Final Report of the Ocean Energy Task Force

to

Governor John E. Baldacci

December 2009

Photo credits (clockwise from top center): Solberg/Statoil; Maine Coastal Program; Ocean Renewable Power Company; Principle Power; Blue H. Center photo: Global Marine Systems, Ltd.

Final Report of the Ocean Energy Task Force

to

Governor John E. Baldacci

December 2009

Financial assistance for this document was provided by a grant from the Maine Coastal Program at the Maine State Planning Office, through funding provided by the U.S. Department of Commerce, Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act of 1972, as amended.

Additional financial assistance was provided by the Efficiency Maine Trust (Efficiency Maine Trust is a statewide effort to promote the more efficient use of electricity, help Maine residents and businesses reduce energy costs, and improve Maine's environment), and by the American Recovery and Reinvestment Act of 2009.

This publication was produced under appropriation number 020-07B-008205

TABLE OF CONTENTS

Figures

Appendices

ACKNOWLEDGEMENTS

The Task Force extends particular thanks and appreciation to staff at the Maine State Planning Office, Matt Nixon, Todd Burrowes, and Lorraine Lessard. Mr. Nixon worked closely with University of Maine researchers and others inside and outside state government to provide GIS - based and other technical analyses and provided significant staff support of primary importance to the work of the Task Force. Mr. Burrowes provided policy analyses and primary staff support to the Task Force, including compilation of this report. Ms. Lessard provided critical secretarial and organizational services for the Task Force and several of its subcommittees.

The Task Force co-chairs also acknowledge and thank the Task Force members and the dozens of members of the public who devoted countless hours to the work that has culminated in this report.

EXECUTIVE SUMMARY

"The dogmas of the quiet past are inadequate to the stormy present. The occasion is piled high with difficulty, and we must therefore rise with the occasion. As our case is new, so we must think anew and act anew. We must disenthrall ourselves, and then we shall save our country"

Abraham Lincoln
December 1, 1862

Governor Baldacci established the Ocean Energy Task Force by Executive Order, dated November 7, 2008, to recommend a strategy for moving forward as expeditiously as practicable with the development of the vast, indigenous, renewable ocean energy resources of the Gulf of Maine. The Executive Order recognizes the enormous promise of renewable ocean energy to address state and regional energy needs, including energy independence and security; limiting exposure to the volatile costs and supplies of fossil fuels; attaining our greenhouse gas reduction goals; and stimulating economic opportunity for our citizens. The Order also recognizes that wind is the fastest growing power source in the world and that Maine has significant offshore wind, tidal and perhaps wave power energy resources; that they can play a role in addressing transportation and home heating needs; and, that Maine's universities, research institutions and businesses can provide needed research capabilities, workforce, and industrial infrastructure to support this development. The Task Force was directed to recommend solutions to overcome potential economic, technical, regulatory and other obstacles to vigorous and expeditious development of these ocean energy resources. The Task Force recognizes that such solutions must also sustain the on-going integrity and vitality of the Gulf of Maine by ensuring that potential adverse effects on its biological resources and existing uses – which provide significant economic, ecological, and cultural value to the State – are assessed and appropriately addressed.

The Task Force undertook its mission in the context of the rude shock our state received in 2008, when crude oil prices soared to $147 per barrel and gasoline and heating oil prices topped $4 per gallon – and Maine came face to face with an economic and social catastrophe. These events, which highlighted our state's long over-reliance on oil to heat our homes and fuel our vehicles and on natural gas and other fossil fuels to run our electric power plants, resulted in dramatic economic concerns and hardships for many Maine families and businesses. The prospect of these high or higher fuel prices for prolonged periods underlined the urgent need to significantly reduce and minimize our state's dependence on oil and gas. At the same time, climate change, caused primarily by the burning of fossil fuels, may in fact pose an even greater threat to the environment, economy, social fabric and human health in the only slightly longer term.

Maine faces a choice of energy futures. Today, around 60 percent of Maine (and New England's) electric generation capacity is fueled by natural gas, oil, or coal, not one ounce of which is

indigenous to the state. When home heating and transportation are added to the calculation, we approach 90 percent dependency on fossil fuels. Choosing a business-as-usual course -- which would maintain and probably even deepen this dependency – exposes us to the enormous risk of oil and gas price volatility and shocks, potential supply disruptions, and mounting levels of greenhouse gases. And, we will continue to export billions in energy dollars out of state and overseas every year. The drop in fossil fuel prices since the summer of 2008 has given us a reprieve, but it is unlikely that the current period of relatively low prices will last, especially as the economy pulls out of the recession of the last two years. What goes down can and will go up – the question is whether we use this time to prepare for a new and more sustainable energy future (economically and environmentally) or to simply dig ourselves ever deeper into the fossil fuel energy hole.

We believe that a more prudent choice for Maine is an aggressive and multi-faceted strategy of diversification and development of a variety of regionally indigenous and nearby energy resources. Key elements of this strategy include increased investment in energy efficiency and demand management; development of smaller scale distributed resources, including community wind, solar, and tri-generation; possible increased imports of largely renewable energy from Canada; and development of large scale on- and offshore wind, tidal, and potentially wave resources. Given that each of these options has its own set of costs and benefits, its own set of advocates, and in some cases its foes, it is important to emphasize that these are not mutually exclusive choices.

Of all these alternatives, however, by far the largest and most capable of supporting a low carbon energy future that is largely decoupled from foreign disruption are the great winds which sweep across the Gulf of Maine. These winds are one of the great untapped energy resources on earth and hold the potential to supply a significant portion of Maine's energy needs – not only for lights and computers but heat for houses and fuel for our cars – when balanced with complementary energy sources during periods of calm. Moreover, Maine has the potential to emerge as a net energy exporter through the aggressive development of its offshore wind and other renewable ocean energy resources.

This path can offer additional benefits. Development of these resources also provides us with a rare opportunity to develop new – and expand existing – composites, boatbuilding, construction and other industries with the potential to create and sustain thousands of quality jobs, keeping the economic benefits of energy generation here at home. However, capturing these quality jobs will take strengthening our supply chain so that the maximum number of Maine workers can be employed in this endeavor.

The Task Force has identified the huge potential of this resource, but also its costs and the substantial obstacles to its development. The three primary issues that must be addressed are technical, financial and regulatory.

Simply stated, the technology to economically harness off-shore winds in deep water (greater than 60 meters) does not exist today. Substantial research and testing will be necessary, and Maine has already taken concrete steps to address this in the demonstration area legislation passed last spring. At a stroke, this law -- recommended by the Task Force in its interim report last winter – put us in a national leadership position in terms of research and development for viable deepwater off-shore

wind technology. This leadership was recently recognized by a major grant from the U.S. Department of Energy to the University of Maine for research and demonstration of deepwater floating off-shore wind technology.

Coupled with this technical issue are the questions of predictability, intermittency, and our current inability to coordinate wind availability with peak energy needs – the fact is that the wind doesn't blow at all times in all places (even in the Gulf of Maine). Intermittency can be addressed through availability of other electric generation to provide balancing power and a robust transmission grid to deliver that power. The State's ambitious renewable energy goals simply must be accompanied by the willingness to efficiently site and permit new transmission capacity. Technologic advances will improve predictability, address the downtimes, and help with cycling while smarter grids will help match generation and load.

The Task Force heard interesting and promising testimony – from Europe as well as the United States – on possible solutions to the technical issues, from the production of hydrogen, ammonia, or compressed air at the generation sites to coordination with Hydro Quebec or others for back-up. While there are no definitive answers at this time, this is another area where aggressive research and development can and must play a major role, and Maine should advocate for a major federally funded research and development effort.

The second major issue is financial – offshore energy production in the current climate of relatively low fossil fuel prices, particularly natural gas, is not presently cost-competitive. While new natural gas finds and drilling techniques, and the economic downturn, have depressed natural gas prices, this could change and change fast, just as it did in the spring and summer of 2008. Hence the strategy of supporting technical research (to drive capital costs down), transmission grid development to be ready when the time comes, and the exploration of financing alternatives which will support large scale deployment on a timely basis when circumstances dictate.

The final principal issue the Task Force has identified, somewhat surprisingly, is regulatory. Although far from land and people, off-shore energy development faces a gauntlet of overlapping, complex, expensive, and time-consuming (mostly federal) regulatory hurdles. The Minerals Management Service of the Department of the Interior governs off-shore leases in federal waters; the U.S. Fish & Wildlife Service has jurisdiction over wildlife impacts, most notably avian and bat impacts; the National Marine Fisheries Service has jurisdiction over fish and marine mammal impacts; the U.S. Army Corps of Engineers has jurisdiction over submerged lands impacts; and the Federal Energy Regulatory Commission has jurisdiction over regional and national energy impacts. The complexity of these overlapping, sometimes competing, and poorly coordinated jurisdictions could effectively stifle any substantial development even if the need is great and the technology and finances are in place.

For this reason, one of the Task Force's most urgent recommendations is a rationalization, acceleration and coordination of the ocean energy permitting process on the federal level, to be led by our congressional delegation and the presidential administration. We are in no way recommending a relaxation of environmental safeguards, simply a more coordinated, timely, and predictable process.

At the same time, we recognize the need for better coordination closer to home if we are to build a significant offshore wind industry. The New England states and the New England Independent System Operator need to support and approve plans to build a more robust regional transmission grid that can accommodate the states' renewable energy goals. We must ask for the same if not greater coordination and timeliness from the many state agencies responsible for renewable ocean energy development, including the Maine Public Utilities Commission, Maine State Planning Office, and Departments of Economic and Community Development, Conservation, Environmental Protection and Marine Resources. And, finally, the jurisdiction and role of Maine's municipalities must be clarified in order to advance the State's renewable energy goals.

The Task Force has concluded that making the transition to off-shore energy (wind, tidal, and wave) when the time is right can provide Maine long-term price stability, domestic political control over its energy future, development of a new industry cluster, and jobs for Maine people. Increasing access to an energy resource with a fuel cost of zero for electricity, heat, and transport would provide Maine people with insurance against increases in oil and gas prices. And despite the hurdles that development of Maine's ocean energy resources will encounter along the way to commercialization, the potential benefits dictate our taking concerted action today to ensure that Maine is positioned to capture the tremendous promise these resources can provide us.

Therefore, the Task Force recommends that Maine make a major commitment to preparing the way for the development of its offshore wind, tidal, and wave power. Given the enormity of Maine's offshore wind resource, particularly in deep water, and the promise of new floating deep water wind technologies, the Task Force is recommending that Maine revise its offshore wind power goal to a transformational level – 5,000 megawatts of offshore wind by 2030 – a power source that would enable Maine to electrify in every sense, including heat for our homes and fuel for our cars, and position Maine as a net energy exporter.

As mentioned, P.L. 2009, c. 270, developed by the Task Force and introduced by the Governor in the spring of 2009, establishes a fair, efficient, and predictable process for the temporary, relatively short-term testing of emerging offshore wind and wave technologies in pre-selected state waters. This testing, by the University of Maine and possibly private developers, will advance technologies needed to harness Maine's deep water wind resource.

The Task Force also recommends that we take action immediately to support the electrification of heating and transportation, the sectors responsible for the bulk of Maine families' energy budget, for consuming the vast majority of petroleum products, and for producing a significant share of greenhouse gas emissions in Maine. A critical part of this process must be the redevelopment of the electrical grid and the incorporation of advanced smart-grid information technologies. A major offshore energy source will avail us little if the power cannot be delivered, and the State should move aggressively to support strengthening our current out-dated transmission and distribution infrastructure.

Commercialization of deep water offshore wind power is at least five to ten years down the road. But we must begin now, *today*, to clear the obstacles and cut the lead time for its development. If we wait until a catastrophe is upon us, we'll be starting from scratch and delay now will be our undoing.

In the meantime, shallow water wind is technologically viable today, as demonstrated by approximately 1,500 megawatts of ocean wind currently operating in Europe with the support of significant government financial support. In order to gain experience with the technology, understand the environmental issues associated with such development, and demonstrate Maine's interest in ocean energy to the world, the Task Force recommends that Maine issue a Request for Proposals to attract ocean energy developers, and is recommending actions that help lay the groundwork for issuance of this Request for Proposals. This development could occur in either state or federal waters; unlike the temporary testing that can occur pursuant to the short-term general permit created by P.L. 2009, c. 270, these commercial developments will require full-blown state and federal permits. Issuance of a Request for Proposals will help the State to better understand the issues development of these energy resources will face and how to overcome the obstacles.

Lincoln recognized that the Civil War was a qualitatively different challenge than any our country had ever faced, and his prescription "to disenthrall ourselves" is timeless in its application. Although nothing can match the urgency of the circumstances Lincoln faced, the challenge of minimizing climate change and reducing fossil fuel dependency may well be our generation's supreme test. The occasion truly is piled high with difficulty – but with foresight, vision, and a great deal of hard work, we can and will rise to the occasion.

Summary of Recommendations

The Task Force's recommendations, summarized below, identify strategic steps to facilitate timely and efficient development of Maine's significant offshore wind, tidal, wave, and potentially other renewable ocean energy resources.

❖ *Establish the following state renewable ocean energy goals:*

- Installation of 5 gigawatts (5,000 megawatts) of offshore wind energy generating capacity in Maine's coastal waters and adjoining federal waters by 2030, which the Task Force realizes is an extraordinary goal, whose achievement will require the strong support of public funders, private investors, and the people of Maine, as well as technological advances to achieve costs that are competitive with other energy sources, the development of new end use markets, and the construction of major new transmission and smart grid infrastructure; and
- Timely and efficient development of tidal energy resources at optimal locations in Maine's coastal waters, including but not limited to those in the Passamaquoddy Bay region.

❖ ***Improve the siting, governance, and permitting framework for renewable ocean energy[1] development in general by:***

- Creating an on-line Coastal Atlas to make the best available and continually improving project planning-related information available to public and private decision makers, and pursuing funding opportunities to engage in marine spatial planning in selected state and federal waters that appear promising for offshore wind development;
- Participating actively, in consultation with Maine's congressional delegation, in the federal Interagency Ocean Policy Task Force and related national and regional efforts in support of changes in federal law and policy that align federal agencies' missions with national and state renewable ocean energy and closely related environmental and economic goals and streamline federal review procedures;
- Developing joint federal-state guidance on project siting issues;
- Coordinating and harmonizing federal-state review and decision making processes and related requirements, including information needed for regulatory review;
- Clarifying renewable ocean energy development's consistency with Public Trust Doctrine principles regarding use of state-owned submerged lands areas;
- Facilitating leasing of state-owned submerged lands for renewable ocean energy development on terms that benefit Maine people by providing for commercially reasonable lease fees; creating leasing procedures that facilitate phased development and discourage speculative site banking; and creating a Renewable Ocean Energy Trust Fund to make lease fees generated by renewable ocean energy projects available for research, resource enhancement and compensation to help avoid, minimize, and compensate for adverse impacts, as well as for local harbor planning and infrastructure improvements;
- Encouraging developers to use "best practices" to foster constructive dialogue with potentially effected marine stakeholders in siting renewable ocean energy projects; and
- Developing a state-federal Memorandum of Understanding or other mechanism to coordinate planning for and leasing and permitting of wind energy development in Maine's coastal waters and adjoining federal waters.

❖ ***Promote and support financing and development of renewable ocean energy projects and related businesses in Maine by:***

- Amending state law to direct the Public Utilities Commission to issue a Request for Proposals for renewable ocean energy development projects and to direct transmission and distribution utilities to enter into long term contracts with renewable ocean energy projects for capacity, energy, and renewable energy credits, even if at an above market price, when

[1] As used in this report, the term "renewable ocean energy" generally refers to electricity produced in a sustainable manner using wind, waves, tides, currents, ocean temperature clines (ocean thermal), marine biomass, and/or other renewable sources in, on, or over marine waters, unless the context dictates otherwise.

the rate impact is determined to be reasonable by the Governor and Legislature given the benefits of these projects;

- Further coordinating initiatives of the Department of Economic and Community Development, the Maine Technology Institute**,** the Maine International Trade Center, and other economic development entities to foster development of Maine's renewable ocean energy business cluster though continued support for research and development of wind, tidal, wave and potentially other promising renewable ocean energy technologies; additional support for private investment in energy-related businesses; and collaboration with other regional research efforts, such as the Nova Scotia Tidal Energy Initiative;
- Designating the Department of Economic and Community Development as the initial point of contact and coordinating agency in state government to assist renewable ocean energy developers;
- Coordinating and expanding provision of state financial assistance to encourage the development of renewable ocean energy-related projects by: establishing a moral obligation credit enhancement program modeled on the Electric Rate Stabilization Program; supporting and expanding existing programs, such as loan guarantees, the Maine Technology Institute's programs, the Seed Capital Tax Credit Program, and the Small Enterprise Growth Fund; developing new initiatives and incentives for private investment, including overseas investment by original equipment manufacturers such as wind turbine and platform vendors; aggressively pursuing federal financing options and partnerships; assessing and improving as appropriate pertinent existing Maine business financing programs; and developing funding-related guidance for developers;
- Directing the Maine Port Authority to identify land parcels proximate to existing Maine port facilities, estimate their cost, and make a recommendation to the Legislature regarding acquisition of one or more of these parcels for purposes of facilitating renewable ocean energy development opportunities;
- Providing incentives through the Efficiency Maine Trust for Maine consumers and businesses to adopt new technologies to shift energy demand from fossil-based fuels to electricity produced from Maine renewable sources;
- Expanding and further coordinating current state work force development-related initiatives; and
- Clarifying personal property tax provisions regarding renewable ocean energy-generating machinery and related components.

❖ ***Improve and align energy transmission infrastructure and state energy policy as needed to attain renewable ocean energy goals by:***

- Explicitly recognizing in law the need for new transmission and distribution capacity to achieve the State's wind power and energy conversion goals;

- Undertaking a comprehensive plan to determine the level of transmission and distribution system investment that will be needed to achieve the State's onshore and offshore wind power goals;
- Directing the Public Utilities Commission to undertake a proceeding to explore mechanisms needed to achieve the State's wind power and electrification goals, including: rate design structures that encourage use of intermittent resources; changes to standard offer pricing to include off-peak time of use energy prices; the penetration of time of use meters; long term needs for a smart grid to enable usage and storage of energy from intermittent renewable resources; and other mechanisms to increase the use of renewable resources and reduce the use of fossil fuels;
- Moving aggressively, in accordance with recommendations developed by the Public Utilities Commission, to design and implement a program along the lines of that described in this report to convert Maine homes and businesses to more efficient electric air and ground source heat pumps, and to electric vehicles as they become available in the market, that will reduce Maine consumers' total (electricity, heat, transport) energy bills and help support the development of renewable ocean energy resources and minimize the ratepayer impacts of any above-market prices paid to support those resources;
- Encouraging utilities to expand the transmission system today to accommodate additional renewable generating capacity needed to meet the State's wind power goals, where doing so will reduce costs to ratepayers over the long term;
- Advocating that the Federal Energy Regulatory Commission and Public Utilities Commission permit recovery of generator lead line costs in certain circumstances; and
- Continuing to work at the regional level to resolve transmission cost recovery and related issues as needed to attain state and regional renewable energy goals.

