-produced noise to aquatic animals. Materials can be accessed on *Tethys* at: http://mhk.pnnl.gov/wiki/index.php/December_14_2011_Webinar
- April 3, 2012—The Annex IV Project: International Data Sharing Efforts for Potential Environmental Effects of Marine Renewable Energy: This webinar discussed the Annex IV Project, an international effort initiated by the International Energy Agency’s Ocean Energy Systems Implementing Agreement (OES-IA) to identify research or data collection efforts that are being conducted around the world, along with available results, and produce a public database to house this information. Materials can be accessed on *Tethys* at: http://mhk.pnnl.gov/wiki/index.php/April_3_2012_webinar

3.2.3 Objective 3—Annex IV Workshop in Dublin Ireland

The International Energy Agency—Ocean Energy Systems Annex IV is an international effort to identify, collect, and summarize environmental reports and metadata from deployments of MHK devices worldwide. The Department of Energy is leading this effort, and PNNL is assisting the Water Power Team in information and data collection, organization of data and information on *Tethys*, drafting and disseminating a number of case studies on topics of environmental interest, and planning and executing an experts workshop in Dublin Ireland on October 15, 2012.

Funds from 2.1.7.2 were used in FY 12 to augment the Annex IV budget and assist in workshop planning, case study preparation, travel for members of the US delegation, and final workshop execution and facilitation. Appendix A provides the draft agenda for the October 15th workshop, along with a cover letter to approximately 50 experts who will be in attendance. The purpose of the workshop is to seek expert review on the annex IV database, the case studies, and the final report. The final Annex IV report updates follow the workshop and will be provided to DOE under a separate cover.

4 Coastal and Marine Spatial Planning

4.1 Subtask Introduction

In July 2010 President Obama issued an Executive Order¹ adopting the recommendations of the Interagency Ocean Policy Task Force, establishing the National Policy for the Stewardship of the Ocean, Coasts, and Great Lakes, creating the National Ocean Council (NOC), and providing for the development of coastal and marine spatial plans. Activities under subtask 2.1.7.3 focus on the directive for development of coastal and marine spatial plans and the implications of those activities on ocean renewable energy, with a particular focus on regional planning activities on the US West Coast.

Coastal and Marine Spatial Planning (CMSP) is a relatively recent coastal and ocean management concept with roots in Integrated Coastal Resource Management, Ecosystem-Based Management, and Comprehensive Shoreline Planning. The development of Geospatial Information System (GIS) spatial analysis tools have emphasized the incorporation and visualization of scientific and human use data to drive planning processes. CMSP is intended to be a collaborative stakeholder driven process, as emphasized by The United Nations Educational Scientific and Cultural Organization's (UNESCO) description of CMSP as "a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that are usually specified through a political process" (Ehler and Douvère 2009). Activities in this subtask aim to engage with and understand both sides of CMSP: Spatial data-driven decision support and collaborative policy processes.

Two objectives for this subtask are:

- To provide input and assess the findings of ongoing coastal and marine spatial planning programs, and to apply those findings to help guide future research directions.
- Incorporate MHK-specific environmental, resource, and competing use data into comprehensive ocean and resource planning tools and engage with industry, government, and other stakeholders to develop coastal and marine spatial planning activities in order to fully incorporate MHK equities and values.

In 2012, PNNL was tasked to participate on the West Coast Governor's Agreement on Ocean Health Renewable Energy Action Team (RE-ACT), the BOEM/Oregon Renewable Energy Task Force, The Oregon Ocean Policy Advisory Committee, The Washington State Ocean Advisory Council, Washington state Marine Resource Committee, west coast National Ocean Commission process and meetings, and other regional planning bodies as directed by Water Power headquarters. The goal of this participation was to connect on-going west coast regional planning activities to DOE-supported research products and information about renewable energy siting needs.

¹ Exec. Order No. 13547, 75 Fed.Reg. 43023 (July 22, 2010).

In addition to direct support for DOE engagement in CMSP activities, PNNL also focused effort in the following tasks:

- PNNL GIS specialist Chaeli Judd completed a prototype for web-based analysis of MHK opportunities and constraints, using Washington State’s Puget Sound as a test case. A report on this effort is included in section 4.4.
- Simon Geerlofs and Luke Hanna collaborated with the Water Power Team and Oregon Department of Energy to draft and publish an article in the IEA-OES Annual Report on the Oregon Territorial Sea Planning process. This article uses interviews with stakeholders and literature review to explore the tension of planning for an emerging use of ocean space (renewable energy) within an existing policy framework that prioritizes existing uses. The report is available online at: <http://www.ocean-energy-systems.org/>
- On May 22, 2012, PNNL Intern Kara Blake attended the European Commission, EU Maritime Day Conference in Gothenburg, Sweden. One of the conference events pertinent to this report included a workshop titled “Delivering offshore electricity to Europe through EU integrated Maritime Spatial Planning (MSP).” A report from that workshop is included below in section 4.5

4.2 Summary of 2012 PNNL CMSP Participation

In fiscal year 2012, PNNL worked on behalf of the Water Power Team to engage with agencies, industry, NGOs and other stakeholders in Coastal and Marine Spatial Planning activities from the perspective of ocean renewable energy. Coastal and Marine Spatial Planning is underway in many states and regions with implications for how and where MHK technologies will be deployed. Continuing work that began in 2011, in 2012 PNNL supported DOE engagement in west coast CMSP activities, through the West Coast Governor’s Agreement on Ocean Health, the BOEM/Oregon Renewable Energy Task Force, and attendance at other national and west coast CMSP forums. PNNL has provided briefings to DOE staff, meeting summaries, presentations, and other support resulting from these activities.

