Developing Ocean Energy in Pacific Northwest

DELIVERING SUSTAINABLE JOBS, REVENUE, AND ELECTRICITY FOR WASHINGTON STATE

Mission

The mission of the Clallam County Innovation Partnership Organization is to deploy its signature capabilities in coastal environmental research and development, industrial recruitment, economic development, and workforce education to deliver to the region new research, development, manufacturing, and operations opportunities supporting a domestic ocean renewable energy industry in the region's coastal environments. We will build and nurture partnerships regionally, nationally, and internationally to support a sustainable environmental and economic future for the Olympic Peninsula, western Washington, and the Pacific Northwest.

Goals

The primary goal of this Innovation Partnership team is to build a regional nexus of businesses addressing ocean energy research, technology engineering and development, and maritime deployment, operations, and maintenance that will deliver sustainable renewable energy from this region's coastal resources to the region, State, and West Coast.

In terms of energy sources, this plan will support the ocean-based renewable energy sources that would be of primary importance to each of the region's counties, including wind and wave (Pacific, Grays Harbor, Clallam), tidal (Clallam, Kitsap, Jefferson), and marine biomass (all).

Leadership/Governance

The Clallam County Innovation Partnership Zone comprises the Clallam County Economic Development Council (Clallam EDC), the Pacific Northwest National Laboratory's Marine Sciences Laboratory (MSL), and Peninsula College. Leadership for the IPZ will be provided by Linda Rotmark, Executive Director of the Clallam EDC, supported by the EDC's Executive Board, Dr. Charles Brandt, MSL Director, and Dr. Thomas A. Keegan, President of Peninsula College. The IPZ will be lead by the Clallam EDC, and will be governed by its Executive Board and the leadership of the IPZ partners.

The renewable energy focus of this IPC embraces the diverse assets of coastal Washington, including the Northwest National Marine Renewable Energy Center in Admiralty Inlet (partnership between University of Washington, Oregon State University, and PNNL), the region's leading ports (Ports of Port Angeles, Grays Harbor, Bremerton, and Port Townsend), continuing and higher education institutions (including, EWU's Huxley College of the Environment, Grays Harbor College, Olympic College, and Bainbridge Graduate Institute), manufacturing expertise (including Angeles Composite Technologies, Inc., Magna Force, Inc., Armstrong Marine, Inc.), and the business development, retention, and recruitment expertise not only of Clallam EDC, but also those of Grays Harbor Economic Development Council, Jefferson County Economic Development Council, Kitsap Economic Development Alliance, and Pacific County Economic Development Council. Each of these entities have been and will continue to engage in development of renewable ocean energy through investments, recruitment, sponsorships, training, and research and development.

Strengths of the Clallam County IPZ

Clallam County Economic Development Council

Clallam County Economic Development Council (EDC) is the largest EDC in the Washington Coastal region. It provides coordination for economic development projects to facilitate the process and encourage investment that creates jobs in the County and region.

One of EDC's primary missions is to assist existing businesses with expansion or retention. The EDC also supports new business investment to diversify the economy and create family wage jobs. The organization provides confidential assistance, including: information regarding site-selection, labor force, training, tax incentives and access to financing.

The EDC encourages new business investment and provides assistance that includes:

- Site identification and selection
- Job training information
- Intergovernmental coordination for large complex projects
- Access to financing
- Securing incentives

The Clallam County EDC is a driving force behind a coastal Washington renewable energy roadmap development, and has received funds from Washington Department of Commerce to develop an asset baseline document.

Marine Sciences Laboratory

The MSL is the only laboratory within the US Department of Energy's national laboratory system that is responsible for delivering science and technology to address DOE's mission needs in the coastal and marine environment. The Laboratory delivers science and technology that will enable the sustainable development of marine & nearshore energy. Their research agenda includes:

- Predict, quantify and mitigate impacts of renewable energy deployments on coastal ecosystems
- Provide the predictive and measurement capabilities that will optimize siting and operation of ocean energy systems
- Optimize engineered systems to meet environmental performance needs
- Significantly enhance the production of algal biofuel feedstocks, including micro and macroalgae.