❖ ***Streamline state permitting of appropriately-sited offshore wind energy development by:***

- Clarifying that the Department of Environmental Protection is the lead permitting agency for offshore wind energy proposals statewide, while providing the Land Use Regulation Commission authority over small, community-scale wind projects proximate to islands in Land Use Regulation Commission jurisdiction;
- Amending state law to make the administrative and judicial review processes for offshore wind energy development equivalent to those applicable to land-based "grid-scale wind energy development";
- Making permitting-related procedures and approval criteria regarding scenic impact assessment, project decommissioning, and provision of public benefits the same as those applicable to land-based grid-scale wind energy development in the Department of Environmental Protection's jurisdiction;
- Amending the Department of Environmental Protection's and Land Use Regulation Commission's permitting statutes and rules, as needed, to include approval criteria that

address issues such as, but not limited to, noise and effects on birds, bats, and marine mammal species, and marine habitats as appropriate in an offshore, ocean environment, with due consideration of adaptive management, potential cumulative effects, and avoidance, minimization and compensation for undue adverse effects on biological resources; and

- Clarifying and limiting municipalities' land use and zoning authority to promote consistency with pertinent state standards and requirements regarding offshore wind energy development.

❖ ***Facilitate permitting of appropriately-sited tidal energy projects by:***

- Ensuring full implementation of and collaborative participation by all pertinent federal agencies in the existing Federal Energy Regulatory Commission-State Memorandum of Understanding on siting tidal power pilot projects; and
- Amending state law to make the administrative and judicial review processes for commercial-scale tidal power development under the Maine Waterway Conservation and Development Act equivalent to those applicable to land-based grid-scale wind energy development in Department of Environmental Protection jurisdiction.

❖ ***Support wave energy development opportunities by:***

- Encouraging testing of wave power technology in conjunction with a wind power generation system as provided for 38 M.R.S. §480-HH (Department of Environmental Protection-administered general permit for a "wind energy demonstration project"); and
- Providing statewide Department of Environmental Protection permitting jurisdiction under the Maine Water Development and Conservation Act, as for tidal power projects.

❖ ***Ensure that state consideration and action regarding offshore oil and natural gas development proposals in the Gulf of Maine reflect the best available science.***

❖ ***Support formation of a private sector-led entity to spearhead renewable ocean energy development efforts in Maine.***

I. OVERVIEW OF THE TASK FORCE PROCESS

A. Mission

Governor Baldacci established the Ocean Energy Task Force by Executive Order 20 FY08/09, dated November 7, 2008 (Appendix 1). The primary mission of the Task Force is to recommend strategies:

- To meet or exceed the goals established in the Maine Wind Energy Act, 35-A M.R.S. §3404(2)(B), to install at least 2,000 megawatts of wind capacity by 2015 and at least 3,000 megawatts by 2020, 300 of which could be located in coastal waters;
- Identify potential economic, technical, regulatory, and other obstacles to development of grid-scale offshore wind resources in Maine's coastal waters[2] and adjoining federal waters, and recommend solutions to overcome those obstacles;
- Promote research and testing to facilitate siting of offshore wind energy facilities;
- Foster in-state growth of diverse wind and other alternative energy related businesses;
- Encourage ocean-based tidal and wave energy development where appropriate;
- Update information regarding offshore oil and natural gas resources and evaluate federal initiatives regarding oil and natural gas exploration and development in the Outer Continental Shelf; and
- Overcome any state laws or policies that might serve as obstacles to vigorous and expeditious environmentally responsible development of grid-scale wind and tidal energy generation facilities in Maine's coastal waters and adjoining federal waters in a manner that generates significant benefits for Maine people.

This report provides the Task Force's recommendations to the Governor on well-integrated strategies for moving forward expeditiously to realize the many and varied environmental and economic benefits of well-sited and sustainable development of the vast, indigenous, renewable ocean energy resources that lie off Maine's coast in ways that optimize their benefits to Maine people.

There are a number of ocean energy-related public policy initiatives currently underway, including the Commission to Study Energy Infrastructure[3], the Regional Greenhouse Gas Initiative and

[2] As used in this report, the term "Maine's coastal waters" means waters subject to tidal influence to the three-mile limit of state ownership recognized under the federal Outer Continental Shelf Lands Act. Waters and submerged lands beyond the three-mile limit to the 200-mile limit of the United States' Exclusive Economic Zone are referred to as the Outer Continental Shelf and are owned and managed by the federal government.

[3] P.L. 2009 c. 372, Part F

related Maine efforts, the New England Governor's Conference regional blueprint, and the Interagency Ocean Policy Task Force initiative led by the White House Council on Environmental Quality. Addressing issues such as marine spatial planning,[4] coordination and harmonization of federal agencies' roles and responsibilities, cost allocation for transmission infrastructure development, and greenhouse gas emissions reductions, these initiatives have significant potential to affect the path to development of Maine's renewable ocean energy resources. The Task Force intends that its recommendations help to inform these on-going efforts as its own work has been informed by them.

B. Task Force Process

1. Members

The Task Force's members (see Appendix 2), among whom are several legislators, were selected to ensure the benefit of different perspectives and expertise in its deliberations and thus provide opportunity for development of the strong and effective solutions that may result from forging consensus among diverse viewpoints.

2. Chairs

The Governor selected Beth Nagusky, Director of Innovation and Assistance at the Maine Department of Environmental Protection, and Don Perkins, President of the Gulf of Maine Research Institute, to co-chair and manage the work of the Task Force and its subcommittees.

3. Staffing; consulting services

The Maine State Planning Office provided and coordinated overall staff support for the Task Force. Staff of the Department of Environmental Protection, Department of Conservation, Office of Energy Independence and Security, Department of Economic and Community Development, and the Public Utilities Commission provided staff support, policy analysis and information to inform and guide the work of the Task Force's seven subcommittees (see below). Staff of the Department of Conservation's Bureau of Parks and Lands and Land Use Regulation Commission, the Department of Inland Fisheries and Wildlife, and the Department of Marine Resources, along with federal colleagues in the U.S. Army Corps of Engineers, National Marine Fisheries Service, Environmental Protection Agency, Federal Energy Regulatory Commission, ISO-NE, Minerals Management Service, U.S. Fish and Wildlife Service, and the University of Maine System, including the University of Maine School of Law, contributed information, expertise, and insights that advanced the Task Force's understanding of key issues and related opportunities.

[4] The Department of Environment, Food and Rural Affairs in the United Kingdom developed the following commonly used definition of the term "marine spatial planning": "strategic, forward-looking planning for regulating, managing and protecting the marine environment, including through allocation of space, that addresses the multiple, cumulative, and potentially conflicting uses of the sea … "

Under contract to the Maine State Planning Office, Mr. Jeffrey Pidot, former head of the Maine Department of Attorney General's environmental law section, provided a detailed and cogent independent policy analysis of Maine's regulatory and proprietary (submerged lands leasing) authorities, including options to facilitate siting of offshore wind projects while maintaining the integrity of state review procedures.[5] Under contract to the Department of Environmental Protection, Mr. Waine Whittier prepared a project-oriented economic analysis of offshore wind energy development and conversion of home heating and transportation to more efficient electric powered options (Appendix 3). These analyses greatly assisted the Task Force in exploring key issues and developing its recommendations.

4. Task Force meetings and study process

The Task Force began its work in December 2008 and met ten times in Augusta, Maine. The Task Force had the benefit of presentations and information from utilities experts and transmission grid managers, biologists and natural resources managers, wind, tidal and wave power developers, state and federal regulatory agencies, private consultants, legal scholars, and attorneys, as well knowledgeable and interested members of the public. In addition to providing a solid foundation for the Task Force's findings and recommendations, this wealth of information and analysis underscored the close connections and inherent inter-relations among state energy, environmental and economic development policies. Agendas, presentations, and summaries of the Task Force's meetings and related information are posted on the project website (http://www.maine.gov/spo/specialprojects/OETF/index.htm), established and maintained by the Maine State Planning Office to provide the public with ready access to information considered and developed by and for the Task Force.

5. Subcommittees

At the outset of its work, the Task Force established six subcommittees to explore issues and develop recommendations on the following topics for the full Task Force's consideration: environmental and human impacts; permitting and leasing; transmission and grid management; economic development and emerging technologies; tidal power development; and oil and gas development. The Task Force created a seventh subcommittee charged with identifying interim actions that could be taken by the Task Force to advance the Governor's directive and facilitating resolution of differences among recommendations of the topically-focused subcommittees. The Task Force later established an eighth subcommittee to develop a recommendation on establishment of a public-private entity to provide leadership and coordination of efforts to advance Maine's renewable ocean energy industry. Task Force members chaired these subcommittees, which, as noted above, were staffed by state agency personnel. Appendix 4 lists the membership and outlines the scope and focus of each subcommittee.

[5] http://www.maine.gov/spo/specialprojects/OETF/Documents/Pidot_windpower_report_final.pdf (accessed 12.15.09)

6. Public participation

Members of the public, including representatives of the wind power industry and concerned citizens, had opportunities at each Task Force meeting, as well as at subcommittee meetings, to provide comments on matters under discussion. The Task Force and each of its subcommittees established lists of interested parties who received notice of and materials considered at meetings. To the extent practicable, the Task Force provided opportunities for interested parties to monitor or participate in meetings electronically or via telephone. Through their active participation in these meetings, research, and provision of information, members of the public made important contributions to the work of the Task Force and helped inform and shape development of its findings and recommendations.

7. Interim report and related recommendations

In accordance with the above-noted executive order, the Task Force submitted its interim report and recommendations to the Governor in April 2009.[6] The interim report focused on identifying recommended legislative actions that merited attention by the Governor and Legislature during the then-pending legislative session. The Task Force recommended enactment of changes in state law to facilitate siting and development of wind and tidal power demonstration projects, which the Legislature unanimously enacted as an emergency measure and Governor Baldacci signed into law as P.L. 2009 c. 270.[7]

A key part of this law required the Department of Conservation, in consultation with the Maine State Planning Office, to identify, through a public process, up to five specific areas in Maine's coastal waters where wind energy demonstration projects may be conducted under the Department of Environmental Protection-issued general permit the law created. The law specified that one of these areas, termed the Maine Offshore Wind Energy Research Center, would be for projects conducted by or in cooperation with deep-water wind energy technology researchers at the University of Maine. The Task Force notes that the Maine State Planning Office and the Department of Conservation recently completed this process and have identified three discrete test areas in Maine's coastal waters, including the Maine Offshore Wind Energy Research Center.[8] Recognizing that significant and sustained public and private investment are needed to accelerate commercialization of offshore, deep-water wind energy and other emerging ocean energy technologies, the Task Force considers this an important milestone in the advancement of Maine's ocean energy industry.

[6] http://www.maine.gov/spo/specialprojects/OETF/Documents/OETF_InterimReport.pdf (accessed 12.15.09)

[7] http://janus.state.me.us/legis/ros/LOM/LOM124th/124R1/PUBLIC270.asp (accessed 12.15.09)

[8] http://www.maine.gov/doc/initiatives/oceanenergy/oceanenergy.shtml (accessed 12.15.09)

II. VISION – USING RENEWABLE OCEAN ENERGY TO REDUCE RELIANCE ON FOSSIL FUELS AND EXPAND MAINE'S GREEN ECONOMY

Wind power is the world's fastest growing utility-scale source of renewable energy. The World Wind Energy Association's most recent forecast for installation of wind energy facilities projected 25 percent market growth despite the on-going global economic slump.[9] Development of wind energy from projects sited offshore promises to play a huge role in the future of wind energy development.[10] While the United States as a whole continues to fall far short of Europe's commitment to wind power, Maine is making important progress toward achievement of its goal to develop 3 gigawatts of wind generation capacity by 2020, and is New England's largest wind energy producer. Maine's wind and renewable ocean energy resources have potential to be a keystone of its future prosperity.

The Task Force believes that issues and opportunities for development of Maine's renewable ocean energy resources should be considered and addressed in furtherance of and guided by the following fundamental public policy goal:

> *Steady reduction and eventual elimination of our state's over-reliance on fossil fuels through transition to use of electric power, produced with renewable energy resources, particularly offshore wind power, to meet the full range of energy needs.*

Development of Maine's vast offshore wind energy resource, particularly that in deep-water areas offshore, is a central feature of the transition to the renewable energy-focused economy envisioned by the Task Force. This transition also includes and necessitates creation of significant opportunities for growth and expansion of Maine's emerging ocean energy business cluster[11] in areas related to manufacturing, research and development, design, financing, deployment, operations and maintenance of ocean energy and other renewable energy systems, energy distribution, and related businesses (Appendix 5). By growing Maine's ocean energy business cluster, the State can transition

---

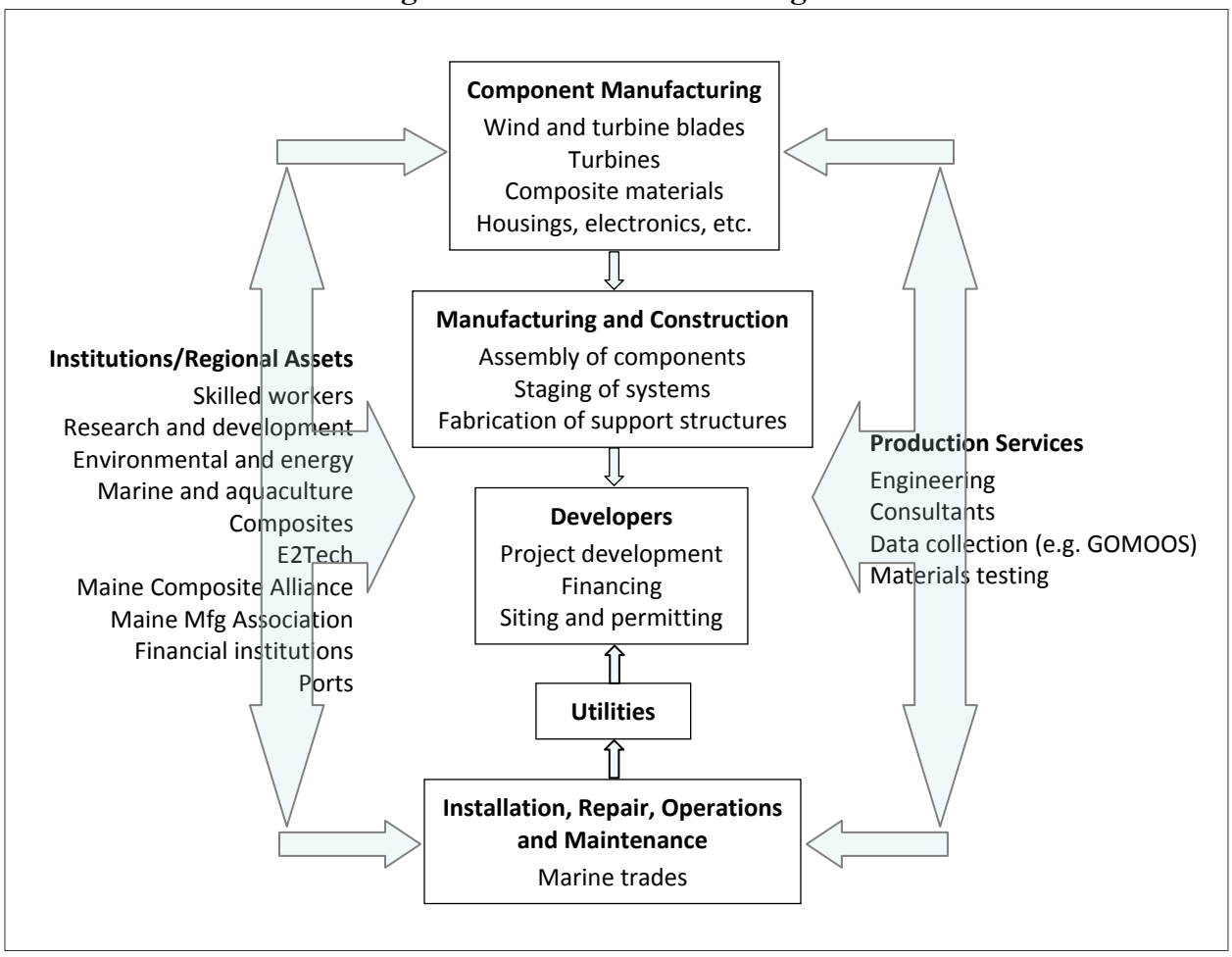
[9] http://www.wwindea.org/home/index.php?option=com_content&task=view&id=245&Itemid=40 (accessed 12.15.09)

[10] In Germany, for example, a world leader in wind energy development and investment, the national governmental announced plans in 2008 to build 30 offshore wind projects with a total generating capacity of 25 gigawatts by 2030 in keeping with its renewable energy policies and goals. See http://www.businessweek.com/globalbiz/content/jul2008/gb2008077_507147.htm?campaign_id=rss_eu (accessed 12.15.09)

[11] A "business cluster" is made up of competing, collaborating and interdependent businesses working in a common industry and concentrated in a geographic region. Clusters draw on shared infrastructure and a pool of skilled workers and represent the specialization and comparative advantage of the region. A synergistic effect is realized when successful companies that focus on a particular industry then cluster locally.

from fossil fuels in ways that will optimize benefits for Maine people and help ensure that indigenous renewable resources are used in ways that generate wealth and business and related opportunities in the State.

Figure 1 – Business Cluster Diagram



Technologies needed to develop deep-water wind energy efficiently are still under development. Current electric power prices, which in the Northeast are largely determined by the price of natural gas, may also present a significant challenge for shallow-water offshore wind development using existing technologies. The application of modern directional drilling and hydro-fracturing techniques to the Marcellus Shale gas province of New York and Pennsylvania, and other existing shale gas provinces in other parts of the country, has the potential to markedly change the United States energy picture. Use of these modern techniques could serve to depress natural gas prices and increase our consumption of gas from the United States.[12]

[12] See http://www.technologyreview.com/energy/23694/page1/ (accessed 12.15.09), which also references concerns that have been expressed about adverse effects on water resources that may result from extracting this gas.

What remains certain is that oil and natural gas are ultimately limited, non-renewable power sources with problematic greenhouse gas emissions whose prices have been volatile and may well prove so in the future. No less certain is the significant economic and related societal hardship Maine people would face if we remain as reliant on oil and natural gas to meet household energy needs as we are today. As outlined by the Ocean Energy Institute[13] and discussed in section IV(B) below, a prolonged or sustained period of prices at those 2008 levels could wreak economic havoc if the State were still deeply dependent on oil and gasoline to meet heating and transportation needs.

Under these circumstances, the Task Force has concluded that the wise course for Maine is to plan ahead and lay a firm foundation today for efficient development of Maine's offshore wind and other renewable ocean energy resources to prepare Maine for the point in time when these technologies become commercially viable and economic.