Table 3 summarizes PNNL participation in CMSP activities in fiscal year 2012. All meetings listed were attended at the request of DOE, with briefings provided to Water Power staff either in memo form, email, over the phone, or in person.

Table 3. FY 2011 PNNL participation in West Coast CMSP activities and processes.

Activity/Attendees	Dates	PNNL Staff	Notes
West Coast Governor’s Agreement on Ocean Health—Renewable Energy Action Coordination Team <i>Representatives from WA, OR, CA, BOEM, NOAA, USFWS, DOE, FERC, Tribes, Interested Citizens, and Industry</i>	Monthly Teleconference	Simon Geerlofs	<ul style="list-style-type: none"> • Monthly updates to the WCGA RE-ACT on DOE activities and research projects. • WCGA activities were less focused in 2012 than they were in 2011. The Oregon Territorial Sea Plan took much of the discussion. Federal lead, Maurice Hill retired from BOEM in April 2012 and RE-ACT activities became less frequent in his absence
BOEMRE/Oregon OCS Renewable Energy Task Force <i>Formal State Federal Working Group, representatives from OR planning and resource management agencies, and federal partners in planning for renewable energy</i>	April 12 2012 and September 24 2012	Simon Geerlofs	<ul style="list-style-type: none"> • Attended April and September meetings in Portland, OR. • BOEM and OR focused discussion around the integration of the OR Territorial Sea Plan with BOEM’s process to identify wave energy areas on the OCS. • A science workshop in Corvallis, OR is scheduled in November to understand the state of the science surrounding siting and planning for renewable energy technologies (sponsored by BOEM and OR). • BOEM is working with NOAA Coastal Services Center to collect spatial data on human uses and visual resources on the OCS that could be impacted by ocean renewable energy.
Oregon Ocean Policy Advisory Committee—Territorial Sea Plan Working Group <i>Working group that will review and recommend approval of the OR Territorial Sea Plan</i>	December 15-16, 2011	Simon Geerlofs	<ul style="list-style-type: none"> • Attended the December OPAC and TSPWG meetings on behalf of DOE. • Meetings discussed the first round of mapping of the OR Territorial Sea—Mapping outcomes provided extremely limited opportunities for renewable energy. • Meeting initiated a dialog with DOE, OR DOE, OWET and others about how to ensure inclusion of renewable energy opportunities in the OR TSP process. • Culminated in article in IEA-OES 2012 annual report on the OR TSP process.
Washington State Ocean Advisory Council <i>Council formed to advise the state on coastal CMSP activities</i>	Grays Harbor, WA May 11, 2012	Charlie Brandt	<ul style="list-style-type: none"> • Delivered a presentation to the WSOAC on renewable energy and CMSP. • The WSOAC is in the early phase of Washington’s CMSP process—PNNL has engaged with the Council and

			secured a seat at the table to provide information on renewable energy opportunities.
North Pacific Marine Resource Committee <i>County based advisory group that is participating in WA CMSP activities</i>	Forks, WA September 18, 2012	Simon Geerlofs	<ul style="list-style-type: none"> • PNNL presented a summary of OR CMSP efforts to inform the MRCs participation in WA’s CMSP process.

4.3 West Coast CMSP

This section summarizes the current status of CMSP within U.S. waters during 2012. At the national level, the National Ocean Council is taking preliminary steps to refine national objectives for CMSP and conducting outreach in each of the nine regions where CMSP plans will be prepared in future years. A lack of federal funding for regional planning activities has slowed the process, although on the West Coast, Washington, Oregon, and California continue with state planning initiatives of their own, as well as coordinated activities through the West Coast Governor’s Agreement on Ocean Health, and BOEM state task forces.

Renewable energy is a CMSP driver on the West Coast. However, as an emerging use of ocean space characterized by diverse technologies and business models, it is not always easy for the renewable energy industry to fully participate in planning processes in a coordinated way. State planning activities have sought to first identify and protect areas that are important to existing users, and then consider areas left over as suitable for energy use. If the best areas for energy production are excluded through this approach, renewable energy may be relegated to places that are not economically advantageous or feasible for energy production due to lack of resource availability, transmission difficulties, distance from port facilities and other factors. Part of the problem stems from uncertainty over technology needs (depth, transmission distance, etc.); as mentioned before, planners may not have a consensus from industry about which areas are most desirable for energy use. Concern and uncertainty over potential effects on other uses is another important factor to consider. As consolidation of technology takes place and as research on the environmental/social effects of MHK devices is completed over the next several years, planners and industry members will be better informed for productive planning and siting conversations. On the other side of the coin, coastal communities still have understandable skepticism over the viability and benefits of ocean renewable energy—the promise of jobs in marine engineering and high technology sectors is attractive, but there is considerable doubt that wave energy will produce enough power at a low enough cost to provide an energy value to coastal communities. Understanding and articulating grid stability and energy security benefits that could result from generation on the coast (most generation is currently located east of the Cascade Mountains) is a necessary task of ocean energy advocates.

Because of the emerging nature of this industry, the skepticism of key coastal stakeholders (primarily fishermen, who are already deriving sustainable economic benefit from coastal waters and fear displacement by energy installations), and because of expected technology development and the potential to work through use conflicts in the future, it will be essential that CMSP proponents strive for flexible outcomes, consider multiple use areas where renewable energy siting would be allowed under existing

regulations, avoid strictly prohibiting energy uses, and designate appropriate areas for technology testing, pilot projects, and demonstration.