The laboratory employs 95 regular staff and between 8 and 12 seasonal and longer-term postgraduate interns, stewarding expertise in modeling, engineering, biotechnology, biogeochemistry, and ecosystems science. The main campus is located on 140 acres of tidelands and uplands located on Sequim Bay, Washington. Additional facilities are located in Seattle and Portland.

Key infrastructure assets include:

- 6,000 ft^2 of analytical and biological laboratories
- 7,700 ft^2 of aquatic research laboratories supplied with heated/cooled freshwater and seawater
- State-of-the-art water treatment system
- Research pier and dock for small and moderate draft research vessel mooring

Key equipment/facilities at the MSL includes:

- Environmental electromagnetics laboratory
- Environmental bioacoustics laboratory
- BSL-1 and BSL-2 laboratories with isolation rooms
- Electronics laboratory

- Ultralow background chemistry laboratories
- Micro/macroalgal production systems
- Bioreactors
- Large-scale experimental flowing seawater mesocosms
- Mobile multisignature detection system
- Autonomous underwater and surface water mobile sensor platforms
- Three coastal research vessels
- High performance computing
- Ultra-trace analytical chemistry

Peninsula College

Peninsula College provides educational opportunities in the areas of academic transfer, professional and technical, basic skills, and continuing education. The College also contributes to the cultural and economic enrichment of Clallam and Jefferson Counties. Its operation is shaped by 6 strategic goals:

- To provide **educational opportunity** in all facets of the college mission-- academic transfer, professional/technical, basic skills and continuing education.
- To maximize **student access** to higher education by expanding educational opportunities for the diverse populations of Clallam and Jefferson counties.
- To provide a **college environment** that places teaching and learning at the center of institutional practice, ensures quality services to students, and demonstrates sound and planful **stewardship** of public resources.
- To provide **college/community connections** through the exchange of knowledge and resources.
- To promote **cultural enrichment** by providing culturally rich and diverse programs in the fine arts.
- To model **pluralism**...a culture of mutual respect and acceptance that embodies diversity and promotes a civil society.

Long-term Market Growth

Solving the national and global need for energy without significantly increasing greenhouse gas emissions is one of the great challenges of this century. The solution, or failure to achieve a solution, will have dramatic consequences for all future generations of humanity as well as large portions of the natural environment. According to the US Energy Information Agency, total world consumption of marketed energy has increased at between 3 and 5% per year, with this pace expected to continue at least for the next several decades, driven primarily by growth in China and India and fueled largely by oil, coal, and natural gas.[1]

Within the United States, electrical energy demand has remained relatively unchanged between 2007 and 2010 at 4.1 TWh of electricity per year, due largely to the Great Recession beginning in 2008 and subsequent stagnant economic growth.[2] The primary source for this generation was coal, followed by natural gas and nuclear energy[3]; renewable sources are 5th. At the end of 2011, China and India will be importing 337 million metric tons of coal fuel, a 78% increase over 2010 imports, when the average price paid in China was $129/ton offloaded.[4] Because of the increasing demand for fuel coal in China and India, the price for US domestic fuel coal has been increasing at 8% per year since 2004, as has the average retail price of electricity (Figure 1). Clearly, the unsustainable global demand for fossil fuels is becoming a primary driver not only of climate change and ocean acidification, but is also raising the domestic price of electricity.

[1] IEA Key Energy Statistics 2010
[2] http://www.eia.doe.gov/electricity/epm/table1_1.html
[3] Data from http://www.eia.doe.gov/electricity/epm/table1_1.html
[4] http://www.businessweek.com/news/2010-12-21/china-s-stocks-rebound-as-developers-coal-producers-advance.html