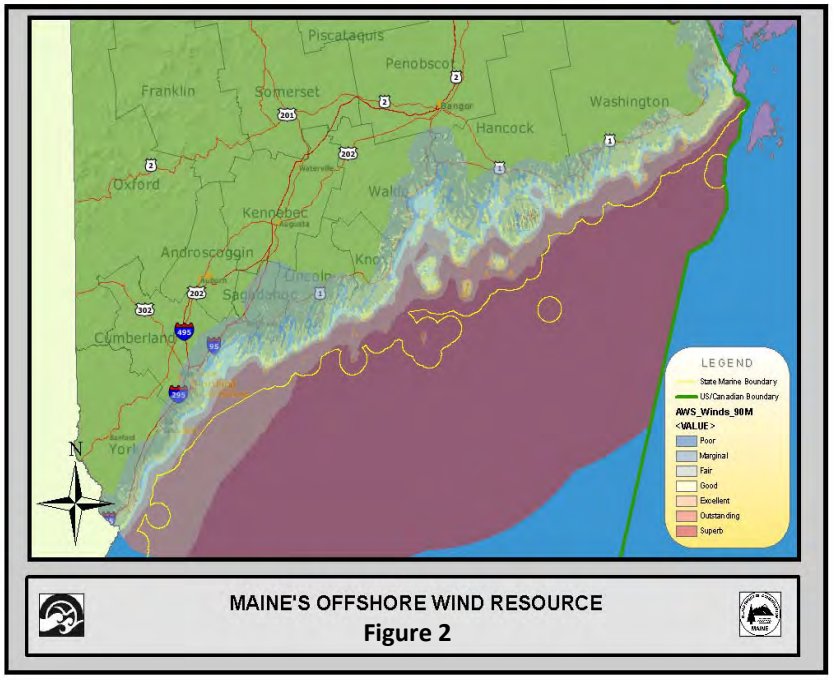
At the same time, it is wisest for Maine to test the waters and pursue creative approaches as well as federal investments to expedite development of these resources. This includes beginning a major shift to electric power to meet transportation and home heating needs, a shift that need not wait for the development of offshore wind and tidal power. Given the climate-change related environmental and economic challenges facing Maine and the nation, the Task Force emphasizes that to make this transformation Maine should actively and persistently pursue development of its offshore wind and other ocean energy resources. As detailed below, wind resources off Maine's shores, particularly those in adjacent federal waters, are vast, relatively proximate to major markets, able (with anticipated technological development) to be stationed in deep-waters areas with limited potential for adverse aesthetic and other impacts, and capable of producing endlessly renewable electricity without generation-related greenhouse gas emissions.

[13] See *Critical Choice for Charting a Course for Ocean Energy in Maine*, Dr. George Hart, presentation to the Ocean Energy Task Force on December 10, 2008; http://www.maine.gov/spo/specialprojects/OETF/Documents/Dec10'08_TFmtg/Hart_NewTechnologies.pdf (accessed 12.15.09)

III. Renewable Ocean Energy's Promise for Meeting Maine's Energy Needs

A. The Central Role of Maine's World Class Offshore Wind Resource

Maine's offshore wind resources have enormous potential to provide energy security and address the full range of Maine's energy uses, while creating new, quality jobs for Maine people. According to estimates prepared for the National Renewable Energy Laboratory, 85 percent Maine's coastal waters contain significant areas with Class 4 or higher winds.[14] More notably, 82 percent of Maine's coastal waters have Class 5 or stronger winds. Federal waters immediately adjacent to Maine are generally considered to have Class 5 or better winds throughout (see Figure 2 – Maine's Offshore Wind Resources). Adding to the value of offshore wind is the fact that ocean-based winds are generally more constant than land-based winds and thus have greater energy production potential.



MAINE'S OFFSHORE WIND RESOURCE
Figure 2

Researchers at the University of Maine estimate that the technical potential of the Gulf

[14] State Wind Resource Assessments [floatto_pwr91]. Conducted by the National Renewable Energy Laboratory, U.S. Department of Energy, Golden Colorado. Spatial Analysis Estimates Conducted by the Maine State Planning Office, 2009). Class 4 winds are generally considered the minimum necessary for commercial utilization. When it comes to wind power, wind speed is enormously important. The power production potential increases exponentially with wind speed in accordance with the following formula: Power = 0.5 x Swept Area x Air Density x Velocity^3, whereas the swept area is the turbine's blades, air density is about 1.23 kg/m^3 at sea level, and velocity is wind speed in meters per second (American Wind Energy Association, *Resources Section*, http://www.awea.org/faq/windpower.html - accessed 12.15.09). National Renewable Energy Laboratory's wind resource calculations are based on estimated wind speed estimates at 90 meters and have seven separate wind classifications (Class 1-7). Class 7 areas are those with the greatest wind energy production potential.

of Maine's offshore wind resource is 149 gigawatts of generation capacity.[15] By way of comparison, there are currently 3.5 gigawatts of installed capacity in Maine and 32 gigawatts in New England. Converting Maine homes and transportation sector to electricity will take 3.8 to 5 gigawatts of offshore wind.[16]

Based on anticipated turbine separation distances for emerging deep-water wind technologies and European experience with ocean wind technology, the University of Maine has calculated that development of 5 gigawatts of offshore wind energy in federal waters would involve use of 320 square miles of federal Outer Continental Shelf area for wind energy production.[17] While 320 square miles is only about 1/10 percent of the total federal Outer Continental Shelf area in the Gulf of Maine, the Task Force recognizes that ocean energy development can and must be pursued with well-informed consideration of natural resources and other human uses of the marine environment to avoid and minimize potential adverse effects and conflicts.

The Task Force suggests that Maine's commitment to support development of 5 gigawatts of deep-water wind energy capacity in the Gulf of Maine would be consistent with and supportive of national wind energy development policy and the State's current role as a leader in the wind energy field. Current federal energy policy calls for meeting 20 percent of the nation's electric power needs with wind power by 2030. The U.S. Department of Energy has concluded that:

> …based on the assumptions used to create the 20 percent Wind Scenario, providing 20 percent of the nation's projected electricity demand by 2030 would require the installation of 293.4 gigawatts of wind technology (in addition to the 11.4 gigawatts currently installed) for a cumulative installed capacity of 304.8 gigawatts, generating nearly 1,200 terawatt-hours annually. Offshore wind technology would account for about 18 percent (54 gigawatts) of total wind capacity by 2030.[18]

So a state goal of 5 gigawatts of offshore wind energy capacity is commensurate not only with Maine's own needs to transform its energy economy but also Maine's share, as a wind energy leader, in achieving this national goal.

Using U.S. Department of Commerce figures regarding construction-related job creation, the University of Maine has estimated that the approximately $20 billion in expenditure needed to build 5 gigawatts of deep-water wind off Maine's coast would mean about "16,700 new or retained jobs

[15] This is a purely theoretical estimate which assumes that the entire wind resource could be developed without regard to constraints related to substrate types, electric transmission, natural resources related impacts or other uses.

[16] See Appendix 3.

[17] At the Task Force's September 25, 2009, meeting, Dr. Habib Dagher explained that University of Maine researchers estimate that 1 gigawatt of deep-water wind capacity would require use of an estimated 64 square miles of ocean area in federal waters for wind turbines and related infrastructure. Additional state submerged lands areas and uplands would also be used if power generated offshore is brought to the electric power distribution grid in Maine.

[18] *20% Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply*, U.S. Department of Energy (July 2008), p. 151

per year for twenty years, including jobs transformed from the traditional to renewable energy sectors."[19]

There is no other indigenous renewable energy resource in Maine capable of generating electricity on this scale, and no other Maine power source appears to have fewer adverse environmental impacts.[20] While the Task Force acknowledges the important contribution all of Maine's renewable resources can make and that other technologies (e.g., use of wind energy to produce ammonia-based fuels or hydrogen, or solar energy using "black silicon") may necessitate reevaluation of options in the future, offshore wind plainly holds the greatest promise today.

B. The Important Roles of Tidal Power, Community Wind, and Other Renewable Ocean Energy Resources and Conservation in Meeting Local Needs, Creating a Diverse and Robust Renewable Energy Mix, and Building a Renewable Energy-based Economy

1. Tidal power

Strong and predictable tidal currents at select locations along Maine's coast provide opportunities to develop electricity using modern, emerging tidal in-stream energy conversion technologies. Tidal in-stream energy conversion is a type of hydrokinetic power production. Regulated as hydropower development at the federal and state level, tidal in-stream energy conversion differs from conventional hydro and existing tidal barrage technologies in that it does not involve use of a dam to impound waters but, as its name indicates, captures the energy of the tidal flow itself.

A 2006 Maine Technology Institute-funded study by the Electric Power Research Institute assesses Maine's tidal power energy resource potential.[21] The Electric Power Research Institute study assesses the tidal power energy generation potential at a variety of locations along the Maine coast. Electric Power Research Institute identified the ten sites with the most potential and found that Passamaquoddy and Cobscook Bays in Washington county have the State's most promising tidal energy resource. According to early estimates by the Electric Power Research Institute, the ten most promising tidal in-stream energy conversion sites in Maine have a combined total potential generating capacity of approximately 25 megawatts. The Electric Power Research Institute's 2006 report recommended additional analysis of current velocities, encouraged the development of pilot test projects, and urged government to accelerate research and development programs. In Maine, these activities have all been occurring since the Electric Power Research Institute report was published.

---

[19] Deepwater Offshore Wind in the Gulf of Maine, University of Maine/Advanced Structures and Composites Center (2009), p. 14; see Bivens, J., *Updated Employment Multipliers for the U.S. Economy* (EPI, 2003)

[20] See, *e.g.,* Prof. Habib Dagher, presentation to Ocean Energy Task Force, *supra* (and references cited therein); see also, Prof. George Hagerman, presentation to Ocean Energy Task Force, *infra.*

[21] Maine Tidal In-stream Energy Conversion: Survey and Characterization of Potential Project Sites (EPRI, April 2006) - http://oceanenergy.epri.com/attachments/streamenergy/reports/Tidal_003_ME_Site_Survey_Report_REV_1.pdf

In his December 10, 2008, presentation to the Task Force, Dr. George Hagerman, who was the study's principal author, suggested that the total statewide capacity may be around 250 megawatts,[22] a figure also used by the University of Maine in its climate action report to Governor Baldacci, reflecting work by University researchers.[23] While significant, this resource is likely much smaller than Maine's deep-water wind resource.

While relatively modest in terms of power production potential compared to offshore wind, Ocean Renewable Power Company estimates that development of 250 megawatts of tidal power in Maine would involve an investment of up to $1 billion over the next five to seven years that could result in employment of 400 to 600 Maine citizens. Experience with Ocean Renewable Power Company's tidal power development in Eastport shows how tidal power development may provide significant benefits to communities while also having a statewide economic impact. Over the last two years Ocean Renewable Power Company has spent approximately $5 million in Maine and provided jobs for over 50 people in seven Maine counties.

In presentations to the Task Force on tidal power in Maine[24], Ocean Renewable Power Company owner Chris Sauer and project manager John Ferland emphasized that Ocean Renewable Power Company's project has provided opportunities for a talented local work force with a variety of skills adapted from boat building, fishing, and related traditional marine trades. Ocean Renewable Power Company's representatives have noted that local involvement with the project has not only resulted in cost-saving innovation through employment of skilled local workers but also has informed decisions on siting of the development in ways that avoid and minimize potential conflicts with existing uses. In addition to regionally and locally significant employment opportunities, distributed tidal power generation projects have potential to foster community support for and broader understanding of the contribution to renewable ocean energy generation and provide localized voltage support and further diversification of the state energy mix.

2. Smaller scale, community wind

Focused on opportunities regarding grid-scale, land-based wind energy development, the Governor's Wind Power Development Task Force expressly recognized "…the benefits and importance of community and smaller-scale wind projects, which include their potential to address local energy supply and cost concerns and to foster public awareness of wind energy's benefits and acceptance of its related environmental and land use effects."[25] The Task Force shares in that recognition as concerns ocean-energy resources, based in part on information presented by Mr. Soren Hermansen,

---

[22] *Maine's Other (Non-Wind) Ocean Renewable Energy Resources*, presentation by Dr. George Hagerman to OETF, 12/10/08; see www.maine.gov/spo/specialprojects/OETF/Documents/Dec10'08_TFmtg/Hagerman_TidalWaveEnergy.pdf; see also www.maine.gov/spo/specialprojects/OETF/agendas_mtgmaterials.htm (meeting summary).

[23] Demeo Ann, Peterson Mick and Rubin Jonathan, "Energy" essay as part of *Maine's Climate Future: An Initial Assessment*, University of Maine, Orono, Maine. February 2009.

[24] See*, e.g., Tidal Energy in Maine: Opportunities, Obstacles, and Issues to Be Addressed*, presented to the OETF by Chris Sauer, 1/14/09 - http://www.maine.gov/spo/specialprojects/OETF/Documents/Jan14'09_TFmtg/mainetidalenergy.pdf

[25] *Report of the Governor's Task Force on Wind Power Development: Finding Common Ground for a Common Purpose* (Department of Conservation, February 2008), p. 11

organization leader of the Samso Energy and Environmental Organization in Denmark regarding that island community's development of Samso's wind energy resources with the goal of becoming energy self-sufficient and reducing to zero the community's estimated carbon emissions on an overall net basis.

At the Task Force's March 11, 2009, meeting, Mr. Hermansen explained how that community organization developed eleven land-based and ten ocean-based and largely community-owned wind turbines that provide generation capacity to address the island's electric power demand. Notwithstanding the island's significant wind power assets, given wind power's intermittent nature, Norwegian hydro and Danish coal-fired plants balance Samso's electricity demand and Samso exports wind to Norway. Mr. Hermansen outlined Samso's plans to continue along the path of energy independence through expanded use of wind-generated power to meet transportation and other needs.

The Task Force notes the differences in social, legal, and economic circumstances in Maine and Denmark, including Denmark's feed-in tariff, funded through taxes on fossil fuels that significantly subsidized the wind development, may not allow adoption of Samso's precise approach here. Nevertheless, that European community's experience does urge consideration of parallel options and opportunities for Maine's offshore island communities, among others.

The Fox Island Electric Cooperative's recent land-based wind energy development on Vinalhaven Island to address that island community's electric power needs with locally-owned, renewable wind energy may provide an important example of how community wind development may be undertaken in Maine.[26] Lessons learned from that initiative may prove useful in further shaping and refining state policy on key issues. Legislation enacted last session that approves increase of the installed net capacity limit for net-metering to 660 kilowatt hours and makes micro combined heat and power systems eligible for net-metering,[27] and creates a community-based renewable energy pilot program,[28] has potential to support growth and innovation in this area.

3. Consumer choice and energy conservation

The Task Force recognizes that actions and decisions of individuals at the personal, consumer level need to play an important role in reducing our state's reliance on fossil fuels, driving the growth and expansion of Maine's renewable energy industry and economy, and in making more efficient use of electric power. Shifting demand to off-peak periods, for example, may help make more efficient use of wind energy generated during off-peak times. In time, particularly with wide-spread deployment of improved "smart grid" capability[29] and energy storage technologies,[30] consumer decisions have the potential to become an increasingly potent force. Under the American Recovery and

[26] See http://www.foxislandswind.com/background.html

[27] Resolves 2009 c. 20

[28] P.L. 2009 c. 329

[29] *Smart Grid: Enabler of the New Energy Economy,* Electric Advisory Committee (December 2008)

[30] See *Bottling Electricity: Storage as a Strategic Tool for Managing Variability and Capacity Concerns in the Modern Grid,* Electric Advisory Committee (December 2008)

Reinvestment Act of 2009, Central Maine Power Company will receive $95.9 million for deployment of smart meter technology throughout its customer service area. Bangor Hydro Electric currently has smart meters in its service area. Installation of smart meters in Maine homes and businesses will enhance Maine's ability to support renewable ocean energy.

As the penetration of electric vehicles and more efficient electric home-heating systems in Maine homes and businesses grows, demand for electric power to address household heating and transportation needs will increase dramatically. This will help to make important reductions in the reliance of Maine homes and businesses on fossil fuels and related carbon emissions. Recently enacted state law[31] sets the ambitious energy conservation goal to weatherize 100 percent of Maine homes and half of Maine businesses by 2030 and provides capital investment aimed at increasing energy efficiency and support for a comprehensive state weatherization program.

4. Maine's wave energy resources

Research conducted by Electric Power Research Institute suggests that, as contrasted with wind power and tidal power, Maine's offshore waters are not likely to be an ideal location for wave power development in the near-term:

> As a new and emerging technology, offshore wave power has essentially no production experience and therefore its costs, uncertainties and risks are relatively high compared to existing commercially available technologies such as wind power with a cumulative production experience of about 40,000 megawatts installed. Private energy investors most probably will not select offshore wave technology when developing new generation because the cost, uncertainties and risk are too high compared to commercially available wind power technology. Even once wave technology reaches commercialization and uncertainties and risk are lowered, the economics in Maine are such that investor opportunities will be much greater in states with better wave regimes (Hawaii, Alaska, Washington, Oregon, California, and Massachusetts)…[32]

In his above-noted testimony to the Task Force, Dr. Hagerman, who worked with Electric Power Research Institute in studying Maine's hydrokinetic energy resources, reaffirmed this conclusion. Accordingly, wave power development was not a primary focus of the Task Force's study. The Task Force recommendations regarding wave power[33] are aimed at identifying opportunities for Maine that may arise as the technology continues to develop and mature. Testing and demonstration of wave power technologies in pre-selected sites in Maine's coastal waters is allowed under P.L. 2009, c. 270, where done in coordination with offshore wind development.

---

[31] P.L. 2009 c. 372

[32] *System Level Design, Performance and Costs – Maine State Offshore Wave Power Plant*, Report E2I EPRI Global WP-006-ME; http://oceanenergy.epri.com/waveenergy.html#reports

[33] See Section VI, Part 7, below.

C. Oil and Gas Development Potential in the Gulf of Maine

The Task Force recognizes that our nation needs sources of oil and gas for the near term that are not vulnerable to foreign ownership and control, including sources from the federal Outer Continental Shelf. Oil and gas development efforts on the Outer Continental Shelf should be focused in the areas with the greatest potential, and where the potential environmental impacts are minimized. Furthermore, the geology of the Gulf of Maine precludes direct comparisons with hydrocarbon production areas on the Scotian Shelf, such as Sable Island.

The Task Force's subcommittee on oil and gas development, led by State Geologist, Dr. Robert Marvinney, assessed current information regarding the potential for commercially-significant oil and gas development in the Gulf of Maine, and potential benefits and natural resources-related impacts associated with any such development in light of current technology. Based on that assessment, provided as Appendix 6, the Task Force finds that the Gulf of Maine, in comparison to other areas of the Outer Continental Shelf, has low potential and does not merit further oil and gas development efforts. See recommendations, Section VI, Part 8, below.

IV. THE NEED TO ACT NOW TO ADVANCE DEVELOPMENT OF MAINE'S RENEWABLE OCEAN ENERGY RESOURCES

Governor Baldacci's Wind Power Development Task Force, which focused its efforts on Maine's land-based wind resource, concluded that the need to reduce greenhouse gas emissions, while increasing the security of the State's electricity and energy supply and providing other benefits to Maine people, is of paramount importance to the State, and that wind power holds great promise in helping meet each of these closely related challenges.[34] The Maine Legislature affirmed these conclusions in its own findings contained in the legislation enacting that Task Force's recommendations aimed at facilitating siting and development of land-based wind energy projects.[35]

The Ocean Energy Task Force concurs with and reaffirms these conclusions as they pertain to offshore wind, tidal, and potentially other renewable ocean energy sources. Moreover, the Task Force emphasizes the importance of assessing, planning for, and developing offshore wind's potential not only for traditional uses of electric power but for transportation and heating needs. Heat and transport make up almost 90 percent of Maine people's energy expenditures[36] and are responsible for roughly three-quarters of Maine's greenhouse gas emissions.[37] In order to address and resolve Maine's extreme and potentially crippling dependence on oil, the State must consider all end uses of energy and must move to more efficient and cleaner technologies.

The Task Force concludes that the following considerations, summarized below, urge a concerted statewide effort now to advance development of Maine's ocean energy resources:

- Need to reduce greenhouse gas emissions;
- Real and present risks to Maine people posed by volatility in fossil fuel prices;
- Need to position Maine to compete for necessary public and private investment; and
- Need to foster economic and business conditions that attract and support and can sustain growth of Maine's ocean energy-related growth in ways optimize benefits to Maine people.