Existing BOEM and FERC process for leasing and licensing technologies allow for project by project consideration of effects on other uses and the environment; the promise of CMSP is that it can provide clear guidance and information tools to coordinate and support these processes, but it is not intended to be a replacement or additional complicating factor. In order to ensure effective participation in national and west coast CMSP activities, DOE may play a role to emphasize and support activities that encourage the promise of CMSP and work to avoid its potential pitfalls.

4.3.1 National Ocean Council

On January 12, 2012, the NOC released a draft National Ocean Policy Implementation Plan for the United States that identifies various actions the Federal Government will be required to take in order to achieve the goals set forth by the National Ocean Policy. Guided by the outcomes of the 12 regional listening sessions and public comments received in 2011, the draft Implementation Plan focuses on nine priority objectives highlighted under the National Ocean Policy. For the CMSP objective, the draft Implementation plan identifies two preliminary national objectives and five actions that the NOC will pursue over the next five years. These are:

CMSP National Objectives:

1. Preserve and enhance opportunities for sustainable ocean use through the promotion of regulatory efficiency, consistency, and transparency, as well as improved coordination across Federal agencies; and
2. Reduce cumulative impacts on environmentally sensitive resources and habitats in the ocean, coastal, and Great Lakes waters.

CMSP Actions:

1. Distribute a *Handbook for Regional Coastal and Marine Spatial Planning*;
2. Convene regional workshops and CMSP exercises;
3. By 2015, all of the applicable non-confidential and other non-classified Federal data identified for inclusion will be incorporated into a National Information System and Data Portal (ocean.data.gov);
4. Establish Regional Planning Bodies; and
5. Within 3-5 years of their establishment, nine regional planning bodies (i.e., one per region) will have developed Council-certified regional CMS Plans for the sustainable use and long-term protection of the ocean, our coasts, and the Great Lakes.

Since NOC's draft Implementation Plan was released, several notable events have taken place pertaining to NOC's CMSP efforts. As of February 1, 2012, the NOC has decided that Regional Fishery Management Councils will now be included in regional CMSP efforts. The inclusion of these regional councils will provide additional knowledge and expertise from each region, strengthening the collaboration between Federal, state and local participants in the CMSP effort. The Obama Administration also launched a new data and information portal, Oceans.Data.Gov, which is NOC's website that provides users with all of the non-confidential and non-classified Federal data and information related to our oceans, coasts and Great lakes.

4.3.2 West Coast CMSP Activities

4.3.2.1 Cross Border, Regional Cooperation, and State/Federal Coordination

The West Coast Governors Alliance (WCGA) on Ocean Health was formed in September 2006 by the governors of California, Oregon and Washington. As a regional collaboration, the purpose of WCGA is to address marine resource management and protection issues along the West Coast. As one of the 11 Coordination Teams created by the WCGA, the Renewable Ocean Energy Action Coordination Team has been tasked to explore the feasibility for offshore renewable energy development along the West Coast and begin to evaluate the potential environmental impacts of these developments. PNNL participates on the WCGA-RE-ACT through monthly coordination calls. PNNL staff provides briefings on DOE funded-research activities and other renewable energy activities that are relevant to west coast planning and coordination activities. 2012 saw transition on the RE-ACT, with federal lead Maurice Hill of BOEM retiring in April and state lead, Paul Klarin, focusing most of his efforts on the OR Territorial Sea Plan.

As part of the WCGA, California, Washington and Oregon have agreed to collaborate with BOEM and other federal agencies to assess the potential impacts of renewable ocean energy on the West Coast. BOEM and Oregon are currently coordinating on OCS renewable ocean energy through a task force which incorporates federal, state, local and tribal entities. The third task force meeting held on April 12, 2012 in Portland, OR and the fourth on September 25 2012, also in Portland. The BOEM/OR Task Force is focusing on identifying priority areas for renewable energy along the OR Outer Continental Shelf (OCS) and also engaging in the territorial sea planning process to ensure adequate federal and state coordination on cross boundary sites, coastal zone management act consistency, environmental and human use research, cabling and interconnection, and device testing. Task Force activities will continue in 2013 with human use and visual impact mapping on the OCS and in the territorial sea. BOEM had originally hoped to use the task force to inform a programmatic environmental impact statement for the OR OCS, however, BOEM has determined that such an effort may be premature at this time and is instead concentrating on human use and visual impact mapping. In late November 2012, OR and BOEM will host a science workshop in Corvallis, OR to inform planning and siting activities. PNNL will participate in this workshop.

4.3.2.2 Washington

In April 2012, the Washington State legislature appropriated \$2.1 million to the Washington State Department of Natural Resources (DNR) to further marine spatial planning in Washington State. (DNR, 2012). In September 2012, DNR released a status report on the state's progress on marine spatial planning, identified how the current funds were being spent, and described future funding needs for the 2013-2015 Biennium. (DNR, 2012). This report is available at: http://www.ecy.wa.gov/programs/sea/msp/pdf/dnr_legislative_report.pdf

The DNR is specifically directed to work with the marine interagency team, the tribes, and the Marine Resource Committees (MRCs) to:

- Develop a marine management plan for the outer coast, allowing an initial focus on this part of the state;
- Begin certain assessment and mapping activities relating to resource use and potential economic development opportunities; and
- Coordinate regional marine waters planning activities, including through the West Coast Governors Alliance.

PNNL engaged with WA Department of Ecology and Department of Natural Resources in 2012 to further planning efforts and ensure inclusion of renewable energy equities in the planning process with presentations to the Outer Coast Advisory Committee and outer coast Marine Resource Committees. PNNL Senior Project Manager for MHK Jeff Ward was nominated and accepted to serve on the Outer Coast Advisory Committee to speak for ocean renewable energy research and Simon Geerlofs is coordinating with the state to include an understanding of ocean energy suitability in the planning discussion. These activities are expected to continue and increase in 2013.