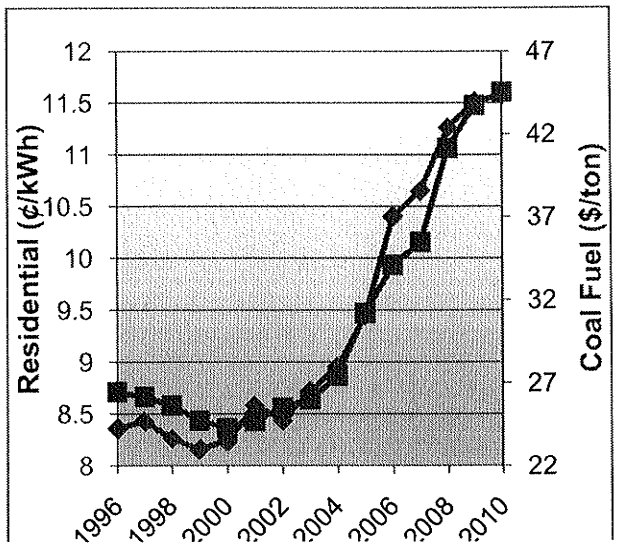

Figure 1: Trends in US Fuel Coal and Residential Electricity Rates[5]

These global and national trends and drivers have been translated into regional requirements for electrical energy generation and use using renewable energy sources such as wind, solar, geothermal, wave, and tidal. Thirty-five states have renewables requirements ranging from 15% to 40% of domestic consumption by 2025.[6] These levels continue to rise every year after those milestones, with the eventual intent of replacing fossil (primarily coal) generation. On the Pacific Coast, the key renewables standards are for Washington (15% renewable by 2020), Oregon (25% by 2025), and California (33% by 2020). Taking the electricity generated by each state in 2009 as a base[7] and adding a minimal 2%/yr increase in annual consumption, over 110 million MWh of delivered renewable energy would have to be added to the western grid by 2020, roughly triple that being delivered in 2009. This translates into an annual renewables growth rate of 10%/yr. Traditional land-based sources for this kind of growth are becoming scarcer, as the primary sites have been or are being exploited. A number of utilities are discovering they have limited land-based options.[8]

Moving air and water in our offshore environment represents a tremendous potential resource for conversion to electric energy. Offshore wind within the territorial waters of Washington and Oregon could provide 258 GW of electrical energy.[9] Waves deliver an average of 20 GW of power to our coasts, and over 40 GW in winter.[10] Tides could deliver several GW or more to this region.[11] To put this in context, total electricity generation in 2009 was 19 GW.[12]

Offshore energy sources provide a number of advantages over land-based renewable sources, especially land-based wind. Tides are completely predictable, and deployments would not be visible from shore. Offshore winds tend to blow harder and more uniformly than onshore wind resources, offering higher capacity factors and the potential for "smoother" integration of wind energy into the grid, as well as the opportunity for significant scale advantages. Waves also are highly predictable.

While offshore deployment presents its own significant challenges, it also offers an opportunity to exert leadership in technology development and market development. Some of the challenges with offshore wind include

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[5] Data from http://www.eia.doe.gov/cneaf/electricity/epm/table5_3.html and /table4_1.html
[6] Data from http://www.pewclimate.org/what_s_being_done/in_the_states/rps.cfm
[7] http://www.eia.gov/cneaf/electricity/epa/epa_sprdshts.html
[8] https://www.snopud.com/Site/Content/Documents/tidal/TidalPresentaton.pdf
[9] NREL 2010 *Assessment of Offshore Wind Energy Resources for the United States*
[10] Fugro OCEANOR, April 2010 and World Energy Council 2007
[11] http://www.tidalstreampower.gatech.edu/
[12] http://www.eia.gov/cneaf/electricity/epa/epa_sprdshts.html

operations in difficult marine environments and higher costs associated with installation, transmission and operations, and unique platform requirements depending on the depth of the resource (including our own deepwater (>60m) offshore wind energy. But progress is being made on these issues, and those that successfully address the challenges will emerge as market leaders in this new sector.

Increasing the use of renewable energy for electricity generation is crucial to mitigate the risks of climate change, shift the nation to a long-term, low-carbon economy, and advance energy independence. While the U.S. has not yet set national renewable energy goals, President Barack Obama called for 80% of the nation's electricity to be generated from clean energy sources, including wind (and any combination of clean energy sources including "clean" coal and nuclear), by the year 2035 (White House 2011).[13] For planning purposes, the US Department of Energy has set a national target of 20% wind energy (300 GW) by 2030.[14]