[34] See *Report of the Governor's Task Force on Wind Power Development, supra* at 7-8.

[35] P.L. 2007 c. 661, Section A-5 and emergency preamble.

[36] See Dr. George Hart presentation to the Ocean Energy Task Force referenced below.

[37] The State Planning Office developed this estimate using estimates from a report from the Climate Change Institute at the University of Maine by C. Cronan, U.S. Census Data, and Department of Environmental Protection information.

A. Climate change concerns and their relationship to greenhouse gas reduction goals

Maine and neighboring states and provinces have taken a leadership role in addressing climate change concerns whose existence and implications are now broadly accepted and possibly viewed as even more imminent than previously understood. The Regional Greenhouse Gas Initiative, in which Maine is a participant, is a ten-state CO_2 cap-and-trade program.[38] The program is focused on CO_2 emissions from electrical generating units. The Regional Greenhouse Gas Initiative calls on the Northeast region to limit CO_2 emissions in 2009, places a cap on them by 2014, and reduces that cap by 10 percent by 2018. As a member of the Conference of New England Governors and Eastern Canadian Premiers, Maine is active in the Conference's greenhouse gas reduction effort pursuant to its 2001 Climate Action Plan which set greenhouse gas reduction goals across all sectors, and calls for cutting those emissions to 10 percent below 1990 levels by the year 2020. In 2004, Maine adopted the Conference's goals by statute.[39]

The Regional Greenhouse Gas Initiative goals are aggressive and their attainment necessitates an unprecedented and concerted statewide effort. Approximately 11,000 megawatts of wind power would be needed in New England in order to meet the 2020 greenhouse gas reduction goal.[40] At present, there are about 174 megawatts of installed wind energy capacity in Maine, another 91.5 megawatts under construction, and 115 megawatts[41] of capacity permitted but not yet under construction. All of this is land-based. There is another 53 megawatts of proposed wind energy in Maine for which regulatory permits are currently being sought, and approximately 1500 megawatts of wind energy in the ISO-NE queue that has been studied and another 4000 megawatts in queue but not yet been studied. The 462 megawatts Cape Wind project is the only offshore wind energy now in the ISO-NE queue.

As noted above, transition in time to use of renewably generated electric power to address energy demands for transportation and heating will require installation of significantly more capacity than that needed to meet Regional Greenhouse Gas Initiative's goals.[42]

---

[38] A key part of this cap-and-trade program involves auctioning of allowances for CO_2 emissions in excess of caps set under Regional Greenhouse Gas Initiative. State participating in the Regional Greenhouse Gas Initiative have held five auctions to date, through which 134,873,748 2008 CO_2 allowances and 6,520,593 2012 allowances have been sold. These sales generated a total of $432,834,987.48. Maine's breakdown is 4,230,870 2008 allowances and 190,365 2012 allowances, with total proceeds of $13,507,410.05, which will be disbursed by the Maine Efficiency Trust for energy efficiency projects and programs.

[39] 38 M.R.S. §576

[40] *Report of the Governor's Task Force on Wind Power Development, supra* at 12.

[41] State approvals for the two projects that would provide this capacity have been appealed.

[42] A recent Department of Environmental Protection report charts progress in attaining Regional Greenhouse Gas Initiative goals. See Brook, J. (February 18, 2009). The Regional Greenhouse Gas Initiative: Profile of Maine's Experience. Presented at: The Association of Professional Foresters of New Brunswick, 2009 Annual General Meeting.

B. Real and Present Risks to Maine of Anticipatable Spikes and Volatility in Fossil Fuel Prices

Maine is perhaps the nation's most oil dependent state. According to the U.S. Energy Information Administration, about three quarters of Maine homes – the highest percentage in the nation – rely on petroleum for home heating.[43] According to estimates prepared by Maine's Office of Energy Independence and Security using Energy Information Administration data, the total cost of petroleum in Maine in 2008 was about $5.97 billion.[44] About 85 percent of that amount, about $5 billion, left the state as what Office of Energy Independence and Security has dubbed Maine's "petro-dependence tax." This figure is over 150 percent of the State's total tax revenue in 2008, and is a staggering cost borne by Maine households and businesses to meet their total energy needs.[45] Political instability and conflict in many of the world's oil producing areas has highlighted grounds for supply and reliability-related concerns regarding the availability of foreign oil as we move into the future.

In 2008, when prices for the fossil fuels on which Maine people are now so deeply dependent for home heating and transportation sky-rocketed, Maine people began to experience the economic and related social hardships of continued reliance on these non-renewable, largely foreign energy supplies. Energy needs (heat, transportation and electricity) made up nearly 25 percent of Maine family budgets in 2008, and this figure could grow to nearly 50 percent by 2018 if oil prices were to increase significantly again; there is an urgent need in Maine for affordable energy.[46] In 2008 about 90 percent of the total energy need of Maine households and businesses depended upon fossil fuels (oil and gas), with 50 percent burned for transportation, 40 percent burned for home heating, and only about 10 percent burned to meet current electric power uses.[47] If fuel oil and gasoline prices were $4/gallon, the Ocean Energy Institute calculates that the average Maine household would incur about $10,000/year in energy expenses if this reliance on petroleum persisted. At $10/gallon fuel prices, this additional annual expense soars to $35,000.[48] In sum, anticipatable increases in oil and gas prices could result in costs many Maine households and businesses simply could not sustain. Notably, widespread use of electric powered heat pumps and vehicles would result in marked savings under each of these scenarios - $6,400/year with $4 fuel and $16,000/year with $10 fuel - even as electricity prices rose with liquid fuel prices (electricity priced at 15 cents/kwh and 37.5 cents/kwh, respectively).[49]

The Task Force notes that maintenance of stable electric power prices that are in line with or lower than fuel oil prices may be a key to widespread transition to electric power to address the full range

---

[43] Energy Information Administration website http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=ME

[44] *Maine Comprehensive Energy Plan: Maine Energy Profile*, p. 26-7.

[45] *Id.*

[46] See *Critical Choices in Charting a Course for Ocean Energy in Maine*, presentation by Dr. George Hart to the OETF, 12/10/08 - www.maine.gov/spo/specialprojects/OETF/Documents/Dec10'08_TFmtg/Hart_NewTechnologies.pdf

[47] *Id.*

[48] *Id.*

[49] *Id.*

of Maine's energy needs. Increases in electricity prices in the 1980s, due in part to public policy fostering renewable energy development, led to more widespread consumer dependence on fuel oil as opposed to electricity for home heating.

Closely related to concerns about volatile and unpredictable pricing for natural gas and oil is the critical issue of energy reliability. At present, Maine, like the New England regional electricity system as a whole that serves it, is highly dependent on natural gas for generation of electricity. Natural gas and oil provide nearly 65 percent of ISO-NE's electric generating capacity.[50] Given the manner in which the New England region's electrical energy markets work, the price of natural gas effectively sets the price of electricity. The price of natural gas historically has been strongly influenced by national and international economic and political events outside the control of policy makers in Maine or New England.

The Task Force notes that, while it presents price-related problems and extraction-related risks to water quality and associated values in some cases,[51] natural gas has some advantages as an energy source, including: markedly lower emissions as compared with oil and coal, particularly in terms of particulates and carbon; large United States and Canadian supplies; and a currently low price as compared with offshore wind and other renewable sources. In the near term, it is possible natural gas could help bridge the transition to sustainable, less-polluting energy produced by offshore wind and other renewable sources. Technological advancement and related cost reductions, public policies that provide financial support for ocean energy and transmission system improvements, and limitations on greenhouse gas emissions and other public policies that serve to include now externalized costs in energy prices are needed and appropriate to bring offshore wind and other ocean energy prices down to more competitive levels.

C. Need to Position Maine to Compete for Necessary Public and Private Investment

In keeping with the above-noted estimates on wind energy development's job creation potential, there is considerable current and foreseeable competition for public and private investment in wind and other renewable ocean energy resources. Other East Coast states are making concerted efforts to bring offshore wind power into their energy mix to meet renewable portfolio standards[52] and related policy goals, and to help secure related manufacturing and employment opportunities for their citizens. Rhode Island, Delaware, New Jersey, and Massachusetts are chief among them.[53]

---

[50] State of Maine Comprehensive Energy Plan 2008-09 (Office of Energy Independence and Security) January 2009, p.82.

[51] http://www.nytimes.com/2009/12/08/business/energy-environment/08fracking.html?_r=1&scp=2&sq=natural%20gas&st=cse (accessed 12.15.09)

[52] EPA defines a renewable portfolio standard as a "requirement that an electric power provider generate or purchase a specified percentage of the power it supplies/sells from renewable energy resources, and thereby guarantee a market for electricity generated from renewable energy resources" http://www.epa.gov/greenpower/pubs/glossary.htm#

[53] The Task Force had the benefit of and expresses its appreciation for presentations by John Weber and Grover Fugate, key state personnel in Massachusetts' and Rhode Island's ocean energy-related ocean resources planning initiatives, respectively, at its May 2009, meeting.

Appendix 7 provides an overview of these states' approaches to attract and site offshore wind energy development.

Through support for its goal of providing 20 percent of the nation's electric power generation capacity with wind energy by 2030 and strong energy and climate policies that support a green economy, President Obama's administration has placed a strong emphasis on development of America's wind and other renewable ocean energy resources. There is some prospect that federal funds for research, development and siting-related planning efforts, as well as other support, including cooperative work with Minerals Management Service and other federal agencies, may be directed at states that are demonstrating active interest and ability to support, foster and secure opportunities for development of those resources.

The marked downturn of the American and world economy, driven by systemic problems in the financial sector, has compounded the challenge of financing large capital projects, like offshore energy development. As a result, competition for available investment dollars is all the more keen.

The Task Force believes that the State should focus its efforts on ocean energy opportunities in which it may have a competitive advantage. It is worth noting that none of the East Coast states discussed above as leaders in the offshore wind development area has appreciable on-shore wind energy resources, whereas as Maine has nationally significant on-shore wind energy resources. Also, ocean wind development contemplated in each of those states would involve use of existing, shallow water technologies and would occur in federal Outer Continental Shelf waters.

Maine, by contrast, has a unique opportunity to test and develop deep-water wind technologies within state and federal waters relatively distant from the mainland. Exciting opportunities exist for testing these technologies in Maine's coastal waters in the near term and subsequently for deploying commercial scale deep-water projects in Maine's coastal waters or, more probably, proximate federal waters. This niche affords Maine an important competitive advantage concerning investment in the next generation of larger, 5 megawatts or greater capacity offshore wind turbines and related floating, spar, or other support technologies currently under development.

The U.S. Department of Energy recently awarded an $8 million grant to the University of Maine-led public-private consortium which will support design, installation, and testing deep-water wind technology at the offshore energy wind test site the State has designated for the University of Maine research and development initiatives in accordance with P.L. 2009 c. 270 as well as related work by the University of New Hampshire at an offshore test site in the Isle of Shoals off New Hampshire. Floating platform design is a focus of the consortium's research and development plan, which includes evaluation of issues and opportunities regarding use of more durable, lighter composite materials. This significant federal grant reflects national recognition of Maine's potential to lead the nation in advancing research, development and commercialization of the deep-water wind technology and demonstrates its ability to collaborate with key players in the global wind energy field, as the recent visit by representatives of the Norwegian energy firm Statoil demonstrates. The Task Force strongly supports the efforts of the consortium and recognizes the key role it can play in securing future opportunity for the State.

The Task Force believes that Maine can optimize its chances for location of related manufacturing and other business enterprises in this state by establishing itself now as a leader in the growth and development of the renewable ocean energy industry, particularly the deep-water wind industry. If Maine fails to do so, experience in Europe, discussed below, suggests that major opportunities may be lost to states where early, major investments in United States offshore wind and other renewable ocean energy development projects are made.

D. Current Need to Lay the Foundation to Attract, Support, and Sustain Growth of Maine's Renewable Ocean Energy Businesses to Optimize Economic Development Benefits to Maine People

Promotion and support for growth and expansion of Maine's renewable ocean energy business cluster and related quality jobs are integral to positioning the State to take advantage of current and anticipated opportunities in Maine and the Northeast region. Based on the work of its economic development subcommittee, the Task Force has identified the following as key issues to maximize the economic benefit from renewable energy development.

Energy Pricing and Project Financing Support and Incentives

Government incentives continue to play an important role in promoting and supporting growth and development of renewable ocean energy and related industries. There is currently a broad range of incentives offered to support wind energy development in the United States. Appendix 8 (reference table from Ernst and Young, 2009 report) provides a comparison showing which of these incentives is currently available in Maine.

Obtaining adequate financing is one of the major hurdles facing renewable energy developers. Quite a few other states and countries have been active in providing incentives in an effort to address economic challenges facing offshore wind energy development in order to meet renewable energy and related climate change policy goals. Appendix 9 provides a summary of selected states' programs.

The European Union and the United Kingdom have been particularly aggressive in this area. The wind industry is one of the highest-growth industries in Europe with over 12 percent growth over the past five years. Europe currently has an aggregate installed wind energy capacity of about 40 gigawatts, with Germany, Denmark, and the United Kingdom contributing the most to this total.[54] Approximately 1.5 gigawatts of this capacity is offshore. Growth in Europe's ocean wind industry has been fueled by significant government subsidies, including hefty feed-in tariffs.[55] Germany,

[54] Jake Ward (November 3rd, 2009). Deepwater Offshore Wind: 5 gigawatts by 2030 In Maine. Presentation to Cutler and Buck's Harbor Fishermen, Cutler School, Cutler Maine

[55] Applied Technology and Management Inc., Loria Emerging Energy Consulting LLC, Maguire Group Inc., TRC Companies Inc., and Birch Tree Capital LLC. 2007. *Final report: RIWINDS phase I wind energy siting study* (Report prepared for the State of Rhode Island Economic Development Corporation); http://www.energy.ri.gov/documents/independence1/RIWINDSReport.pdf

Spain, and Denmark have benefited the most and account for more than 70 percent of the European Union's installed capacity and 90 percent of the European Union's wind sector employees.

Figure 3. Clusters for Wind turbine manufacturing in Denmark, Germany and Spain. Source: Bain and Company

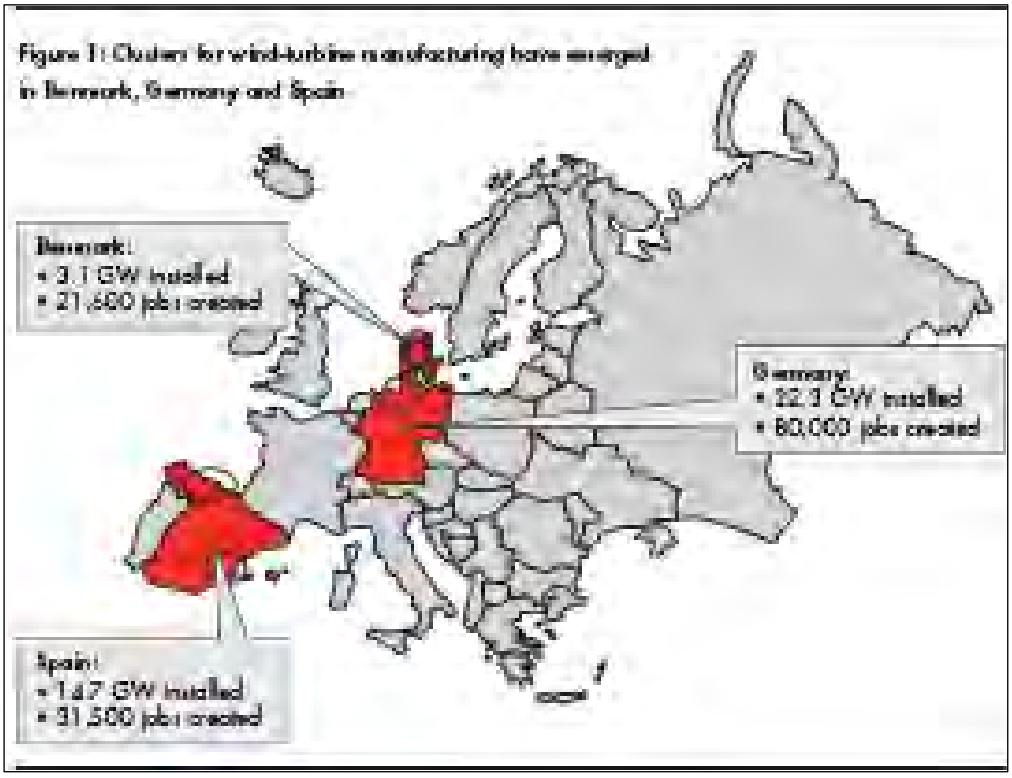
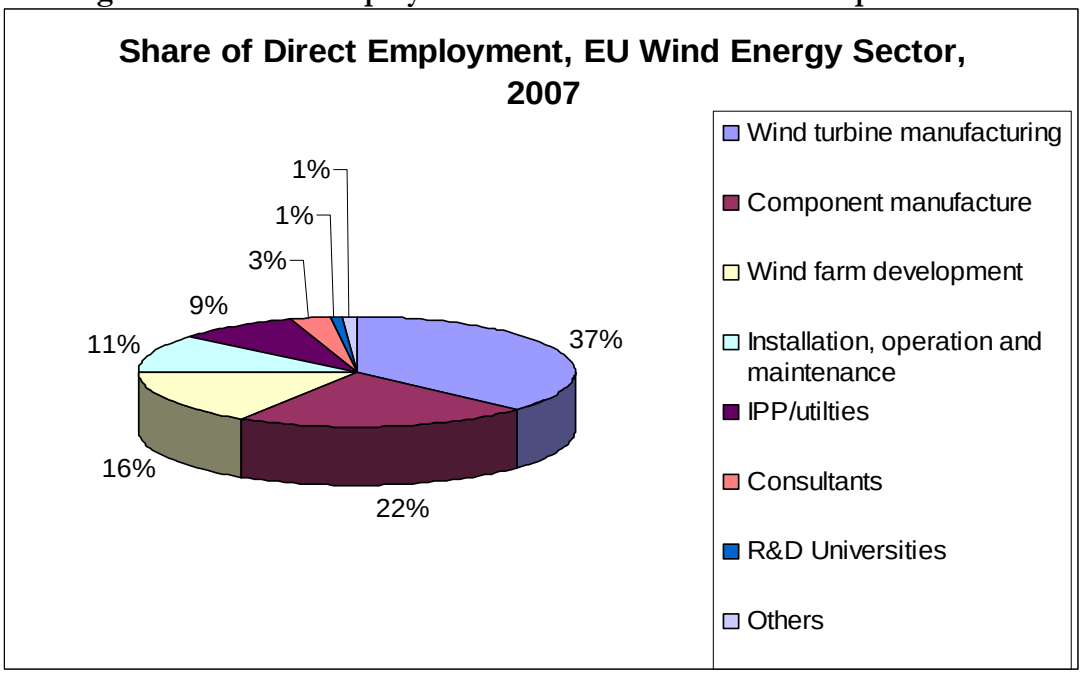


Figure 4. Share of Employment in Various Sectors in European Union



Source: European Wind Energy Association, ***Wind at Work: Wind Energy and Job Creation in the EU***

Bain and Company analysis[56] suggests that there are four factors integral to Europe's success to date in developing its wind resources and related industries:

- Support for energy pricing policies that reduce commercial uncertainty, such as feed-in tariffs[57];
- Rapid building of transmission and other necessary grid infrastructure;
- Fast and efficient planning and regulatory review for approval of installation sites; and
- Public support for wind energy in local communities generated either by participation on ownership of wind farms or through tax revenues paid to local authorities for tangible benefits to communities.