4.3.2.3 Oregon

The Oregon Territorial Sea Plan (OR TSP) process continued in 2012 with the first draft planning maps released at the end of 2011 and subsequent revisions released throughout the year. The initial planning maps provided minimal space for development of ocean renewables, with existing uses and identified resources prioritized and renewable energy confined to the space left over; areas designated as acceptable for energy development did not match up with economically feasible and previously identified energy sites. The Oregon Wave Energy Trust worked closely with the state to address this, offering their own set of maps depicting ocean renewable energy feasibility from the standpoint of economic constraints (distance from shore, distance from transmission, distance from deepwater ports suitable depth, suitable bottom type) for shallow, mid-depth, and deep ocean renewable energy technologies. As of the writing of this report, the state's maps have been revised substantially and the Ocean Policy Advisory Commission, Territorial Sea Plan Working Group, Territorial Sea Plan Advisory Committee, the governor's office and others are encouraging exploration of sites that meet both the needs of industry as well as minimize impacts on other user groups. Final maps and recommendations are expected at the end of the calendar year.

While the OR TSP is moving in a direction that emphasizes positive outcomes for the renewable energy and existing user groups, it should be noted that the length and tone of the planning process has deterred at least one potential developer from investing time and efforts in potential project sites in state waters this fiscal year. In November 2011, Aquamarine Power pulled its office out of Oregon, saying that a lack of regulatory certainty over the ability to acquire seabed leases pending completion of the Oregon Territorial Sea Plan process has made it impossible to continue investing resources in Oregon. (sustainablebusinessoregon.com, 7 Nov. 2011). The company has consolidated its U.S. operations in a California office and is exploring potential project sites on the U.S. west coast in California and Washington State (sustainablebusinessoregon.com, 7 Nov. 2011).

State approval of the wave energy project off the coast of Reedsport proposed by Ocean Power Technologies (OPT) was grandfathered in under the Territorial Sea Plan (sustainablebusinessoregon.com, 7 Nov. 2011), and the company plans to launch the first commercially licensed grid-connected, wave energy device in Spring, 2013.

4.3.2.4 California

California has not made significant moves towards energy driven CMSP in 2012. The state is still emerging from an intense planning effort to designate marine protected areas under the Marine Life Protection Act. CA does engage in WCGA activities and at the state level is actively pursuing renewable ocean energy on a project by project basis.

4.4 Recent Marine Spatial Planning Activities in the European Union

4.4.1 Introduction

This section is included to provide international context for West Coast and US CMSP planning activities. PNNL intern Kara Blake is conducting her thesis research on CMSP in the European Union (EU) and provided the following report on her attendance at the SU Maritime Day conference as well as a brief summary of EU CMSP activity.

4.4.2 SEANERGY 2020 project

On May 22, 2012, PNNL staff member Kara Blake attended the European Commission, EU Maritime Day Conference in Gothenburg, Sweden. One of the conference events pertinent to this report included a workshop titled “Delivering offshore electricity to Europe through EU integrated Maritime Spatial Planning (MSP).” The panel included three representatives from the European Wind Energy Association (EWEA) and one representative from the Offshore Wind and other marine renewable Energies in Mediterranean and European Sea (OWEMES). The purpose of the workshop, in part, was to present the main results and policy recommendations of the SEANERGY 2020 project, a two-year study (May 2010—June 2012) that was funded by the Intelligent Energy Europe and coordinated by EWEA. The core objective of the project was to facilitate offshore renewables (wind, wave and tidal) “by formulating and promoting policy recommendations on how to best address and remove MSP obstacles to offshore renewable energy generation, in order to implement the EU’s Renewable Energy Directive (2009/28/EC)” (EWEA 2012, p. 8).

The first phase of the SEANERGY 2020 project was to analyze and compare the different national MSP practices in 17 countries around four sea basins, focusing on the potential for developing offshore renewables. (EWEA 2012) Key findings from the national MSP review showed three broad legislative framework models for MSP, all of which can be effective in facilitating the deployment of offshore renewable energy projects. While several sources offer “soft guidance” on MSP processes and best practices, a more definite and detailed set of guidance on national MSP best practices is needed for EU Member States. Lacking in the existing national MSP approaches is an explicit focus on trans-national cooperation (EWEA 2012).

The second phase of the project was to analyze existing international MSP instruments “to identify critical elements that impact on a coordinated development of offshore renewables” (EWEA 2012, p. 9). The project looked at national offshore renewable energy zones designated as a result of international MSP instruments and examined the offshore grid infrastructure and cable routing for a pan-European grid at sea (EWEA 2012). Key findings from this phase showed that offshore renewables are not explicitly considered in existing international MSP instruments. International MSP instruments have an indirect impact through their translation into Member States national MSP framework and EU level action on MSP is an appropriate way forward to address barriers to transnational cooperation (EWEA 2012).

The third (and final) phase of the SEANERGY 2020 project was to “focus on the challenges and opportunities of moving towards transnational approaches to MSP in support of offshore renewables”

(EWEA 2012, p. 10). Because many sea uses and issues transcend national borders, national MSP efforts also need to incorporate cross-border cooperation. Currently there is little to no guidance from the European Commission on how to achieve cross-border cooperation. The project identified 13 specific barriers to transnational MSP relating to issues of power, interests, and capacity and concluded that offshore renewables could benefit from cross-border cooperation and transnational approaches to MSP (EWEA 2012).