Other countries (led by the UK, Denmark, the Netherlands, and recently China), have both onshore wind energy facilities *and* offshore wind initiatives (virtually all in shallow waters less than 30 meters in depth) and significant offshore development plans. In the U.S. about 20 offshore wind projects are in the planning and permitting process, including a decade long campaign to meet requirements for commencement of the 420 MW Cape Wind Project off of Cape Cod. To date no offshore wind turbines have been installed in U.S. waters. It is clear, however, that the stronger, steadier winds offshore, and their proximity to the major population centers of the U.S. represent a major domestic renewable energy resource. This year the DOE delivered its National Offshore Wind Strategy, which establishes a goal to achieve 54 GW of offshore wind deployment at a cost of energy of 7¢/kWh by the year 2030.[15] The National Renewable Energy Laboratory estimates that offshore wind development would create more than 20 direct jobs for every megawatt (average) produced in the US.[16]

Entrepreneurial Climate

Washington's Olympic Peninsula possesses significant assets and advantages for the demonstration and commercialization of ocean energy.

- Significant wave, tidal, and offshore wind resources.[i,17]
- A high capacity triad of ports with significant industrial/manufacturing and maritime transportation capacity.[18]
- A "model-scale" economy with a well-integrated education and training infrastructure adjacent to internationally significant resources.
- A modest grid that has already been the subject of smart grid activity.[19]
- The Department of Energy's only marine sciences laboratory, part of the Pacific Northwest National Laboratory. PNNL is responsible for resolving the environmental impacts component of the DOE's ocean energy program. PNNL is also one of the premier smart grid research institutions in the nation.[20]
- One of the largest U.S. Navy Complexes in the Nation.[21] DOD and DOE have entered a Strategic Partnership to Enhance Energy Security MOU (2010), which includes the intent to use "military installations as a test bed to demonstrate and

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[13] The White House (from State of the Union 2011)
[14] www.eere.energy.gov/windandhydro http://www.nrel.gov/docs/fy08osti/41869.pdf
[15] http://www1.eere.energy.gov/windandhydro/pdfs/national_offshore_wind_strategy.pdf
[16] http://www.nrel.gov/wind/pdfs/40745.pdf
[17] ibid
[18] Renewable Industry for Sustainable Economic Recovery in Western Washington (2011)
[19] http://eioc.pnnl.gov/research/gridwise.stm
[20] Among numerous other smart grid projects, PNNL currently leads the DOE's $178M Northwest Smart Grid Demonstration Project intended to conduct regional demonstrations of smart grid technologies that are necessary for the integration of renewable energy sources with existing generating capacity. http://www.pnwsmartgrid.org/
[21] Navy Region Northwest includes a substantial presence on the Olympic Peninsula, including the Bremerton area north to the Strait of Juan de Fuca, and in nearby locations: Naval Base Kitsap Bangor, Keyport Undersea Warfare Center, Naval Magazine Indian Island, Whidbey Island Naval Air Station, Naval Base Kitsap Bremerton, Puget Sound Naval Shipyard. NRNW also includes Everett Naval Station.

create a market for innovative energy efficiency and renewable energy technologies coming out of DOE laboratories...."[22]

- A dynamic microcosm that has all of the environmental and social features that must be addressed by offshore wind enterprises, as well as key stakeholder communities including Tribal Nations, fisherman, recreational users, maritime transportation, natural resources managers and more who must be part of deployment and commercialization activities.

The region possesses significant assets that could be deployed to support an ocean energy economic hub. These include ports, marine transport and servicing, and the manufacturing sector (described below). In addition, the region's higher educational institutions have commitments to and are delivering trained graduates into many aspects of the renewable energy/maritime industries of the region.

Ports

Port infrastructure lies at the heart of an ocean energy industrial enterprise. Ports supporting ocean energy development will need to be near ocean deployment sites and have excellent multi-modal transportation linkages, as well as capacity for substantial co-located industrial supply chain industries, and large lay-down areas, and the ability to operate as a staging, assembly, and load-out area(s) for massive components.[23] For just one example, blade lengths, driven by scaling efficiencies and economics in offshore settings, may ultimately reach up to 90 m or beyond. LM Wind Power recently announced production of a record 73.5 m blade for Alstom's offshore-purpose 6-MW wind turbines.[24]

Washington's Olympia Peninsula port system, like others in the U.S. positioning to service offshore wind energy, may require upgrades to handle the logistics of turbine supply chain activities, turbine assembly, substructure assembly and load-out. The "port triad" of Bremerton, Port Angeles, and Grays Harbor has substantial industrial capacity, large vessel capacity, flexibility, and the strategic intent to embrace transformational economic initiatives.[25] Port Angeles and Grays Harbor, both with sheltered harbors, can both easily handle ships of the size necessary to transport wind turbine components and have substantial staging areas. Other regional ports, including the world-class Ports of Seattle and Tacoma, are capable of major support roles.