The Task Force notes that on the strength of these four factors European nations active in the wind energy development area attracted wind turbine manufacturers and that related business clusters developed near these factories. These related businesses include material and component suppliers

[56] Bain and Company, "A closer Look at the development of wind, wave and tidal energy in the UK: Employment opportunities and challenges in the context of rapid industry." Dr. Marcus Boettcher, Niels Peder Nielsen and Dr. Kim Petrick , 2008.

[57] A "feed-in tariff" is a law or public policy that requires utilities to buy electricity produced with renewable resources, such offshore wind or tidal energy at a government-set, above-market prices that address high renewable energy production costs relative to those using traditional fossil fuels and thus support renewable energy development.

as well as universities and research institutions that provided tailored education and research and development support.

The Task Force notes that it is reasonable to infer that these factors are also germane to the tidal power industry. Employment opportunities created by tidal power investments in Maine to date discussed above further illustrate the connection between ocean generation facility siting and job creation in related industries.

There are evident economic and political differences between Maine and the European Union that may preclude wholesale or verbatim adoption of Europe's financial support policies for wind power and other ocean energy industries. Nevertheless, each of the four factors listed above has been cited as essential by prospective developers of ocean energy in Maine waters and the Task Force believes that state policy makers should give careful consideration to them when assessing the efficacy of existing or planning additional financial incentives and other measures to foster growth of Maine's ocean energy industry.

Research and Development and Cluster Development

Maine has taken and is advancing some important steps to provide incentives for and support growth of offshore wind, tidal, and other aspects of the State's nascent ocean energy business cluster. Actions to date have included:[58]

- Provision of over $12 million in funding for renewable energy and other clean technology research and development projects through the Maine Technology Institute;
- A $6 million bond initiative, scheduled for public vote in June 2010, to support the University of Maine Marine Wind Energy Demonstration Site;
- Establishment of the Maine Wind Energy Industry Initiative;
- Cluster Development Award to the Environmental and Energy Technology Council (E2Tech) for Ocean Energy cluster;
- The EnergyOcean 2009 Conference, hosted in Rockland, Maine, in June 2009; and
- Statewide expansion of Pine Tree Zones, effective September 2009, that will include wind and tidal energy projects with a substation or other facility located on the mainland.

According to "U.S. Offshore Wind Energy: A Path Forward,"[59] a recent paper by the U.S. Offshore Wind Collaborative, there are many areas where additional research is needed. For instance, improvements in remote-sensing measurement technologies will help to improve the accuracy of offshore wind characterization. Better information on water depth, current, seabed, and wave heights is also needed. Technical design issues, such as support structures and anchoring technologies, turbine capacity, drive trains, control systems and turbine blades, are all intensified for

[58] See Appendix 10.

[59] U.S. Offshore Wind Energy: A Path Forward – A Working Paper of the U.S. Offshore Wind Collaborative, October 2009, http://www.usowc.org (accessed 12.15.09)

the offshore environment. Finally, research will continue to be needed to improve siting, environmental assessments, monitoring and impact mitigation regarding wind, tidal, wave, and other ocean energy technologies as they develop.

While acknowledging the value of the State's efforts in this area to date, the Task Force believes that additional state investment and other steps to address barriers to private investment are needed now to optimize potential for Maine people and help ensure that Maine's indigenous renewable resources are not just harvested for export but used to generate wealth and business and related employment opportunities in this state.

Workforce Development

Establishment of a robust in-state ocean energy industry has the potential to create and enhance job opportunities in a host of occupations.[60] A 2003 analysis of the Cape Wind project by Global Insight, for example, estimated that, without assuming any related cluster development, that single commercial-scale project would create 391 construction jobs and 50 operations jobs.[61] In addition, the Ocean Energy Institute estimates that one gigawatt of deep-water wind power development would have the following jobs-related effects:

- *Assembly and manufacturing:* 2,153 to 2,691 temporary full time direct jobs, $28.8M in salaries and wages to supply chain, $26M of additional consumer spending and 134 jobs as a result.
- *Construction and Installation Phase:* 3,893 temporary fulltime jobs in installation, $30.3M. Consumer spending $39.8M leading to 204 jobs.
- *Operations and Maintenance Phase:* 135 to 271 permanent full time jobs with spending producing an additional 222+ jobs.
- *Indirect and Induced jobs:* 620 jobs.[62]

In the European Union, which is the world's wind energy leader, employment from offshore wind deployment totaled 154,106 in 2007 and is projected to exceed 377,000 by 2030.[63]

Most of the ocean energy-related job opportunities would involve increased demand for workers with skills held by those currently employed in existing Maine business sectors such as pulp and paper, fisheries, and marine trades. A few others, such as wind energy operations managers, wind energy project managers, wind energy engineers and wind turbine service technicians, require more

---

[60] See Erich Dierdorff et al, February 2009, *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations* (Developed by the National Center for O*Net Development for the U.S. Department of Labor); http://www.onetcenter.org/)

[61] Global Insight. April 2003. "Economic Impact Analysis of the Cape Wind Off-shore Renewable Energy Project; http://www.windpoweringamerica.gov/econ_project_detail.asp?id=5

[62] See Thorne, Malaika. 2008. Maine's Offshore Wind Energy Future: Economic Impacts and Job Creation. Ocean Energy Institute.

[63] See Wind at Work: Wind energy and job creation in the European Union, January 2009, European Wind Energy Association; see also Bain and Company, *supra*

specialized knowledge and training. Development of Maine's offshore wind resources industry at a scale sufficient to provide wind energy to address state transportation and heating needs would require additional suitably skilled workers. For example, increase in demand for conversion of oil-based home heating to electric-based heat pumps and for power for electric cars has the potential to both change and add significantly to employment opportunities.

State economic development agencies and higher educational institutions need to monitor growth and development of Maine's ocean energy industry with an eye toward the effects and implications for the work force, especially with regard to the needs for training and skill development. Planning to provide needed educational programs and work force training should be done in concert with state energy resource planning.

Conversion of Heating and Transportation to Electricity

Expansion of the demand for electricity to include transportation and home and business heating is another essential element of the economic development picture. Electrification of these end uses with more efficient heat pumps and electric vehicles can help reduce total energy bills (i.e., electricity, heat, and transport) while improving energy security and reducing carbon dioxide emissions. Due to these significant efficiency, gains, a carefully designed electric conversion program would reduce consumer total energy bills from day one. In Appendix 3 Waine Whittier sets forth the fundamental principles of a home heat conversion program: 1) there is no up-front cost to the homeowner; 2) all up-front costs would be rolled into the monthly electric bill; 3) the price of electricity would be guaranteed not to increase faster than a certain rate for a 20 year contract term; 4) the homeowner would realize immediate savings in heating energy costs; and 5) only homes that meet specified efficiency levels will be eligible for conversion to a heat pump. The upfront funding for such a program could potentially come from a variety of sources, some of which may require enabling legislation. These could include: a bond issue, Maine's transmission and distribution utilities, the Efficiency Maine Trust, and/or the Regional Greenhouse Gas Initiative. These funds would be paid back over time by participating ratepayers. Similar program provisions could apply to an electric vehicle conversion program.

The Task Force believes it makes sense to undertake the design and implementation of an electric conversion program today, regardless of the State's moving forward with development of its offshore wind resource. However, the electric conversion program could and has been recommended to help pay for the above-market costs of offshore wind and tidal power. By converting to electric heat pumps and vehicles, participating consumers would help build demand for offshore wind and tidal power, and by paying an electric rate (taking into account the cost of the loan) that is above the current electric rate, these participating ratepayers would help support the above market costs of offshore wind and tidal power. Even at this higher rate, the consumer would still save from day one, due to the greater efficiencies of heat pumps and electric vehicles as compared to their petroleum fueled counterparts. All above-market costs of contracts with offshore wind or tidal projects not covered by the electrification program described above would be paid by the general body of ratepayers. As explained elsewhere in this report, the Task Force recommends that ratepayer impacts be kept to a reasonable level, as defined by the Governor and Legislature giving due consideration to a balance of both the costs and benefits of these resources.

Assuring Adequate Port Resources

Ocean energy developers, including those developing both tidal and offshore wind resources, will require significant on-shore land resources at or close to port facilities for manufacturing, assembly, maintenance, and support of the energy generating equipment. There is a risk that the growth of the ocean energy sector could be stunted if there is insufficient real estate and infrastructure available to manufacturers, assemblers, and developers. Ocean wind developers, for example, construct huge towers with very large blades that need to be assembled near the ports from which they can be barged to installation sites. Because of the time it will take to fully develop offshore wind and other ocean energy opportunities and the pressure on real estate near port facilities, it is important that a process be established in the near term to identify key real estate needs and acquire or protect them.

Simplifying Municipal Tax Issues

Existing laws regarding the ability of municipalities to tax personal property, including ocean energy-related machinery and equipment, are not clear, as the laws were written long before ocean energy was a topic under consideration. Ordinarily, a municipality taxes personal property owned by residents or located within the municipal borders on April 1 of each year. Tax rates vary considerably from town to town. Under the Maine Constitution[64], if the Legislature creates a new exemption from this tax, the State must reimburse the municipality for not less than 50 percent of the lost revenue. By statute, this reimbursement obligation extends to the unorganized territory as well.[65]

Without legislative clarification, it is not clear whether or to what extent an ocean energy generating facility may be subject to municipal personal property tax. The lack of clarity regarding municipal boundaries discussed below and the potential for future change in a municipality's boundaries by the Legislature's amendment of its charter create more uncertainty, as does the prospect of multiple requests to the Legislature for boundary changes aimed at securing taxing jurisdiction. Further, it is unclear whether turbines, blades, towers, or other renewable ocean energy-generating machinery or components that are intended to be located offshore are taxable by a municipality if located temporarily within its boundaries on April 1, even if moved offshore prior to April 1st of the following year.

The Task Force believes that these uncertainties should be addressed now to prevent them from becoming deterrents to the development of offshore energy projects and to create a more predictable and equitable taxation structure that attracts renewable ocean energy development. While the complexities of Maine's tax laws and municipal boundary issues make it difficult to propose simple solutions, the Task Force believes that the Legislature should at a minimum consider legislation necessary to exempt renewable ocean energy-generating machinery and components that are in transit and only temporarily located in a municipality from municipal personal property tax and to exempt renewable ocean energy development from personal property taxation unless it is installed within currently existing municipal boundaries.

[64] Constitution of the State of Maine, Article IV, Part 3, §23.

[65] 36 M.R.S. §661(5)

V. KEY CHALLENGES AND IMPEDIMENTS TO DEVELOPMENT OF MAINE'S WIND AND OTHER RENEWABLE OCEAN ENERGY RESOURCES

The Task Force has identified hurdles that stand in the path of development of Maine's offshore wind and other renewable ocean energy resources. These hurdles can be overcome but doing so will take concerted and well-coordinated efforts by the government, academic, and private sectors. The following summarizes key challenges in the areas of technological development, grid infrastructure and management, natural resources management and permitting, and project financing and economics.

A. Technological Barriers and Challenges

1. Status of deep-water wind technologies[66]

The offshore wind technology in depths of up to at least 60 meters, and possibly 90 meters, has been proven commercially viable and is in widespread use in Europe. Such technologies, including monopile support structures and turbines designed for use in the marine environment, are on the market and could be deployed in sufficiently shallow areas of Maine's coastal waters or adjoining federal water to generate electricity.

On the other hand, technologies that would enable the placement of wind turbines on floating platforms or other structures in greater depths needed to tap the world-class deep-water wind resources in Maine's coastal waters or in adjoining federal waters are under development and have not yet been proven ready for commercial utilization. Lack of the requisite technology is an obvious barrier to establishment of the deep-water wind industry in Maine or elsewhere in the near term.

To date, no offshore wind energy projects have been built in the United States; and no offshore wind energy project has been proposed for siting in Maine's coastal waters or adjoining federal waters. Northern European nations across the Atlantic, on the other hand, are world leaders in ocean wind energy.

In Europe, offshore wind turbine construction has generally involved the use of monopiles driven into the seafloor or foundations weighted at the bottom as support structures.[67] The utility of

[66] This section is largely adapted from Attachment K (Assessment of the Status of Offshore Wind Power Technology, Economic Viability and Future Outlook) to the final report of the Governor's Wind Power Development Task Force.

[67] Massachusetts Technology Collaborative, U.S. Department of Energy, and General Electric. 2005. *A framework for offshore energy development in the United States.* http://www.masstech.org/offshore/final_09_20.pdf (accessed 12.15.09)

monopiles decreases as water depths increase since the foundation must be driven deeper to ensure stability of the turbine against wind, wave, and current forces.[68] Since monopiles are usually driven into the seafloor, areas with softer bottoms are most feasible from a construction standpoint. Comparatively high costs, such as those associated with drilling through harder rock bottoms, while technically feasible, are a factor that may make a project uneconomic.[69] Also, there is very limited availability in the United States of "jack-up barges" capable of lifting the turbines, large pile-driving equipment and cable-laying ship-based equipment and other marine equipment needed for deep-water construction.[70]

Offshore wind faces a number of transmission-related technical and cost challenges. Costs and technical concerns generally increase with the length of electric transmission cable needed to connect offshore sites with the onshore grid. Long cable lengths raise concerns not only with construction practicality and cost but also power loss. In general, AC cables longer than 20 miles in length can have significant power loss. Use of DC technologies and converter stations to allow cables to conduct direct current provide options to address this issue. The costs of these systems can, under certain circumstances, be competitively disadvantaged as compared with AC systems. The ideal circumstances for DC line installation involve long distances (greater than 30 miles) with few intermediate DC converter stations (taps) along the line. The more taps there are, the higher a DC system's price tag, even though the line itself may be a cheaper alternative than AC for the distance traveled and reliability secured. An ideal system might be comprised of DC for long distance transmission converted to AC for local distribution.[71] Connection to the existing electric grid on land may also necessitate infrastructure upgrades to handle the new power supply, further adding to project-related costs. (See discussion of transmission-related challenges in section B, below).

Insurance coverage of cables required by project financers can also add significantly to project costs.[72] Inherently higher operations and maintenance costs as compared with land-based or even inshore wind energy development and other electric power generation options, present another major challenge.[73]

Development of larger turbines for deployment offshore is seen as a key to addressing the cost issues outlined above through improved economies of scale (i.e., reduction in the unit cost per

---

[68] Applied Technology and Management, LLC , et al (2007), *supra.*

[69] See Whittier analysis, *supra*; also, Coakley, L. "Coke". 2008. Personal communication with Coke Coakley, Florida Power and Light, with John Weber, Maine State Planning Office, regarding offshore wind power technology. January 17, 2008

[70] General Electric Energy. 2007. Offshore wind energy presentation; www.clemson.edu/scies/wind/Presentation-Grimley.pdf (accessed 12.15.09)

[71] United States Congressional Address by the Government Accountability Office, February 1, 2008; http://www.gao.gov/new.items/d08347r.pdf (accessed 12.15.09)

[72] Coakley, *supra*

[73] Butterfield, S., W. Musial, J. Jonkman, and P. Sklavanous. 2005. *Engineering challenges for floating offshore wind turbines.* Paper presented at 2005 Copenhagen Offshore Wind Conference, Copenhagen Denmark. Conference paper National Renewable Energy Laboratory/CP-500-38776. 13 pp.

kilowatt generation). For example, Germany's North Sea alpha ventus project involves the use of 5 megawatt capacity turbines.[74] In its 2008 Annual Report, the International Energy Agency noted that in the United Kingdom, for example, "the higher capital costs of offshore are due to the increase in size of structures and the logistics of installing the turbines at sea," noting that offshore turbines are 20 percent more expensive than terrestrial ones and that "towers and foundations can cost more than 2.5 times offshore than onshore for a project of similar size."[75]

Turbine support technologies to enable the wind power industry to capture wind in deeper water areas are under active development. The National Renewable Energy Laboratory notes that adaptation of designs and techniques from the oil and gas industry is likely to play a key role in advancement of wind power industry.[76] Current examples include the following:[77]

- Floating turbine support structure under development by Blue H Technologies, a prototype model was launched in late 2007 offshore Italy in water depths of about 300 feet;
- Principle Power's "WindFloat", a three-column floating structure designed to support a wind turbine manufactured for marine applications in the power range of 3.6 to 10 megawatt; and
- StatoilHydro's (Statoil) floating platform design adapted from technology deployed in the oil and gas industry.

Statoil, a state-owned Norwegian company, recently announced installation of its two-year "Hywind" pilot project which is comprised of a 2.3 megawatts wind turbine with 80-meter diameter rotors and a 65-meter tower installed on a floating platform with a 100-meter draft of a kind used in the past by the oil and gas industry as a production platform that is attached to the seabed with a three-point mooring spread. Towed to sea and installed at a depth of 220 meters near Stavanger, Norway, this pilot project marks an important milestone in the development of the offshore wind industry. Notably, in press materials announcing the project, Statoil explains that "[f]loating wind power remains an immature technology, and the road to commercialisation and full-scale construction of wind farms will be long" and its goal is to "test how wind and waves affect the structure, learn how the operating concept can be optimised and identify technology gaps."[78]

While it recognizes the many technological and associated cost-related challenges the deep-water wind energy industry faces, the Task Force concludes that technological advances are improving the economic viability for offshore projects by allowing larger turbines that take advantage of economies

---

[74] See http://www.alpha-ventus.de/fileadmin/user_upload/Pressekit/av_Factsheet_091005_EN.pdf (accessed 12.15.09)

[75] *IEA Wind Energy: Annual Report 2008*, executive summary, p.21; www.ieawind.org/AnnualReports_PDF/2008.html (accessed 12.15.09)

[76] See Butterfield, et al., *supra*

[77] The Task Force's mention of these particular technologies, information about which was presented to it during its study process, does not reflect or constitute their endorsement by the Task Force or State. They are referenced only as examples of emerging technologies.

[78] See http://www.statoilhydro.com/en/NewsAndMedia/News/2009/Pages/InnovativePowerPlantOpened.aspx (accessed 12.15.09)

of scale and can be sited in deeper waters over which there is greater wind power generation potential. As projects in the United States and elsewhere continue to be developed and constructed, the industry will gain experience and technical capability needed to produce wind power over deeper waters.[79] Incentives for technological advances (e.g., increased costs for generating electricity with fossil fuels that result in a more attractive economic model for offshore wind energy development, or government subsidies or programs) may also help to increase the pace of development.

The current status of the technology for tapping the energy potential of Maine's huge deep-water wind resource underscores the importance of support for research and development aimed at commercialization and closely related efforts to foster growth of Maine's ocean energy business cluster emphasized elsewhere is in the report.

2. Tidal power technology

Tidal energy projects use tidal action (tidal amplitude or currents) to generate power. Tidal energy projects have higher power densities (power output per unit area) than either solar photovoltaic or wind projects, which increases their attractiveness for development and utilization.[80] Designs for tidal energy systems have been patented since the 1800s. At present, there are no commercial-scale tidal projects in operation in the United States, although there are several in operation world-wide.[81]

In recent years, interest in tidal power, as a source of renewable, predictable power that produces electricity without greenhouse gas emissions, has grown worldwide and promising technologies are under development. Ocean Renewable Power Company, for example, has been conducting in-water demonstration testing off Eastport, Maine, and in 2008 became the first company to generate electricity from Bay of Fundy tidal currents.