Overall the SEANERGY 2020 project found that a transnational approach to MSP is particularly important to offshore renewables in that it allows for more efficient coordination, helps to reduce transaction costs, increases certainty on exploitation potential, facilitates implementation of an ecosystem-based approach, and aids in the development of cross-border infrastructure. The project found that national level MSP should be promoted and that the EU should treat EU-level MSP as a priority to accelerate development of renewables in Europe. Final recommendations included support for the EU to draft an MSP Directive that focuses on two aspects: 1) a requirement that Member States to adopt national MSP legislation over an agreed-upon time frame (leaving process and content decisions to each individual Member State), and 2) promoting cross-border cooperation and coordination of MSP. The project further offered procedural recommendations on how this could be achieved; including implementing transnational MSP practices on a micro-regional or regional action as an appropriate starting point.

4.4.3 Other European Commission MSP projects

In addition to the SEANERGY 2020 project discussed above, other projects pertaining to marine spatial planning in the European Union for FY12 include the following:

- **MASPNOSE:** Preparatory Action on Maritime Spatial Planning in the North Sea (2010-2012). This project, co-financed by the European Commission under the European Integrated Maritime Policy, focused on mechanisms for cross-border cooperation in MSP in the North Sea. The project targeted countries in the southern North Sea (Belgium, Denmark, Germany, and the Netherlands) looking at two specific case studies (Dogger Bank and Thornton Bank). Information is available at: <http://www.cmp.wur.nl/maspnose>
- **Plan Bothnia:** The Baltic Sea transboundary MSP Preparatory Action (2010-2012). This 18-month project investigated mechanisms for cross-border cooperation in MSP in the Baltic Sea. A pilot plan for the offshore areas of the Bothnian Sea, a part of the Baltic Sea bordered by Sweden and Finland, was released in the spring of 2012. Information available at: <http://www.planbothnia.org>
- **BaltSeaPlan:** Baltic Sea Regional Programme project “Introducing Maritime Spatial Planning in the Baltic Sea” (2009-2012). This project supports the introduction and implementation of MSP in the Baltic Sea Region, as well as contributes to the implementation of the HELCOM recommendations on broad-scale Maritime Spatial Planning and the VASAB Gdańsk Declaration. The project lists five activities: a) improve the joint information base/ stocktaking; b) include spatial planning in National Maritime Strategies; c) develop a Common Spatial Vision for the Baltic Sea; d) demonstrate MSP in 8 pilot areas; and e) lobbying and capacity building for MSP. Information on these activities is available at: <http://www.baltseaplan.eu/index.php/Home;1/1>

4.5 Marine and Hydrokinetics (MHK) Siting Web Map Prototype

4.5.1 Introduction

In FY 2012, PNNL staff Chaeli Judd initiated a test project to utilize ESRI-based web mapping tools for the purposes of assessing renewable energy opportunities and adding those capabilities to the *Tethys* database. This project was intended to pave the way towards energy suitability mapping in WA state in anticipation of outer coast planning activities in 2013.

The purpose of creating the Marine and Hydrokinetics (MHK) Siting Web Map (<http://coastgis.pnnl.gov/TethysExplorer/AlternativeLayout.html>) was to develop a prototype webmap for offshore energy opportunities and constraints. While there are many existing datasets and research results, the focus of the prototype was to explore and develop the best technical approach for *how* to implement a mapping and energy opportunity approach that it is expandable at a greater scale and for different focused datasets.

The requisites for development of the prototype were that the map should:

- Display energy resource availability, taken from a PNNL developed hydrodynamic model in Puget Sound that forecasts power density energies throughout the Sound.
- Display economic development feasibility factors, including ports and transmission interconnection.
- Display geophysical information that would limit construction (depth, slopes)
- Display environmental information of interest in the area, including essential fish habitat, marine protected areas.
- In addition, we wanted to explore the ability to allow users to run user-defined simple analysis such as distance to ports, shores, and nearest transmission interconnection.

The following challenges were identified:

- How to balance web-mapping speed with the amount and detail of data represented.
- To be effective, a map must focus on a specific purpose and audience. Presentation of representative data needs to be as simple as possible.
- In addition, we needed to explore a framework that would enable the interaction desired from simple analysis. It is important to understand that the datasets here may or may not be those of interest at a national or regional scale. Thus, the actual datasets represented were not as much interest as the technique in their display.

The developed application is based on two main components: (1) a FLEX based application that resides on the CoastGIS webserver at PNNL, and (2) tiled and dynamic service layers that are referenced by the application and serve spatial data (Figure 1). The setup leverages heavily off of the architecture employed in the Multipurpose Marine Cadastre's Offshore Wind Prototype developed in conjunction with ESRI. The code for this application was shared with PNNL and adaptations were made to their concept of using a unit dataset that summarized values of relevant features, termed the Marine Unit Database. This allowed PNNL to simplify data so that they are still meaningful to users but do not contain unnecessary information that can impair the site's display speed and user queries.