The region's ports include industrial capacity, commercial facilities and ocean-going freighter support that provide the backbone of the larger economy in the five-county region. The facilities below have planned for future growth by acquiring the zoning, permits, warehouse/manufacturing square footage and industrial acreage necessary to expand well into the future. Ocean energy businesses choosing to locate large commercial or manufacturing operations in these ports will find modern facilities, inexpensive utilities, workforce development support and accommodating regulatory environments. In addition, easy access to deep-draft ports provides water transportation options normally available only in areas with much higher costs of living.

Port of Port Angeles

By far, the most commercially robust and developed port in the 5-county area of Western Washington is the Port of Port Angeles. Of its four active terminals, two are capable of handling ocean-going barges and super-tankers. A 110-acre industrial park next to the airport (which is also owned and managed by the Port) encompasses 140,000 ft^2 of developed manufacturing and commercial space.

At Terminal 1, the Port can berth vessels up to 1,200 feet, and 125,000 dead weight tonnage. It carries utilities and services that allow topside and voyage ship repair and shipment and discharge of general cargo. Terminal 3 is the

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[22] http://www.energy.gov/news/documents/Enhance-Energy-Security-MOU.pdf

[23] See, for example, TETRA TECH EC Inc. (2010) Port and Infrastructure Analysis for Offshore Wind Energy Development. Prepared for the Massachusetts Clean Energy Center

[24] http://www.windpowerengineering.com/design/mechanical/blades/manufacturer-develops-record-73-5-m-wind-turbine-blade/

[25] Clallam County et al. (2011)

primary cargo-loading terminal, and handles forest products destined to Pacific Rim countries, and ocean log barges shipping to domestic markets. It can handle loading from both water and wharf.

At its smaller terminals, it offers refit services for vessels up to 200 feet, a lay berth facility for vessels up to 750 feet, and a variety of services including welding, mechanics, hydraulic services, fiberglass and wood repair/painting, design/build marine carpentry, yacht joinery and fishing vessel repair.

The Port's current facilities puts it in an ideal position to service, repair and support the vast majority of medium- and heavy-lift vessels necessary for offshore construction.[26] Its abundance of smaller docks and service facilities would allow it to support a large number of the smaller craft of the type useful for wind, tidal and wave equipment maintenance, without impeding the traffic of large vessels.

Port of Grays Harbor

The Port of Grays Harbor is the most developed port facility on Washington's ocean coast. The Port operates four terminals with rail and state highway access, along with staging areas, warehouse facilities and secured exterior storage. The Port maintains a dredged channel depth of approximately 41 feet. As well as the four terminals, The Port of Grays Harbor also maintains the Westport Marina. From construction to maintenance vessels, the Port of Grays Harbor could easily facilitate marine traffic needs for the development of an offshore wind farm.

Port of Port Townsend

While it isn't a deep-water port, the Port of Port Townsend is an active, robust commercial facility able to accommodate a wide array of diverse vessel types and sizes, in addition to the commercial and industrial enterprises necessary for their support. Port Townsend also serves as a ferry terminal serving Whidbey Island residents. Its shipyard, repair, maintenance and fabrication facilities serve a wide variety of vessels. Its ongoing partnership with a well-established, technologically advanced paper mill puts the Port in a strong position to support long-term sustainable economic development in the city of Port Townsend.