Existing commercial-scale tidal energy projects all use traditional tidal dam (barrage) technology. This technology generates electricity using the "head" created by holding tidal water back behind a dam, then passing that water through a turbine once on-going tidal action creates a sufficient difference in water levels on the two sides of the dam to power hydro-mechanical or hydro-electric systems. The nearest such project is the 20 megawatts Annapolis Royal project in Nova Scotia,

---

[79] Musial, W., and S. Butterfield. 2006. *Energy from offshore wind.* Paper presented at the 2006 Offshore Technology Conference, Houston TX. Conference paper NATIONAL RENEWABLE ENERGY LABORATORY/CP-500-39450. 14 pp.

[80] Bedard, Roger, George Hagerman, Mirko Previsic, Omar Siddiqui, Robert Thresher, and Bonnie Ram. 2005. Final Summary Report, Project Definition Study, Offshore Wave Power Feasibility Demonstration Project. Report No. E2I EPRI Global WP-009-US Rev 2. September 22, 2005; Hagerman, George, Brian Polagye, Roger Bedard, and Mirko Previsic. 2006b. Methodology for Estimating Tidal Current Energy Resources and Power Production by Tidal In-Stream Energy Conversion Devices. Report No. EPRI TP-001 NA Rev 3. September 29, 2006.

[81] Free Flow Energy, Inc. 2009a. Report to Assess the Design/Inspection Criteria/Standards for Wave and/or Current Energy Generating Devices. MMS Project Number 628. March 31, 2009; Bedard, Roger, Mirko Previsic, Brian Polagye, George Hagerman, and Andre Casavant. 2006. North American Tidal In-Stream Energy Conversion Technology Feasibility Study. Report No. EPRI TP-008-NA. June 11, 2006.

Canada.[82] Combinations of multiple dams and/or reversible turbines can be used to generate power on both the incoming and outgoing tides, as was proposed for Passamaquoddy Bay in the 1930s.[83]

While generally using tried-and-true technology, tidal barrages have high capital costs and potentially significant environmental impacts. Finally, there is a limited number of sites with tidal range and channel width characteristics necessary for economic viability.

There is currently one tidal barrage project under active consideration in Maine, at the entrance to Half Moon Cove in Cobscook Bay, Washington County.[84]

New tidal in-stream energy conversion technologies (commonly referred to as hydrokinetic technologies) seek to use tidal currents to generate electricity without a dam or barrage.[85] All of these technologies are currently in the research and development stage, with limited *in-situ* operations to date.

There are two primary types of tidal in-stream energy conversion devices - horizontal axis and vertical axis turbines. Turbine designs include helical or "cross-flow" units (similar in design to the blades on a hand-power lawnmower) and axial flow (propeller-type) units of varying diameters that are either open or closed (ducted) and that have either fixed or variable-pitch blades.[86] Deployment configurations include single, dual, or multiple units utilizing bottom foundations (either pilings or weighted platforms), monopole foundations (underwater windmills), or anchoring systems for units positioned in the water column.[87] Hydrokinetic systems may use conventional generator technology (wire-wound rotors and stators) or may employ permanent magnet generators that are located either above-surface or are submerged.[88]

Since 2006, the Federal Energy Regulatory Commission has issued seventeen study permits for tidal hydrokinetic projects in Maine waters. At this time, nine of these permits are still active.[89] Two of these permits were issued to Ocean Renewable Power Company for potential sites in Cobscook and Passamaquoddy Bay in Eastport. Ocean Renewable Power Company is pursuing development of a

---

[82] Hagerman, et al. (2006b), *supra*

[83] Popular Science Monthly. 2005. Electricity from Ocean Tides. Vol. 127 No. 2. August 1935.

[84] Tidewalker Associates. 2009. Pre-Application Document submitted to the Federal Energy Regulatory Commission for the Half-Moon Cove Tidal Power Project. March 2009.

[85] Bedard, et al (2006), *supra*

[86] *Id.*

[87] Previsic, Mirko. 2006. System Level Design, Performance, Cost and Economic Assessment – Maine Western Passage Tidal In-Stream Power Plant. Report No. EPRI TP-006-ME. June 10, 2006; Ocean Renewable Power Company, Maine, LLC. 2009. Ocean Renewable Power Company, Eastport Tidal Energy Project, Draft Pilot License Application. Vols. I-III. July 2009; and Hagerman, George. 2006c. Energy from Waves, Tides, Ocean Currents, and Free-Flowing Rivers: An Overview of Resource, Technology, and Business Issues. Presented to FERC Technical Conference. December 6, 2006.

[88] Ocean Renewable Power Company, *supra*; and Free Flow Energy, Inc. 2009b. Free Flow Energy Signs Development Agreement with Lucid Energy Technologies for Use of Gorlov Helical Turbine. Press Release dated October 10, 2009.

[89] Maine Department of Environmental Protection 2009. Status of Tidal Power Project Proposals in Maine as of October 1, 2009.

proprietary turbine-generator unit that uses an advanced cross-flow turbine and integral permanent magnet generator, mounted in a semi-buoyant frame, and anchored in the water column. Ocean Renewable Power Company's plans call for deployment of a small-scale grid-connected pilot project in 2010.[90] Ocean Renewable Power Company continues to advance its project and now has a pilot project license application pending before Federal Energy Regulatory Commission. Other technologies may be field-tested in Maine waters in the near future.[91]

3. Wave power technology

Although they have not reached the mature stages of development of existing wind power technologies, wave energy extraction technologies are advancing. There are over 100 differing methods for wave energy extraction now under development.[92] A number of wave energy technologies use hydraulics to convert water level oscillations into electricity. Others employ compressed air or direct mechanical drive. Some ride on the ocean's surface, while others are submerged. Some produce electricity at the device, while others pump pressurized water to onshore generators. Some are designed for shallow, inshore locations, others for offshore, deep-water locations.

Major investments in wave energy are being made in the United Kingdom, Portugal, Japan, South Korea, and Australia.[93] The world's first commercial-scale wave power project, off the coast of Portugal, was dismantled in 2008 due to technical problems after about six months of operation. Reported to be the world's largest active "hydro-electric wave energy device" and the only one producing power, one wave power technology was deployed and connected to Scotland's electric grid in November 2009.[94]

There are no wave energy projects under active development or study in Maine waters at this time. To date, Federal Energy Regulatory Commission has issued or has pending less than a dozen preliminary (study) permits for wave energy projects in the United States. All are on the West Coast, in the states of California, Oregon, Washington, and Hawaii. The one license issued to date by the Federal Energy Regulatory Commission for a wave energy project was subsequently surrendered for economic reasons prior to any project construction.

The wave energy potential off the New England and Mid-Atlantic coasts has been estimated at 110 terawatt hour/year.[95] Although the Electric Power Research Institute has suggested that wave technology, if developed commercially, will likely be deployed in states, such as Oregon, with wave

---

[90] Ocean Renewable Power Company, *supra*

[91] Freeflow Energy (2009b), *supra*

[92] http://www.emec.org.uk/wave_energy_developers.asp (accessed 12.15.09)

[93] See, e.g., www.carnegiecorp.com.au (announcements November 16, 2009); www.oceanpowertechnologies.com (investor relations November 6, 2009); and www.aquamarinepower.com (press release, February 23, 2009) (all accessed 12.15.09)

[94] http://www.aquamarinepower.com (November 20, 2009 press release) (accessed 12.15.09)

[95] Hagerman, et al. (2006c), supra

energy resources more promising than Maine's,[96] wave energy facilities may become economically viable in Maine and other places with more modest wave energy resources as technologies are refined and unit costs come down.

It is simply too soon to say how large a contribution wave energy could make to Maine's renewable ocean energy mix. It is possible that wave power technology could afford commercially significant opportunities for Maine in the future. There was testimony and information presented to the Task Force, for example, that there may be a role for wave power deployed in combination with offshore wind energy to address in part intermittency-related issues associated with wind power. Wave power technology of this kind may be tested, as an element of a wind energy demonstration project, pursuant to the above-noted legislation facilitating siting of ocean energy test projects enacted last session (P.L. 2009 c. 279).

B. Electric Transmission-related Barriers and Challenges

The integration of up to eight gigawatts of new on and offshore wind into the state and regional generation mix will require correspondingly significant investment in state and regional transmission infrastructure, and possibly to its distribution infrastructure, particularly if goals to pursue electrification of the home heating and transportation sector are pursued. These ambitious renewable energy goals also demand that attention be paid to transmission investment cost recovery; the "smart grid," and utility rate design.

Transmission and Distribution

As it evolved, the Maine transmission system was designed for approximately two gigawatts of installed generating capacity. The addition of four times this capacity from an intermittent resource, such as wind, will necessitate an as yet undetermined amount of expansion of the transmission system. The North American Reliability Council has noted that:

> Many new variable generation plants interconnecting with the bulk power system will be located in areas remote from demand centers and existing transmission infrastructure due to fuel availability. Additional transmission infrastructure is therefore vital to reliably accommodating large amounts of wind resources, specifically in order to (1) interconnect variable generation output planned in remote areas; (2) smooth the variable generation output across a broad geographical region; and (3) deliver ramping capacity and ancillary services from inside and outside a Balancing Area to equalize supply and demand.[97]

[96] Previsic, *supra*

[97] Special report-Accommodating High Levels of Variable Generation to Ensure the Reliability of the Bulk Power System, North American Electricity Reliability Council, April 2009, pgs. 34-5

Maine must explicitly recognize that investment in transmission and distribution capacity is an intrinsic part of its renewable energy strategy. According to Lisa Martin, Manager of Transmission Development at Bangor Hydro:

> Getting to 3,000 megawatts will take a considerable overhaul – picture the current 345 kilovolt lines and assume you would need two of them for every one; or the 115 kilovolt lines would need to be upgraded and augmented. This point should be well understood – this is a REALLY big change, not an incremental growth. Not just the lines but also the associated equipment within Maine and beyond would need to be changed. It would take a LOT of public support to make this happen from the perspective that it would take more new utility corridors.[98]

Recent efforts to site new or expand existing transmission facilities, such as the Maine Public Service interconnect, the Maine-New Brunswick Corridor Project, and Central Maine Power Company's Maine Power Reliability Project, illustrate inherent complexities and difficulties in expanding transmission infrastructure.

The Joint Coordinating System Plan suggests that 15,000 miles of new transmission lines, at a cost of $80 billion, will be needed to meet a 20 percent wind energy scenario in the Eastern interconnect.[99] Distribution infrastructure capacity likely will also need to be expanded, especially if the Task Force's recommendations to promote movement to more efficient and less polluting electricity-based forms of home heat and transportation, such as heat pumps and electric vehicles, are implemented.

Pre-designating renewable energy zones could help the State achieve its ocean energy goals most efficiently at the lowest cost. To reassure the environmental and business communities, and to minimize environmental impacts and costs over the long run, the ideal solution would be for Maine and the region to limit the costs and scope of such incremental transmission by comprehensive advance planning, including pre-designating the offshore zones in which such projects will be subsidized. Without an overarching plan, lead lines and transmission may develop project by project, willy-nilly, lacing Maine in a web of incremental lines and forfeiting the economies of scale possible by sizing lines for reasonably likely future expansion. Advanced planning would help address "chicken and egg" dilemma: energy developers are hesitant to build new plants until transmission lines are in place, but transmission companies will not build until they know there will be a steady supply of energy. An overarching and pro-active comprehensive plan incorporating the amounts of power sought, its location, and supporting development of the necessary infrastructure, would be the ideal solution to this dilemma, as demonstrated by Texas, which is among the nation's wind development leaders (see below).

[98] Personal communication (email). Lisa Martin, Bangor Hydro Electric to Beth Nagusky, Department of Environmental Protection. February 23, 2009.

[99] Joint Coordinated System Plan (2008); http://www.jcspstudy.org (accessed 12.15.09)

The Task Force realizes that the State currently does not have the resources to engage in this exercise. The Task Force has recommended[100] that the State seek resources to develop a Coastal Atlas to help ensure that public and private decision making on appropriate locations for offshore energy development is based on the best available information. In time, if the significant financial and technical resources needed became available, this initiative could be expanded, with provision for stakeholder involvement, to include designation of areas that are well or ill-suited to ocean energy development.

Upfront planning for transmission and distribution capacity increases is of paramount importance, and the Task Force is recommending that the Public Utilities Commission, the Office of Energy Independence and Security, and the Public Advocate engage experts to develop a long range plan for the State's transmission and distribution system to accommodate state wind and tidal energy development goals , as well as to meet any goals adopted to electrify home heating and transportation. The plan should estimate the amount and cost of incremental transmission and distribution capacity needed to achieve these goals. State agencies should cooperate with the ISO-NE, North American Electricity Reliability Council, and other organizations to develop these estimates.

Utilities today generally size their transmission and distribution systems to meet current load and projected demand. However, utility regulators have been reluctant to approve capacity increases even where there is a strong likelihood that those capacity additions will be needed to meet the growth in wind power development called for by state wind power goals. The Task Force believes that the utilities should be encouraged to increase the capacity of their transmission and distribution infrastructure over the next two decades to help the State achieve its on and offshore wind power goals by 2030, particularly where building today for tomorrow's reasonably anticipated increases in generation will reduce costs to ratepayers over the long term. As noted above, proactive planning to identify on and offshore energy development areas and transmission corridors could lower the costs of such new or expanded lines.

Notwithstanding some key differences in circumstances, Maine and the Northeast region can look to Texas, which has quickly catapulted to being a national leader in the development of wind power, for transmission policy-related ideas. Texas operates its own, single-state transmission system, which is the size of the Northeast's, and provides impressive incentives for wind power development that are clearly working. Texas's public utilities commission has approved development of new transmission infrastructure that will enable eleven gigawatts of new wind resources to go on-line. Texas has established renewable energy zones and provided subsidies for development of wind in those zones, including property tax concessions and production tax credits. The costs of generator lead lines are paid by ratepayers, in contrast to how they are treated in Maine and the rest of New England.[101]

[100] See Section VI, Part 2(A)

[101] Under changes in law restructuring electric utilities, generator leads are a generation cost that is paid for by the developer.

The need to cover generator lead line costs plainly disadvantages development of wind power in relatively remote offshore (or onshore) locations as compared to a new combined cycle gas plant, for example, which can locate near transmission. Furthermore, as noted previously offshore and wind faces transmission related technical and cost challenges. The cost of underwater cables linking the generation platform to the shore-side transmission system can run into the millions of dollars per mile, depending largely on bottom conditions. The use of AC lines is limited by distance, and the cost of DC transmission lines must include the cost of converter stations.

Incorporating the costs of generator leads into transmission and distribution rates can be a wise investment, as the addition of renewable generation can displace generation from higher priced fossil units and lead to reduced electricity prices. A 2006 Texas study concludes that an investment of $4.9 billion in new transmission would save Texas ratepayers $1.7 billion annually in fuel costs, thereby paying for the new transmission in less than 3 years.[102] A separate study for Kansas, Oklahoma and Texas reached a similar conclusion.[103]

To the extent generator lead lines are subject to Federal Energy Regulatory Commission jurisdiction, the State should advocate for changes in cost recovery policy at the regional and federal levels. To further encourage such lead line and incremental transmission development, the State, through the Governor, Office of Public Advocate, Office of Energy Independence and Security, and Public Utilities Commission, should also advocate for federal treatment for incremental transmission capacity related to wind energy equivalent to that Federal Energy Regulatory Commission and Congress authorized for the Midwest "Green Transmission Superhighway," a proposal to bring wind from the Great Plains to eastern markets. This treatment includes use of federal eminent domain authority, and financial and other incentives.

Even in the absence of socialization of the costs of lead lines, Maine can help by making available leaseholds on state-owned lands at discounted rates for rights of ways for transmission infrastructure, including public highways and submerged lands.

The Task Force recommendations help address the high cost of renewable ocean energy by "socializing" the costs of both lead lines and incremental transmission across New England consumers. Adopting such a policy would require a change in current ISO-NE rules. If New England wants an industrial policy to favor its own generation over imports from the Midwest via the "green superhighway," it must act as a unified region. Maine officials should do all they can to frame, articulate, and implement such a policy.

Serious attention is being paid to transmission policy at the federal, regional, and state levels. However, at times individual states have engaged in battles over issues such as transmission siting and permitting, construction, and cost allocation. New England must do a better job of acting

[102] Electric Reliability Council of Texas (ERCOT) Competitive Renewable Energy Zones (CREZ) Transmission Optimization Study (April 2008).

[103] This study projected that a $400 to $500 million per year transmission investment would yield $1 billion in reduced electricity costs annually, and an additional $1 billion in CO_2 reductions, increased property taxes and other wind-related economic activity. Charles River Associates Study, First Two Loops of Southwest Power Pool Extra High Voltage Overlay Transmission Expansion: Analysis of Benefits and Costs (September 26, 2008)

collectively so Maine and the region can move forward with the development of indigenous renewable energy resources on a massive scale. On-going efforts by the Governor and his Office, Public Utilities Commission, and the Office of Energy Independence and Security must continue.

At a minimum, New England's leaders should insist that the federal government address our region's transmission-related interests on par with the multi-state and enormously costly Midwest transmission corridor proposal intended to bring wind power from the Dakotas to major East Coast cities. On April 4, 2009, Federal Energy Regulatory Commission approved a 12.38 percent return on investment in a "green superhighway" calling for a 3,000-mile, high voltage, 765 kilovolt line with a 12,000 megawatts capacity and a cost of $10-12 billion, despite that fact the proposal had not been submitted to any of the states along the route."[104]

A Smarter Grid

Smart grid [105] upgrades are needed to successfully integrate significant new renewable energy resources into the bulk power system. Such upgrades are needed to help balance the generation of significant amounts of intermittent wind and tidal power with electric load and to help move toward electrification of home heating and transportation. Consumers should also be given price signals that encourage use of these resources when they are generating.

According to Federal Energy Regulatory Commission Chairman Jon Wellinghof:

> A 'smarter' bulk power system, and the generation and demand resources associated with it, will operate more securely, reliably and efficiently. Improved monitoring of the electric system with real time information from advanced sensors, and the enhanced ability to process information and coordinate actions of millions of devices and systems in real time, will allow system operators to optimize system reliability and reduce grid costs and congestion. The Smart Grid will also play a critical role in the integration of new renewable resources and will be vital to enable advanced technologies, such as plug-in electric vehicles with 'vehicle to grid' capabilities.[106]

Smart grid advantages can include:

i) Higher levels of efficiency and demand response;
ii) Reduction in the amount of incremental transmission required;

---

[104] "Energy Industry Updates", Foley & Lardner LLP Publications, April 30, 2009.

[105] "Smart Grid" is a much-used but seldom-defined term. We use it to include: 1) Development of relevant principles for planning and system development; 2) Pricing for demand response programs, among other attributes; 3) Cost/benefit evaluations of potential upgrades; 4) Interconnection and standards for equipment; 5) Data storage, collection and dissemination protocols; and 6) Access by grid participants to Smart Grid functionalities.

[106] Statement re Proposed Policy Statement and Action Plan Dkt. #PL09-04-000, Federal Energy Regulatory Commission Chairman Jon Wellinghoff, March 19,2009.

iii) Facilitating off-peak usage, for example by technologies favorable to wind consumption, such as plug in vehicles and home heating through ground pumps and thermal storage;
iv) Giving customers more control over energy bills and allowing their participation in the energy market through time of use pricing;
v) System integration and efficiency;
vi) Stimulus funding eligibility through the U.S. Department of Energy's Smart Grid Investment Grant Program, such as the $96 million Central Maine Power recently received for advanced meters;
vii) Identification of elements which would be particularly helpful to the use of wind and other intermittent power sources.