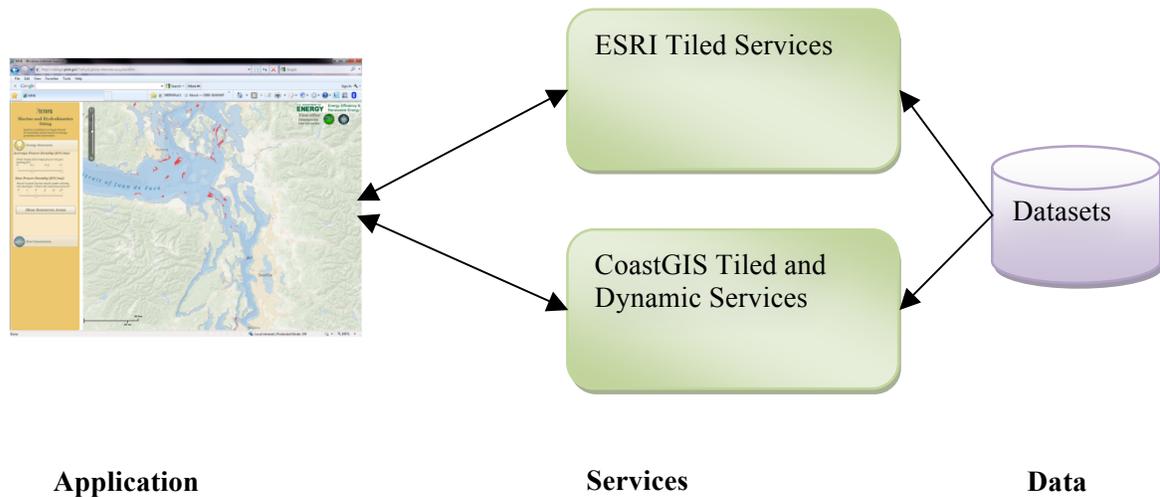


Figure 1. MHK Architecture. The application displays services distributed by an internal server (CoastGIS) as well as ESRI Tiled Basemap services. Application was developed in Adobe Flex 4.6

A short description of the data, services and application follow.

4.5.2 Data and Services

4.5.2.1 Marine Unit Database

We created a Marine Unit Database that both simplified the geometry and attributes of the features of interest. The original geometry was based on PNNL’s FVCOM hydrokinetic model with 222,098 features (Figure 2). For each feature, attributes were added that recorded distance to port, depth, and power density (Table 1). Features were then grouped into categories for each unique combination of values, and new features created for each category, reducing the number of features to 185 (Figure 2- B) and distributed as a service: <http://coastgis.pnnl.gov/ArcGIS/rest/services/Power/MapServer/0>

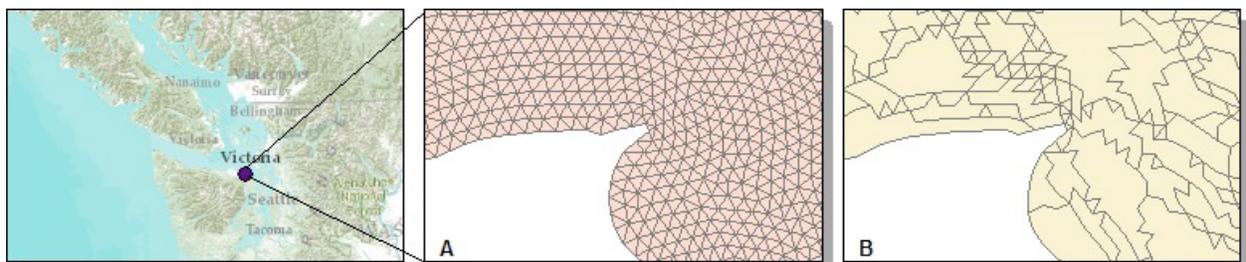


Figure 2. Marine Unit Database - Example of Geometry. Attributes for each feature in (A) were recorded, and 185 final categories were created (B), representing unique combinations of each attribute combination described in table 1.

Table 4. Marine Unit Dataset Details

Attribute	Dataset Source	Details Recorded
Distance to Nearest Port	Ports (USACE); Euclidean distance calculation	Five Categories: 0-3 miles 3-5 miles 5-10 miles 10-20 miles Over 20 miles
Depth	PNNL FVCOM Model	Four Categories: 15-30m 30-50m 50-80m Out of Range (These features were eliminated)
Average Power Density	PNNL FVCOM Model	Four Categories: 0.0 - 0.1 KW/m ² 0.1 – 0.5 KW/m ² 0.5 – 1.0 KW/m ² Over 1.0 KW/m ²
Maximum Power Density	PNNL FVCOM Model	Six Categories: 0 – 1 KW/m ² 1 - 2 KW/m ² 2 - 3 KW/m ² 3 - 4 KW/m ² 4 - 5 KW/m ² Over 5 KW/m ²

4.5.2.2 Other Data Sources

In addition, the datasets in table 2 are distributed as services and viewed within the application.

Table 5. Other Siting-relevant Data Sets

Dataset	Description	Service
Slope	Slope greater than 10 degrees. Calculated from depth recorded for each feature in hydrodynamic model	http://coastgis.pnnl.gov/ArcGIS/rest/services/PhysicalConstraints/MapServer/3
Ports	Source: Ports (USACE)	http://coastgis.pnnl.gov/ArcGIS/rest/services/PhysicalConstraints/MapServer/0
Clallam	Substation Locations on Olympic	http://coastgis.pnnl.gov/ArcGIS/rest/services/

County Substations	Peninsula. Source: Clallam County Power District	PhysicalConstraints/MapServer/1
Navigation Channels	Source: ENC Direct	http://coastgis.pnnl.gov/ArcGIS/rest/services/MHKNTILE/MapServer
Marine Protected Areas	Source: Marine Cadastre	http://coastgis.pnnl.gov/ArcGIS/rest/services/ECO20/MapServer (Tiled)
Historic Eelgrass Coverage	Source: Jeremy Davies, NOAA, digitized from Hallard and Thom (1991)	http://coastgis.pnnl.gov/ArcGIS/rest/services/ECO20/MapServer (Tiled)
Critical Habitat	Source: Marine Cadastre. Recorded as Chinook-nearshore, Green Sturgeon, Leatherback, SR Killer Whale, and Multiple Species	http://coastgis.pnnl.gov/ArcGIS/rest/services/ECO20/MapServer (Tiled)
BaseMap – Oceans	Source: ESRI	

4.5.3 Application

The application itself permits users to interactively query the marine unit database and view their results (Figure 3). A drawing function is used to render the selected areas, which speeds up visualization. Tooltips appear when the user hovers over energy resources and site constraint elements. Users can display and hide the datasets and services listed under *Other Data sources*. *Tethys* and EERE logos function as hyperlinks, taking the user to these websites when clicked. As with most webmaps, users can zoom in/out and pan over study extent.