Marine Transportation, Services, and Shipbuilding

Offshore energy development presents a major opportunity for Washington's maritime industry, including shipbuilding capabilities. Purpose built or adapted vessels will be required for some offshore wind construction and maintenance activities. The lack of US vessels[27] adapted to the special requirements of wind turbine installation particularly represents a major challenge, as does the need for routinized onsite installation involving very large components, placement of massive foundations, and assembly of towers, nacelles and blades involving high lifts. Opportunities include nearshore construction/assembly support vessels, towing vessels with advanced positioning capabilities and capacities for transport and placement of massive floating platforms, and ultimately a purpose-built maintenance and operations fleet. Cable laying vessels are also in short supply.

Although the entire shipbuilding industry in the US has declined in recent decades, Washington State still has a robust maritime industry and significant capacity to respond to both national and regional fleet requirements associated with the development of ocean energy. Major operators include Vigor Marine and Vigor Shipyards (formerly Todd Pacific Shipyards), Saltchuck Marine (which owns Foss Maritime Company), Crowley Maritime, Platypus Marine, Inc., and others. Olympic Peninsula based shipyards include Westport Shipyard, Pacific Ships Repair and Fab, Inc., and others

[26] http://www.4coffshore.com/windfarms/vesselSearch.aspx

[27] The Jones Act (46 U.S.C. ch. 551 *et seq.)* requires vessels engaged in the transport of passengers or cargo between U.S. places to be built and flagged in the United States, and owned and crewed by U.S. citizens.

Manufacturing and Support Industries

A recently completed study by Clallam EDC[28] identified more than 250 industries and existing business as possessing cross-industry expertise in support of renewable industry development. These include industries in areas such as:

- Metallurgy/ironwork
- Cement/foundations
- Civil, Mechanical Engineering
- Transportation Systems

Strategic Plan

Implementation of this business plan will be delivered through specific strategic actions whose outcomes will deliver measureable progress in five dimensions: Planning and Policy, R&D, Resource and Infrastructure Development, Industrial Recruitment, and Workforce Development.

Planning and Policy: The strategic actions in this area are intended to establish the industrial and policy baseline for regional ocean energy development and define the specific actions to move those toward actionable resource development. Specific actions include:

1. Build the strategic ocean renewable energy roadmap for Western Washington – this will encompass the maritime, manufacturing, and R&D asset configuration for the region and define the specific endeavors required to align that configuration to support and lead ocean renewable energy development.
2. Assist with policy analysis and development that favors domestic production of renewable energy – this will identify the areas of need with regard to identification and implementation of federal, state, and local policies that favor sustainable regional ocean energy development as a jobs-creation policy and as a sustainable national energy policy. This may include Federal RPS/RES, new cost allocation/cost recovery mechanisms for grid expansion (FERC and state PUCs), state incentives, tax or production based credits, grants/loans, added value for green tags from ocean energy technologies, etc.
3. Establish and support strategic workshops and forums for regional ocean energy development – Sustainable development of the region's ocean energy resources will require a continual dialogue between stakeholders, industry, developers, educational institutions, and the public. This task is necessary to support and manage that dialogue to achieve the right balance for development.

Research and Development: Achieving a multi-GW base of installed, cost-efficient ocean energy within the region's coastal waters will require innovation in machines, platforms, operations, and environmental performance. This will be accomplished through:

4. Establish northwest deepwater wind energy center of excellence – establishing this center of excellence will focus on all aspects of deepwater wind development for the challenging Washington and Oregon coastal environments. Primary focus would be on enabling R&D, but also regional capacity building and market development.
5. Support expansion of Northwest National Marine Renewable Energy Center to deliver full-scale device and system testing for tidal energy – The joint UW/OSU/PNNL tidal power test center remains the nation's only full scale test platform for tidal power devices, and one of two platforms for wave energy devices. Additional funds are required to build the tidal platform, with key participation from Navy NW.
6. Establish intermediate scale tidal device and monitoring systems test facility – The nation currently lacks in-situ development and testing facilities for intermediate-scale (1/15th to 1/10th scale) tidal power devices, or for the

[28] Renewable Industry for Sustainable Economic Recovery in Western Washington (2011)

environmental and device performance monitoring and measurement systems. This task will focus on establishing such a facility in/near Sequim Bay.

7. Expand ocean renewables R&D – This task encompasses building and funding the R&D pipeline to assure environmental information and associated engineered systems are available and sufficiently mature to meet the continued need of the ocean energy industry.