To advance usage of Maine's renewable energy resources to reduce the use of fossil fuels not only for lights and computers, but also for home heating and transportation, the Task Force is recommending that the Legislature direct the Public Utilities Commission to undertake a proceeding to explore mechanisms needed to achieve the State's wind power and electrification goals, including: rate design structures that encourage use of intermittent resources; changes to standard offer pricing to include off peak time of use energy prices; the penetration of time of use meters; long term needs for a smart grid to enable usage and storage of energy from intermittent renewable resources; and, any other mechanism to help Maine achieve its goals to increase the use of renewable resources and reduce the use of fossil fuels.

While the elements of a smart grid may seem complex and exotic, Maine can rely on experience from the Federal Energy Regulatory Commission, ISO-NE, and other expert sources for precedent to guide policy development. The work done to date by Bangor Hydroelectric to install "smart" meters and the recent major federal stimulus funding for installation of "smart" meters in the Central Maine Power territory are evidence that significant progress is being made on this front that will favorably influence Maine's ability to integrate wind into its system.

Request for Proposals and Long Term Contract with Ocean Energy Projects combined with Heating Conversion Program

New Jersey, Delaware, and Rhode Island have all signed contracts with developers of offshore wind projects.[107] The Task Force believes that Maine should begin to "test the waters" by issuing a Request for Proposals aimed specifically at commercially viable renewable ocean energy projects. This will help position Maine to better understand and overcome the hurdles that will be associated with development of its ocean energy resources, such as siting, permitting, and interaction with federal agencies.

The Task Force notes that this Request for Proposals process is distinct from the on-going state effort to identify up to five offshore wind energy test areas in state waters. Because they are ineligible for the 60-day Department of Environmental Protection general permit for a demonstration project, a commercial-scale project selected through the Request for Proposals process would need to obtain all pertinent federal, state, and potentially local permit or other

[107] See Appendix 7

approvals and provide for public notice and comment as required under applicable review procedures.

The Task Force recommends that the Legislature direct the Public Utilities Commission to issue a Request for Proposals for renewable ocean energy projects,[108] and that it direct a transmission and distribution utility to sign a long term contract (which should include the purchase of energy, capacity, and renewable energy credits) with a project if the rate impact is determined to be reasonable.

Given the economics of offshore wind and tidal projects today, Maine needs to think creatively about how to finance them without having an unreasonable rate impact. The Task Force has designed a conceptual program that couples Maine's renewable ocean energy goals with its goals to reduce reliance on fossil fuels, which as outlined above present serious price-related risks to Maine homeowner and businesses.

It is possible to combine the State's renewable energy goals and its goal to reduce dependence on fossil fuels and greenhouse gas emissions. The essence of the home heating electrification program described in more detail in Appendix 3 would be to convert Maine homes from oil heat to more efficient heating sources that rely on electricity (e.g., heat pumps), or that use off peak power, preferably power generated from renewable resources (e.g., thermal energy storage). Either would help to reduce energy bills and carbon emissions significantly, as well as using large quantities of off peak wind energy. The Task Force recommends that the State establish programs and goals to expedite the process of electrifying homes and businesses.

The home heating electrification program described in Appendix 3 would provide an on-bill financing mechanism to Maine ratepayers who weatherize their homes and convert to a more efficient electric heat source. The tariff could be designed to help subsidize the above-market costs of the renewable ocean energy project. The above market costs not covered by these customers could be rolled into the transmission and distribution or energy prices of remaining customers.

The Task Force believes that the rate impacts of any contracts with ocean energy developers must be reasonable. The Governor and Legislature should play a key role in defining what is reasonable in light of goals to advance development of the State's renewable ocean energy resources. The Task Force recognizes that this will be a balancing exercise. On the one hand, Maine's electric rates are among the highest in the country, which undermines its competitive position and standard of living. At the same time, some rate impact may be necessary to promote development of Maine's offshore wind and tidal power industry, to reduce our fossil fuel dependence and greenhouse gas emissions, and to increase energy independence by taking advantage of one of our greatest untapped natural resources. On balance, the Task Force believes that the rate impact should be no greater than the current system benefit charge, which is approximately $0.0015 per kilowatt hour, and adds less than one dollar to the average residential monthly utility bill.

[108] This can be done through an amendment to Maine's existing long term contracting statute (35-A M.R.S. § 3210-C) directing the commission to conduct a competitive solicitation specifically for renewable ocean energy projects.

C. Regulatory challenges

1. Governance framework

As outlined in previous studies of the governance framework[109], proposed development in the marine environment in Maine and elsewhere in the United States faces a complex array of federal, state, and local environmental and natural resources reviews and the obligation to obtain approvals from multiple governmental agencies.[110] Proposed development of renewable ocean energy resources is no exception.[111]

Notwithstanding the important underlying natural resources protection and management objectives of the web of laws of which it is comprised, the Task Force notes that the existing governance framework has significant potential for imposition of major and potentially unpredictable project-development costs. Such potential costs include studies and analyses required to demonstrate compliance, delays associated with multiple, complex administrative procedures, project design changes, and compensation and mitigations measures required as conditions of regulatory approval. No less significant are the cost and timing-related uncertainties inherent in such a multi-faceted regulatory regime. The Task Force anticipates that such uncertainty could be a significant deterrent to investment in offshore renewable energy ventures. Accordingly, the Task Force believes that the existing governance framework needs to be streamlined while ensuring regulatory and submerged lands management authority to identify and address natural resources issues including potential conflicts with existing uses and to secure appropriate compensation to the public for use of submerged lands. Key issues to be addressed include:

- Mechanisms for optimal coordination among federal and state review authorities;
- Jurisdictional provisions, review, and appeal procedures, and approval criteria in key state environmental laws, such as the Site Location of Development Act and Natural Resources Protection Act, that ensure their applicability and utility in addressing natural resources issues that offshore wind projects may present, in a manner consistent to the extent practicable with that for land-based wind;

---

[109] *America's Living Oceans: Charting a Course for Sea Change (Pew Oceans Commission*, May 2003, http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Protecting_ocean_life/env_pew_oceans_final_report.pdf (accessed 12.15.09); and *An Ocean Blueprint for the 21st Century: Final Report of the U.S. Commission on Ocean Policy* - http://oceancommission.gov/documents/full_color_rpt/welcome.html (12.15.09)

[110] In order to enhance the Task Force's understanding of and opportunities for targeted improvements to the governance framework, Maine State Planning Office contracted with Jeffrey Pidot, former head of the Maine Attorney General Office's natural resources division, to provide an objective assessment of Maine's pertinent regulatory and proprietary (submerged lands leasing) authorities, including options to facilitate siting of offshore wind projects while maintaining the integrity of state review procedures. Mr. Pidot's research, focused in particular on approaches to submerged lands leasing in light of Public Trust Doctrine and related public interest considerations, offers a more detailed discussion and of topics addressed in this section.

[111] Appendix 11 provides a summary of the primary regulatory reviews and related federal, state, and local environmental approvals that may be required for wind, tidal or wave energy development in Maine's coastal waters or adjoining federal Outer Continental Shelf areas.

- Recognition of the compatibility of Public Trust Doctrine principles and use of public submerged lands for development of renewable ocean energy resources;
- Provisions of the state submerged lands leasing program, including commercially reasonable lease fees that ensure public benefit, as applied to renewable ocean energy projects;
- Nature and scope of municipalities' decision making role regarding renewable ocean energy projects that use state-owned submerged lands;
- Assurance of federal review agencies' participation in implementing the federal-state Memorandum of Understanding on review of tidal power projects; and
- Clarification of the Department of Environmental Protection's authority over wave energy projects.

Paragraphs a through c, below, outline and address Maine governance framework-related challenges to all types of ocean energy development posed by submerged lands leasing and potential municipal regulatory requirements. Sections d and e focus on issues specific to offshore wind, and tidal and wave power, respectively.

a. Federal-State coordination

The current federal regulatory framework poses formidable barriers to development of ocean energy resources. Multiple federal agencies have review, permitting, or leasing obligations. There is no single federal agency responsible for coordinating or harmonizing federal agencies' review of development proposals. Although President Obama's administration has clearly made satisfaction of 20 percent of our nation's electricity demand with wind power by 2030 a national goal, federal agencies' review and permitting authorities and practices have not been aligned with this important objective. Indeed, there is no single federal ocean policy to unify, guide, or reconcile their actions.

The Task Force believes that current federal law and policy are among the primary obstacles to the efficient growth and expansion of the ocean energy industry and must be refined and improved to streamline siting and development of ocean energy in appropriate locations. Accordingly, the Task Force believes it is critical for the State, in consultation with Maine's congressional delegation, to take an active role in regional and national efforts to fashion a unified federal ocean policy that facilitates development of appropriately-sited ocean energy projects. In the immediate term, close collaboration with federal agencies is critical to ensure that existing opportunities to streamline and harmonize federal and state review procedures are identified and implemented.

Federal regulatory requirements apply to projects both in state waters and on the federal Outer Continental Shelf.[112] Compliance with the National Environmental Policy Act, for example, which obligates federal agencies to prepare an environmental assessment or in some cases a more extensive environmental impact statement in connection with a proposed federal permitting, leasing, or other authorization action, may generate significant project costs, in some cases costs that developers of non-renewable projects in coastal waters do not incur. Notably, Minerals Management Service's

[112] See Appendix 13

alternative energy leasing rules specify that developers of offshore wind projects must pay the costs of National Environmental Policy Act compliance documentation and associated studies, while Minerals Management Service itself incurs such costs for oil and gas leasing and plans.[113] Faced with ocean energy projects new to our region, federal resource agencies may request pre-construction field studies to gauge potential environmental adverse effects for purposes of National Environmental Policy Act or required federal environmental reviews or approvals. The U.S. Fish and Wildlife Service, for example, has indicated that it may request three years of pre-construction bird migration-related studies even for a small-scale wind energy testing and demonstration project.[114] This significant federal role in offshore energy siting creates potential not only for cost, complexity, and delay associated with federal reviews and approvals themselves but also potential for conflict or duplication in relation to the state regulatory framework. The Task Force believes a concerted effort to improve federal-state consultation regarding regulatory review of ocean energy development is needed to avoid and minimize these potential pitfalls.

The State's decision making role, other than that provided by the federal Coastal Zone Management Act (see below) regarding permitting and leasing is limited to projects proposed for siting within the three-mile limit of state jurisdiction. Section 307 of the Coastal Zone Management Act, the so-called "federal consistency" provision, provides Maine, like other states with a federally approved coastal zone management program, authority to review federal actions for consistency with the "enforceable policies" of its program. In Maine, select state environmental laws, including the Site Law and Natural Resources Protection Act, provide the enforceable policies. Maine has integrated Coastal Zone Management Act consistency review into the process for state environmental permit review of ocean energy and other projects within the State's boundaries. The Coastal Zone Management Act also provides a means for exercise of a state's federal consistency review authority over projects outside its territorial limits on the federal Outer Continental Shelf. The Task Force believes that this federal consistency authority may and should be exercised judiciously to address significant impacts on state coastal resources or uses while avoiding placement of an additional hurdle in front of offshore energy development.

b. Submerged lands management and the Public Trust Doctrine

Since ocean energy development takes place on publicly owned submerged lands, a developer must obtain a lease or easement from the State for project activities within the three-mile limit of state jurisdiction or from the federal government for project activities located seaward of the three-mile limit on the Outer Continental Shelf. An ocean energy project on the Outer Continental Shelf may require lease or easement approval from both the state and the federal government in the case of project with generation facilities, offshore wind turbines, for example, located on the Outer Continental Shelf and a transmission cable bringing power over state submerged lands to connect with the power grid on land.

[113] 74 FR at 19689 (Alternative Energy/National Environmental Policy Act compliance for Plans).

[114] Letter of August 4, 2009, Lori Nordstrum (USFWS) to Matt Nixon (SPO).

The Submerged Lands Division with the Department of Conservation's Bureau of Parks and Lands is responsible for considering applications for leasing Maine's submerged lands.[115] State law prescribing the Bureau of Parks and Land's leasing authority does not specify that offshore wind power or other ocean energy development is a type of "water-dependent use" afforded a preference under that law.

The Minerals Management Service in the U.S. Department of Interior is responsible for leasing lands on the Outer Continental Shelf for renewable ocean energy development as well as oil and gas exploration and development. Minerals Management Service recently completed rulemaking to adopt specific standards, procedures, and energy generation-related lease fees for issuance of federal Outer Continental Shelf lease for offshore wind and other alternative ocean energy development.[116]. Minerals Management Service has not yet issued a lease for a commercial project under this new program. However, the Task Force is concerned that Minerals Management Service's lease process is lengthy, complex, and inherently and unnecessarily risky for developers. For example, the program does not give a developer any assurance of rights to a site after it has spent considerable funds on a test project to determine whether the site is viable for full commercial development.

Unlike the Minerals Management Service, the Bureau of Parks and Lands does not currently have lease approval or lease fee criteria specifically tailored to ocean energy development. Recent amendment of the Bureau of Parks and Lands' authority to allow it to negotiate appropriate lease fee terms for "offshore projects" on a case by case basis does not cover offshore wind or other renewable ocean energy development.[117]

Submerged lands leasing decisions are made subject to the common law Public Trust Doctrine. This doctrine provides in effect that the State (or federal government regarding Outer Continental Shelf areas) holds submerged lands in trust for the public and is responsible as trustee for ensuring that a lease or easement authorizing private use of submerged lands provides commensurate public benefit. Offshore wind power development is a new, emerging use of the ocean environment which hosts multiple traditional uses, including fishing and navigation, recognized under the Public Trust Doctrine as appropriate uses of submerged lands areas.

The Task Force recognizes that, notwithstanding offshore wind energy development's overall climate change-related environmental benefits, it is appropriate to clarify the consistency of this important new use with Public Trust Doctrine principles, including those that may favor use of submerged lands for "water-dependent" uses, and thus with other established Public Trust uses. In addition, the Task Force believes that establishment of a commercially reasonable fee schedule for offshore wind and other renewable ocean energy development is an important step to adding certainty and predictability to Maine's ocean energy governance framework. The Task Force further believes that development of such a fee schedule for commercial-scale development merits more detailed consideration through rulemaking pursuant to clear legislative direction that ensures fair

[115] 12 M.R.S. §1862

[116] 30 C.F.R. Part 285

[117] P.L. 2009 c. 316, sections 3 and 4

value to the public in return for use of state submerged lands without providing an economic disincentive for investment.

c. Ambiguity regarding municipalities' marine boundaries

The potential for ambiguity regarding a proposed ocean energy project's location in relation to municipal boundaries creates further uncertainty and complexity. Maine has 138 municipalities located on coastal waters. In Maine, as in many jurisdictions, municipal boundaries are established by legislative charter. The Legislature adopted and has amended these charters at various times. Although detailed analysis of these many municipal charters has not been done,[118] experience of and other agencies which have worked directly with them in administering state programs have noted imprecision and inconsistencies in their language regarding ocean boundaries (seaward extent and lateral boundary with neighboring municipality(ies)). Because the Department of Environmental Protection's jurisdiction applies to a project located within the boundaries of a municipality (State's organized areas), with the Land Use Regulation Commission exercising jurisdiction over a project in the unorganized areas of the State, this ambiguity needs to be addressed to clarify the ocean energy projects' regulatory obligations.

d. Permitting offshore wind energy development

Although it appears any offshore wind development subject to the Department of Environmental Protection's jurisdiction would require a Natural Resources Protection Act permit due to its location on a "coastal wetland,"[119] it is unclear how the Department of Environmental Protection would calculate the project footprint as needed to determine the applicability of the Site Location of Development Act (Site Law), a state law that is generally applicable to larger scale development and affords a vehicle for assessment of a wide range of potential impacts.[120] Also unclear is the applicability of certain Site Law approval criteria, which were generally developed and focused to address land-side development, to ocean-based offshore wind development. The Task Force notes, in addition, that the Site Law's provisions to facilitate land-based, grid-scale wind energy development, including those regarding assessment of potential scenic effects and administrative review and appeal, do not apply to comparable development below the mean high tide line.[121]

The Task Force believes that offshore wind energy development, in light of its greater potential for environmental, renewable energy, and other public benefits recognized by the Legislature in enacting changes to facilitate land-based wind development, merits consideration using the same administrative and judicial review procedures as grid-scale land-based wind development. Moreover, to ensure adequate review and identification of measures to address potential adverse effects on natural resources and communities that may differ from those associated with land-based wind, the Task Force thinks the Department of Environmental Protection should review wind power-related

[118] As an initial step, at the Maine State Planning Office's request, the Law and Legislative Reference Library compiled these charters.

[119] 38 M.R.S. §480-B(2)

[120] 38 M.R.S. §482(2)

[121] 35-A M.R.S. §3451(3)(A)

Site Law and Natural Resources Protection Act criteria and related study, monitoring, and other review protocols and develop offshore wind-specific rules and policy as needed. The Task Force also believes the Land Use Regulation Commission should similarly assess and revise its approval criteria applicable to the type of community-scale project over which the Task Force recommends the Land Use Regulation Commission have jurisdiction. See Section VI, Part 5, below.

e. Permitting tidal and wave power development

i. Tidal power

Development of Maine's tidal power resources involves use of new technologies in the State's biologically rich and diverse, and often heavily and variously used, coastal waters about which federal and state regulators may lack basic information, such as species' presence or abundance, directly related to regulatory review and approval requirements. These circumstances, coupled with the complex framework of local, state, and federal regulation applicable in the marine environment, present a number of regulatory challenges to this emerging Maine industry.

Both tidal power and wave power development are forms of "hydropower development" subject to regulation under Maine's Water Development and Conservation Act.[122] The Maine Water Development and Conservation Act provides a vehicle for consolidation of state permitting, water quality certification, and Coastal Zone Management Act consistency review authorizations.

The potential benefits of this consolidated state review were enhanced by the recently formed Memorandum of Understanding among the Federal Energy Regulatory Commission and Maine agencies (Appendix 12) that coordinates the Department of Environmental Protection and Federal Energy Regulatory Commission review and decision making regarding hydrokinetic tidal power development, including development eligible for review under the Federal Energy Regulatory Commission's pilot project license process.[123] Recent changes in Maine law[124] closely coordinate state permitting and submerged lands permitting processes with this innovative Federal Energy Regulatory Commission process for permitting pilot projects. The Memorandum of Understanding further details how the Federal Energy Regulatory Commission and the State will coordinate their project review efforts.

[122] 38 M.R.S. §632(3)

[123] In April, 2008, in recognition of the commercialization potential nationwide of hydrokinetic technologies and their role in helping the United States create a new source of domestically produced renewable energy, Federal Energy Regulatory Commission developed it hydrokinetic pilot project license process to advance testing of new technology while minimizing the potential for environmental impacts. The goal of the process is to allow developers to test and evaluate new hydrokinetic technologies and determine environmental effects of the technologies, while maintaining Federal Energy Regulatory Commission oversight and agency input. Federal Energy Regulatory Commission developed guidelines to provide that licenses could be granted within six months to allow for project installation, operation, and environmental testing as soon as possible. Pilot projects must be temporary, limited in size, removable, and able to shut down on short notice, and license terms ensure environmental monitoring and safeguards during the short project term.