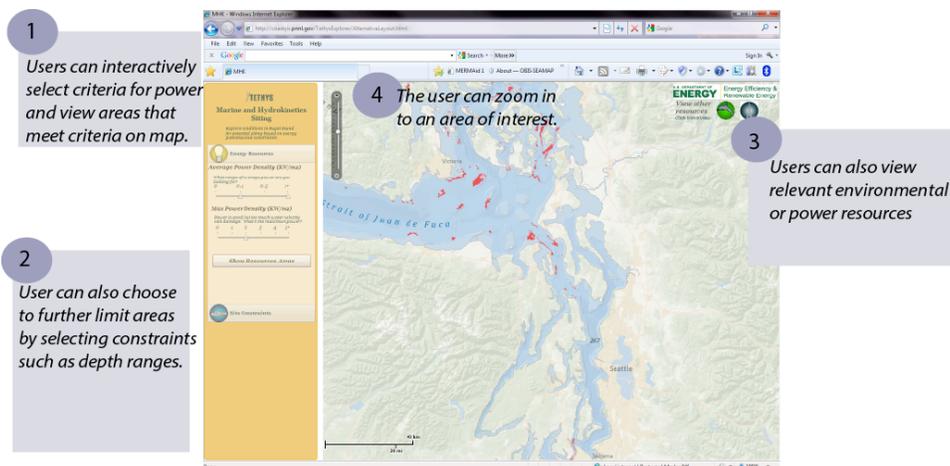


Figure 3. Application interface for MHK Siting Application

4.5.4 Recommendations and Future Thoughts

The objective in developing this application was to investigate how best to develop a solid architecture that could be used and implemented in the future. This was accomplished by exploring different ways to serve and summarize data. A Marine Unit Database was used to simplify the spatial and attribute information. Tiled services also helped speed up rendering time and will be used more extensively in future. While these services worked well for speed, the result was that multiple layers were tiled together in one service for environmental resources. This made it impossible to show/hide individual environmental resource layers. In the future, these datasets could be tiled separately to allow greater user interaction. However, permitting the user more interaction also has its downside in that the application can become too complex. Directed user testing and observation could help make these decisions.

Some datasets used are available nationwide (environmental resources and ports), while others are limited to Puget Sound (hydrodynamic modeling results, kelp and eelgrass distribution). For expansion into other areas, additional sources of tidal or wave energy data would be necessary. Finally, while this framework was developed to support visualization of energy resources, a similar framework could be adapted from this model to permit user interaction with spatial data for a variety of applications.

5 Summary and Outcomes from 2011 Activities

As articulated in the FY 2012 AOP, task 2.1.7 has the following four objectives:

- To work with stakeholders to streamline the MHK regulatory permitting process
- To work with stakeholders to gather information on needs and priorities for environmental assessment of MHK development
- To communicate research findings and directions to the MHK industry and stakeholders
- To engage in spatial planning processes in order to further the development of the MHK industry

Through the activities described above, PNNL addressed all four objectives through outreach, regulatory assessment, and spatial planning activities. Outcomes for each subtask are summarized below:

2.1.7.1

- With carryover funds, presented the findings of the 2011 regulatory assessment project to the Federal Renewable Energy Working group.
- Working with industry to revise report for public release.

2.1.7.2

- In partnership with DOE, organized and carried out two environmental research webinars (acoustic effects and international data sharing) each attended by approximately 150 stakeholders. Results recorded and housed on *Tethys*.
- Developed outreach materials and presented those materials at the GMREC conference in April in Washington, DV.
- Planned the Annex IV International Data Sharing workshop in Dublin, Ireland. Workshop will be executed on October 15. Funds were used for workshop development, travel, and PNNL facilitation activities.

2.1.7.3

- Identified ongoing CMSP activities on the US west coast where renewable energy siting and permitting is a primary driver. At the request of the Water Power Team, engaged with these initiatives and provided input on ongoing DOE activities and research that could facilitate siting and permitting.

- Published an article in the 2012 IEA-OES Annual Report on the Oregon Territorial Sea Planning process.
- Increased involvement in Washington state CMSP activities, and continued to engage with Oregon and Federal partners through the OR/BOEM Ocean Renewable Energy Task Force.
- Developed a case study for web-based mapping and user-defined exploration of ocean renewable energy suitability, with Puget Sound as an initial case study. Added this capability to *Tethys*.

The overarching strategic goal for Task 2.1.7 is to “reduce the regulatory costs, time, and potential environmental impacts associated with developing, siting, permitting, and deploying MHK systems.” Task 2.1.7 is just one task of many intended to achieve this goal but it’s contribution is an important one. Work under 2.1.7.1 helps DOE identify key environmental and regulatory uncertainties where additional research resources would have the greatest impact on driving down costs and reducing timeframes. Through 2.1.7.2 activities, we strive to encourage use of DOE-funded research tools by industry, regulators, and other stakeholders. Connecting stakeholders to research and information that can address uncertainty and present a path forward towards deployment of first generation technologies enhances the value of DOE work. And finally, through active engagement in policy and planning forums, work under 2.1.7.3 helps DOE stay involved in West Coast forums where decision about the availability of ocean space for renewable technologies will be made over the next several years.