Resource and Infrastructure Development: Maximizing the pace of sustainable ocean energy development in the region will require directly assisting developers both at the community scale and at the grid scale. This will be accomplished through:

8. Support grid-scale ocean renewable energy developers throughout the region – Current ocean energy development by Snohomish County PUD, Principle Power, and others, if successful, will provide a significant springboard for expanded development by these and others, including Puget Sound Energy, Tacoma Power, and others looking both to meet Renewable Portfolio Standards and to export renewable energy to other states in the West. Actions here will be to provide R&D, in-kind, information, and support pipeline assistance to grid-scale development.
9. Engage and assist Tribal Nations and other communities in developing community-scale renewable energy projects throughout the region – Options for community-scale and Tribal renewable energy development are more robust than those for grid-scale in many ways, including support grants and financing options. Actions here will be to provide industry/financing connections to community-scale ocean energy development, as well as information on resources/impacts/operations.
10. Advocate and support renewables grid integration and grid expansion to accommodate the western renewables grid of the future – Keys to expansion of intermittent ocean renewables is the ability to manage intermittency and to expand the ability to deliver coastal energy up and down the coast. This task will support options analyses and advocacy for expanding the regional grid, onroading smart-grid systems, and test/build/deploy storage systems.

Industrial Recruitment: Establishment of a robust, long-term ocean energy economy in the Washington coastal region will require partnership with leading ocean energy device/system developers as well as site developers. This partnership must include commitments to locate R&D, manufacturing, and operations support businesses within the region. This will be accomplished through:

11. Recruit device developers to build and test systems in Washington waters, and ultimately site manufacturing and R&D facilities in region – identify and target leading ocean energy device vendors who's portfolios and interests align with the region's renewable asset base; provide direct assistance in siting, permitting, R&D platforms, and construction/testing sites. Establish partnerships with leading energy utilities and developers.
12. Recruit site developers and operations support organizations to the region – identify and target leading offshore energy developers, builders, and O&M companies to visit; market the area's energy assets, including resources, grid, storage, etc.; establish partnerships between leading energy utilities and developers.
13. Provide state of the art information to support siting, development, and sustainable operation of ocean renewable energy regionally – Provide active engagement in coastal and marine spatial planning efforts. Make available PNNL's state of the art resource modeling for tidal energy development, and provide a clearinghouse for offshore wind and wave characterization data. Make available PNNL's international database on ocean energy information. Build, update, and make available regional data and information on maritime, manufacturing, and operations and maintenance capabilities.

Workforce Development: A successful industrial development pipeline requires an associated workforce deployment pipeline that delivers appropriate skills at the appropriate stage of development of the ocean energy industry. We will support this aspect of the business plan by:

14. Identify and strengthen workforce development pipelines to meet domestic ocean renewable energy deployments – Assuring a well-trained workforce is available in a timely fashion to meet all aspects of the renewable energy business will be a key component to growing endemic employment rather than relying upon imported labor.

Key external linkages for implementing this business plan include those with academia, industry, state and federal agencies, and the financial sector, including:

- University of Washington
- Oregon State University
- University of Maine
- Georgia Technical Institute
- Oregon Wave Energy Trust
- US Department of Energy – Energy Efficiency and Renewable Energy
- National Oceanic and Atmospheric Administration – NOAA Fisheries
- National Oceanic and Atmospheric Administration – Olympic National Marine Sanctuary
- Bureau of Ocean Energy Management, Regulation, and Enforcement
- Washington Department of Ecology
- Washington Department of Natural Resources
- Pacific Energy Ventures
- Principle Power, Inc.
- Snohomish County PUD
- Puget Sound Energy
- Aquamarine Power, Ltd.
- OpenHydro Group, Ltd.
- Iberdrola Renewables
- Ocean Renewable Power Co., LLC.
- Ocean Power Technologies

In addition, execution of this plan will require close participation by the region's tribal councils, economic development organizations, and business divisions, as well as regional stakeholder groups, such as the Surfrider Foundation, and regional ocean energy non-profits, esp., Cleantech West Sound, a not-for-profit renewable energy advocacy group.