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Appendix A
Annex IV Workshop Materials



Dear Workshop Participant:

We look forward to seeing you at the Dublin Convention Centre on October 15th 2012 for the second OES Annex IV Expert Workshop on the *Environmental Effects of Renewable Energy Development*. This letter and the attached draft final report provide workshop details and materials to help you prepare for effective participation. A preliminary draft of the workshop agenda is attached; a final agenda and further logistic details will be sent closer to the event.

The Annex IV effort relies on experts like you; in order to maximize our short time together and facilitate a productive discussion, we ask that you review and comment on the following materials prior to the workshop:

- The content and functionality of the Annex IV database
- The Annex IV draft final report

Please send comments to andrea.copping@pnnl.gov before the workshop if possible.

Annex IV Database:

The Annex IV database is password protected through the end of the year when it will be made publically accessible. In order to review and provide comments on the database, you will need to take the following steps to gain access to *Tethys* and sign up for an Annex IV account:

You may already have registered at *Tethys* and received access to the database, if so, just go to http://mhk.pnnl.gov/wiki/index.php/Annex_IV

If you have not signed up for a *Tethys* account, navigate to (http://mhk.pnnl.gov/wiki/index.php/Tethys_Home) and follow these steps:

- Follow the link above and click on "Log in / create account" in the upper right corner.
 - Follow the instructions to create your account.
-

- Send an email with your username to Luke Hanna luke.hanna@pnnl.gov and Jonathan Whiting jonathan.whiting@pnnl.gov (one email).
- You will be granted Annex IV access and be sent a confirmation email as soon as your email is received.
- Navigate to http://mhk.pnnl.gov/wiki/index.php/Annex_IV

During your review of the database, we are most interested in questions that fall into two major categories: Content and Functionality.

Content Questions

1. Does the Annex IV database contain environmental information on all marine energy projects of which you are aware? If not, can you supply this information?
2. Does the Annex IV database contain all research study information on environmental effects of marine energy of which you are aware? If not, can you supply this information?
3. Does the database contain most of the key resources you consider important for exploring the environmental effects of marine energy development?
4. Are there seminal papers or reports missing? If so, what are they?
5. Are there fields of research that are underrepresented? If so, what are they?
6. Can you identify gaps in knowledge within the Annex IV database that interfere with your ability to understand the current state of knowledge in the field?
7. Is there extraneous content that you believe is unnecessary and gets in the way of learning? If so, what?
8. What additional content would you recommend be added to the Annex IV database?

Functionality Questions

1. Is the Annex IV database intuitive and straight-forward to use?
2. Can you navigate the Annex IV database easily and reliably find resources you are seeking?
3. Have you encountered broken links or dead ends? If so, where?
4. Does the functionality of the site support your needs as a marine energy practitioner?
5. Do you see yourself using the Annex IV database in your work? If so, how?
6. What additional functions would you like to see added to the Annex IV database?

Annex IV Draft Report

The Annex IV draft report consists of introductory material on the Annex and its purpose. The main portion of the report consists of three case studies. Each case study has been written so that it can stand on its own as well as within the report; you may find some repetitive areas for this reason. Some references are unfinished at this time (but will be published before the report is finalized). The discussion section of the report is largely missing; this section will be completed after input from you prior to and at the workshop.

As you read the report, please consider the following questions:

1. Does each case study adequately reflect the state of knowledge of the topic?
2. Are there sources missing that you can identify for us?
3. Does each case study correctly use the available information and support the conclusions?
4. Are there specific statements or sections of the report that you feel are particularly strong?
5. Are there specific statements or sections of the report that you feel are particularly weak or inappropriate?

On behalf of U.S. Department of Energy and the Annex IV Nations, thank you again for your time and energy attending this workshop and reviewing these materials. Once again, if you have any questions about the workshop or preparatory guidance, please contact Andrea Copping (andrea.copping@pnnl.gov) at Pacific Northwest National Laboratory.

Best wishes, and see you in Ireland.



Andrea Copping, PhD.
Research Lead for Ocean Energy
Pacific Northwest National Laboratory

OES-IA Annex IV Experts' Workshop
15 October, 2012
The Convention Centre Dublin
DRAFT AGENDA

Monday, October 15, 2012

09h00 Registration

09h30 Welcome and Introduction (John Huckerby OES-IA/Hoyt Battley US DOE)

09h45 Purpose of the workshop, Agenda Review – US DOE

10h00 Session 1: Tethys/Annex IV Knowledge Base (10h00-12h30)

- Demonstration of the knowledge base (Andrea Copping/Luke Hanna – PNNL)

Tea / Coffee: 11h00 - 11h30

11h30 Breakout Groups

- Facilitated break out groups discuss database functionality and content, develop recommendations

Lunch: 12h30 – 13h30

13h30 Session 2: Annex IV Case Studies and Final Report (13h30 – 16h30)

- Led by Andrea Copping – PNNL
- Review the process of developing the final report: how were case studies selected and analyses performed? How did the first experts' workshop inform the report?

14h30 Breakout Groups

- Facilitated breakout groups to discuss previously assigned sections of the final report and case studies. Participants will receive additional questions or points of evaluation to discuss in breakout groups to review before the workshop.

16h00 Summary of breakout session discussions presented to full group

Tea / Coffee: 15h15 – 15h45

16h30 Future Plans for Annex IV

17h00 Close



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