[124] P.L. 2009 c. 270

While significant steps have been taken to address tidal energy's regulatory challenges, the Task Force believes that developers continue to face the following significant obstacles, as further discussed below:

- Lack of baseline data and information needed to inform regulatory decisions;
- Lack of coordination and shared objectives among federal agencies regarding support of renewable ocean energy; and
- Lack of federal commitment to adaptive management for pilot projects.

The Task Force is aware that several marine hydrokinetic projects have been delayed in various regions of the United States due to lengthy environmental permitting requirements, particularly imposed by federal resource agencies. The Task Force believes that environmental permitting requirements, particularly pre-construction studies of existing conditions, should be commensurate with the scope and size of the pilot projects currently proposed and less demanding than those for a full-scale, commercial project.

At the root of this industry's regulatory challenges are significant gaps in the existing baseline information regarding Maine's coastal waters and related natural resources. Ocean Renewable Power Company representatives have commented to the Task Force that federal resources agencies have requested the company to undertake a costly and significant effort to collect and assess baseline environmental data in support of the Federal Energy Regulatory Commission's approval of its pilot project proposal. Ocean Renewable Power Company suggests that the information requested is comparable to baseline data required for full-scale, riverine hydropower project development, and that such an approach, at the pilot project stage, is fundamentally at odds with the technology development-oriented intent underlying the Federal Energy Regulatory Commission's pilot project license. Ocean Renewable Power Company emphasizes that the costs and time needed to meet such study requests may significantly slow or even stifle the development of new technologies due to start-up research and development companies' difficulties in financing such generalized studies of evolving technology. In addition, where more than one year of baseline studies is requested, the timeframe of the proposed studies may extend beyond the time deadlines of the Federal Energy Regulatory Commission licensing process and so undermine the pilot license's objective of getting technology in the water to test and assess its efficiency. Preparation of baseline studies, particularly in an area that has not been previously characterized by researchers, either with regard to physical site characteristics or marine populations, may present significant financial challenges for the State's fledgling tidal power industry.

The Task Force believes that Ocean Renewable Power Company's experience illustrates core challenges facing the industry. As stewards of marine waters and submerged lands, the state and federal government can and should play a more prominent role in conducting research and developing baseline information on site characteristics and marine populations. The Task Force is also aware that there are limited funds for such federal and state government sponsored research and that available research funds need to be prioritized. The Task Force notes that higher education institutions, such as the University of Maine, state agencies, and non-governmental organizations can play a vital role in acquiring baseline environmental information and knowledge.

In addition, the Task Force believes that adaptive management, particularly as applied to pilot projects, may afford a flexible, efficient, and effective tool to address problems presented by less than complete baseline information. Adaptive management may be used to ensure that project-related adverse effects are addressed if identified through well-designed post-construction monitoring.

The Task Force also suggests that its is vitally important to clarify federal policy to ensure that natural resources agencies, such as the U.S. Fish and Wildlife Service and National Marine Fisheries Service, have the authority, flexibility, and responsibility to share a common overall goal of supporting and facilitating the growth and development of in-stream tidal power and other renewable ocean energy resources. The National Ocean Council proposed in the interim report of the Council on Environmental Quality's Oceans Policy Task Force[125] may provide a suitable forum for development of this shared federal policy objective and for identification of specific initiatives and changes in federal agencies' policies, programs, and authorities needed ensure its meaningful implementation.

Section 2, below, discusses this regulatory challenge in more detail in the broader context of overall improvement of science-based information available for both public and private decision makers.

ii. Wave power

P.L. 2009 c. 270 addressed the state-permitting related issue of potentially ambiguous municipal boundaries by clarifying that the Department of Environmental Protection has exclusive permitting jurisdiction under the Maine Water Development and Conservation Act regarding tidal power development statewide, and that Land Use Regulation Commission rezoning and land use permitting are not required for such projects. In keeping with the joint suggestion of the Land Use Regulation Commission and Department of Environmental Protection, the Task Force thinks a comparable change to the Maine Water Development and Conservation Act regarding proposed wave energy development is an appropriate clarification.

2. Information on natural resources and related human uses to guide decision making

Lack of baseline information on key natural resources issues, such as migratory bird and bat migration routes and more localized feeding patterns, may exacerbate problems with the existing complex regulatory structure described above. As discussed in more detail below in relation to tidal power development, the lack of such information may trigger natural resources agencies' requests for costly and time-consuming field studies, at the applicant's expense, to provide information to assist agencies in making a threshold determination on whether there are resources or uses that may be impacted by the proposed development. Compounding problems created by the lack of available baseline information to guide agency comments and regulatory decisions is the lack of clear protocols for undertaking and assessing the results of studies that may be required.

[125] *Interim Report of the Interagency Ocean Policy Task Force* (CEQ, September 2009); http://www.whitehouse.gov/administration/eop/ceq/initiatives/oceans/interimreport (accessed 12.15.09)

Studies recently undertaken by the environmental consulting and engineering firm, Stantec, University of Maine, the U.S. Fish and Wildlife Service, and the not-for-profit BioDiversity Research Institute[126] to evaluate bat and birds movements off the coast of Maine provide examples of the type of basic research needed to fill voids on key natural resources questions tied to state and federal regulatory or leasing approval criteria. The pilot study begun this fall by Stantec, for example, is the first study of its kind on the Atlantic coast and its results are expected to provide some baseline data for the planning of offshore wind projects in the region and a basis for related research in other offshore areas.[127]

The Task Force's subcommittee 1 considered issues regarding information and protocols for assessment of potential adverse effects of ocean energy development on and conflicts with other natural resources values and related human uses of the marine environment. Working together, the University of Maine and state agencies have compiled a comprehensive data bibliography that lists available sources of siting-related information. Much of the subcommittee's work focused on assessment of the nature, scope, and availability of information for assessing and addressing project effects. The subcommittee's work also contributed significantly to the State's efforts to identify areas in state waters suitable for offshore wind energy demonstration projects pursuant to P.L. 2009 c. 270. In addition, the subcommittee explored in detail several natural resources issues, such as the availability of information to assess potential avian impacts.

Based on the subcommittee's review of potential impacts and pertinent information resources available to assess them in making siting decisions, the Task Force concludes that:

- *Information Gathering and Dissemination.* There is a great deal of information concerning the habitat, species, and existing uses in the Gulf of Maine. There is an even greater amount of information necessary to fill gaps in this information. Well-coordinated, comprehensive data gathering efforts must continue to add to current information about the ecosystem as a whole so public and private decision making is guided by the best available information.
- *Standing Technical Review Committees.* The Task Force has had the benefit of input from many experts in the fields of marine habitat, birds and bats, marine mammals, commercial and recreational fisheries, and other existing human uses of the marine environment. Maine should continue to seek to benefit from this expertise as efforts to develop the ocean's renewable energy resources continue by maintaining standing technical committees on birds and bats and marine mammals and fisheries, and ensuring an appropriate forum to consider human uses.
- *Adaptive Management.* The Gulf of Maine is a dynamic ecosystem that has great value environmentally, economically, and emotionally. Regulation and management of offshore renewable energy projects must take a precautionary approach and must be able to adapt to the best available data as it becomes available in order to minimize adverse impacts. This will require sustained monitoring of environmental impacts to identify and respond to unanticipated changes in the environment. Regulation must take into account not just the

[126] http://www.briloon.org/windpower/ (accessed 12.15.09)

[127] http://www.stantec.com/News.html (accessed 12.15.09)

construction and operation of offshore renewable energy projects but also cumulative impacts of such projects.

- *Avoidance, Minimization, and Compensation.* In developing offshore energy projects, applicants should seek to avoid any adverse impacts to habitat, existing uses (both human and non-human), and species using the effected resource. Applicants and regulatory agencies should ensure that any undue adverse impacts that cannot be reasonably avoided are minimized to the greatest extent possible. For any undue adverse impact that cannot be avoided and that has been minimized to the greatest extent possible, an applicant should provide, take, or fund appropriate measures that compensate for that impact.

The Task Force's recommendations regarding these conclusions are provided in Sections VI, Parts 2 and 5.

D. Multiple Use-Related Challenges

Maine's nearshore, coastal waters are home to multiple and in some places longstanding uses, including commercial fishing and water-based recreation, that are closely associated with communities' character, economic vitality, sense of place, and identity and values. Ocean energy development, particularly if proposed in in-shore areas, may initially be seen as potentially at odds with these community interests.

While the ocean industry as a whole faces challenges in addressing real as well as perceived use conflicts, these challenges may be particularly difficult for in-shore, shallow water wind energy development. Given the diverse and intensive use of the harbors, bays, and protected nearshore areas in Maine' coastal waters, and the high value of these areas for marine industry, tourism, recreation, sport and commercial fishing, and many other uses, as well as anticipatable economic and social concerns regarding long-term visual and noise impacts, the Task Force notes that developers should be encouraged to explore areas seaward of Maine's bays and headlands when evaluating offshore wind energy development opportunities.

Notwithstanding these challenges, the Task Force believes that there is significant potential for identification, management, and resolution of potential conflicts through early consultation and collaboration to the extent practicable. Constructive dialogue with marine stakeholders is vital to allaying or at a minimum accurately defining the nature and scope of potential use conflicts and economically viable options to address them. Shared understanding of the proposed technology and how and where it would be deployed and related cost considerations is critical. For example, it appears that the tidal power generation facilities under development by Ocean Renewable Power Company can and are anticipated to be deployed in high-energy areas not commonly used for lobstering and at depths that would not interfere with vessel passage. The State should strongly encourage and facilitate through guidance to prospective ocean energy developers an open and community-focused approach to development. While recognizing that a number of development-related costs may be expected to increase with a project's distance from shore, Ocean Renewable Power Company's approach to siting and design of its proposed tidal energy project in Eastport provides a useful example of such a community-based approach.

VI. RECOMMENDATIONS: FACILITATING DEVELOPMENT OF MAINE'S RENEWABLE OCEAN ENERGY-RELATED RESOURCES

The Task Force's recommendations reflect its detailed consideration of key issues regarding financing and economics, transmission and grid-management, potential effects of development on the environment and related human uses, permitting, leasing and related ocean governance, and other related matters. The Task Force believes that the following integrated package of recommendations provides a strategy for facilitating development of Maine's significant offshore wind, tidal, wave, and potentially other renewable ocean energy resources:

❖ *Part One: Setting an Appropriate State Goal for Offshore Wind Energy Development*

Amend the Maine Wind Energy Act[128] to set a goal of installation of five gigawatts of offshore wind energy generating capacity in Maine's coastal waters and adjoining federal waters by 2030.

---

[128] The Maine Wind Energy Act, 35-A M.R.S. §3404(2)(B), establishes the following goal:

"At least 3,000 megawatts of installed capacity by 2020, of which there is a potential to produce 300 megawatts from generation facilities located in coastal waters, as defined by Title 12, section 6001, subsection 6, or in proximate federal waters."

This statutory goal is based on the recommendation of the Governor's Wind Power Task Force ("WPTF"), which "considered the issue of wind power goals for Maine within the larger context of New England's electrical generation system and Maine's energy and greenhouse gas reduction policies." Report of the WPTF, *supra*, at 12. The WPTF based this goal in part on detailed modeling analysis prepared by a consultant team led by Bob Grace of Sustainable Energy Advantage. That analysis "concluded that approximately 11,000 megawatts of wind power would be needed in New England in order to meet our 2020 greenhouse gas reduction goal, even assuming a major increase in energy efficiency across the region, substantial development of other renewable energy sources (including solar and tidal), and significant contributions in greenhouse gas reductions from transportation and other sources." *Id.*, at 12-13. This analysis noted that "the potential for offshore wind power development is also very large, yet the costs of offshore wind power remain high, particularly so in the near-term for deep tidal zones along Maine's coast." *Id.*

In presenting his analysis to the WPTF, Mr. Grace explained that his assessment of the potential contribution of offshore wind to the above-noted state wind energy goal, among other assumptions, excluded development potential beyond 20 nautical miles of shore and in deep water and that the area in which development potential was estimated was reduced to 12.5% of total area identified to reflect conservative estimate of feasible development (consistent with analysis done for RGGI)." *Development of a Wind Power Resource Deployment Framework for Maine & New England,* Bob Grace, Sustainable Energy Advantage, LLC October 30, 2007; presentation to WPTF - http://www.maine.gov/doc/mfs/windpower/meeting_summaries/103007_summary_files/Grace_Wind_Task_Force_103007.pdf

In sum, the Task Force concludes that the goal of 300megawattsof installed ocean wind capacity by 2020, while potentially appropriate for shallow-water wind development using existing technologies does not (nor was intended) to account for and reflect the enormity of the deep-water wind development potential, particularly in federal OCS areas adjoining state waters.

Given the central importance and potential of offshore wind resources to help Maine achieve energy independence and reduce greenhouse gas emissions the Task Force believes that the Legislature's establishment of this goal is appropriate and necessary to guide and benchmark state efforts in the renewable ocean energy field. As outlined above, achievement of this goal has the potential to enable Maine to meet the full range of state energy needs, including home heating and transportation, from renewable ocean energy and is consistent with Maine's contribution, as a national wind energy leader, to the national goal of 20 percent wind power by 2030. The Task Force realizes that achievement of this extraordinary goal will require the strong support of public funders, private investors, and the people of Maine, as well as technological advances to achieve costs that are competitive with other energy sources, the development of new end use markets, and the construction of major new transmission and smart grid infrastructure.

❖ *Part Two: Improving the Governance Framework for Renewable Ocean Energy Development*

The Task Force has determined that the existing governance framework in Maine needs improvement to facilitate orderly, efficient, and timely consideration of offshore wind energy, tidal power, wave, and potentially other renewable ocean energy proposals that are important to Maine's future and necessitate use of publicly-owned submerged lands areas. Recommendations in this part address challenges common to renewable ocean energy development proposals. Parts 5, 6, and 7 address offshore wind energy, tidal, and wave power issues, respectively.

A. Making the Best Available and Continually Improving Information Available to Public and Private Decision Makers

The Task Force believes that assurance of a shared understanding of the best available information on natural resources and related human uses in the marine environment is vitally important to efficient and appropriate siting of renewable ocean energy development and optimizing public and private efforts to avoid, minimize, and compensate as appropriate for potential adverse effects on natural resources and related human uses. The Task Force recommends that the following efforts be undertaken concurrently with (not as a precursor to) implementation of proposed changes in state permitting and leasing laws and rules:

1. The Maine State Planning Office, in conjunction with the Department of Conservation/ Bureau of Parks and Lands, the Department of Marine Resources, and the University of Maine System, coordinate development, publication and maintenance of the following, as detailed, non-regulatory guidance:

    a. An on-line Coastal Atlas that provides a map-based, user-friendly information resource to facilitate public (leasing and permitting) and private (site selection and investment) decision makers' use of the best available information regarding planning for and siting of offshore commercial wind energy development and other matters;

b. On-line information, developed in consultation with the Department of Environmental Protection, the U.S. Army Corps of Engineers and state and federal natural resources agencies, on:

   i) Characteristics, such as presence of endangered species, location of shipping lanes, concentrations of commercial fishing activity or stocks, that may present difficult regulatory issues under applicable state and federal wind energy laws; and

   ii) Studies of existing conditions that may be required to provide information needed for requisite federal and state reviews and approvals and identification of options for collaboration with higher educational institutions, state or federal agencies, non-governmental organizations, and others in acquiring such baseline environmental information.

   In designing this resource, focused on Maine's coastal waters, the agencies should build on pertinent current efforts (including those of the University of Maine and the Task Force itself) and consider options to address the information needs identified in the "Data and Information Needs Assessment" found in Appendix P of the State's January 2007 Bay Management study.[129] Funding to support this effort should come from the following state sources: project-specific federal funding; (over time) a portion of submerged lands leasing fee for offshore wind or other development utilizing state submerged lands for energy transmission or generation; and a portion of state share of Outer Continental Shelf alternative energy development related revenue.

2. The Governor should work with Maine's congressional delegation to secure an appropriation needed to undertake the above-described Coastal Atlas-related work in coordination with related regional and national marine spatial planning efforts, including those of the Northeast Regional Ocean Council.

The Task Force notes that the Coastal Atlas may, in time, serve as a map-based (Geographical Information System) tool to inform ocean management planning efforts aimed at identifying and mapping areas well-suited or unsuited to commercial offshore wind energy development due to the potential for significant adverse effects on or conflicts with natural resources or related existing human uses. The Task Force believes that such an effort is impracticable in Maine at this time due to its scope, scale, and related costs if directed at Maine's extensive coastline and adjoining federal waters and uncertainties regarding technologies that may be deployed.

B. Coordinating Federal-State Decision Making

As emphasized in its report, the Task Force considers improved federal-state coordination on natural resources planning for and environmental review of proposed ocean energy projects essential

[129] Managing Maine's Nearshore Coastal Resources: Report of the Bay Management Study (Maine State Planning Office/Department of Marine Resources, January 2007) http://www.maine.gov/dmr/baystudy/finalrpt/index.htm (accessed 12.15.09)

to the timely and efficient growth of the renewable ocean energy industry. The following recommendations, along with recommendations on coordination of federal and state permitting, below, are aimed at such improvement:

1. The Governor and Maine's congressional delegation should work together to urge that the White House Office of Energy and Climate Change Policy, working with the Council on Environmental Quality-led Oceans Policy Committee, or other appropriate senior-level management coordination groups, develop and implement changes needed in federal law and policy to ensure that federal agencies coordinate effectively and efficiently among themselves and with coastal states to tailor environmental review, including that required under the National Environmental Policy Act, to the size and scope of the project under review and to streamline environmental review, leasing, and other siting-related decisions regarding renewable ocean energy projects, including offshore wind energy and pilot and commercial scale marine hydrokinetic development.

2. The Maine State Planning Office, in consultation with the Governor's Office, should work with the Minerals Management Service to establish a federal-state task force or other mutually-agreeable mechanism to ensure optimal federal-state coordination and consultation regarding siting and development of renewable ocean energy resources on federal Outer Continental Shelf areas proximate to Maine.

C. Encouraging Developers to Use "Best Practices" to Foster Constructive Dialogue with Potentially Effected Marine Stakeholders in Siting Renewable Ocean Energy Project

The Task Force believes that an open and community-focused approach to renewable ocean energy development that features collaboration with marine stakeholders should be strongly encouraged. Accordingly, the Task Force recommends that:

> Developers proposing to site renewable ocean energy development projects, particularly in nearshore areas in Maine's coastal waters, would be wise to explore opportunities for consultation and dialogue with communities and other stakeholders potentially effected by the proposed development as early in the development process as practicable and consider use of the "best practices" for stakeholder and public engagement developed by the National Coalition for Dialogue and Deliberation, which focus on collaboration, openness and information sharing, and respect for diverse viewpoints,[130] in planning and implementing public outreach efforts. The Task Force further recommends that the Department of Economic and Community Development, in its role as initial point of contact, provide these recommended "best practices" to prospective renewable ocean energy developers for their consideration.

[130] See Appendix 13 and http://www.thataway.org/?page_id=1442 (accessed 12.15.09)

D. Clarifying Consistency with Public Trust Doctrine Principles

The Task Force believes that facilitation of well-sited renewable ocean energy development is in the public interest and thus serves and is consistent with the State's obligations as trustee and steward of state submerged lands resources under the Public Trust Doctrine. Accordingly, the Task Force recommends the following:

1. As a foundation for submerged lands leasing and related permitting provisions recommended below, the Legislature make findings, tied to offshore wind and tidal energy generation goals, that:

    a. Maine's coastal waters and submerged lands provide unique and valuable opportunities for development of wind, tidal, and potentially other indigenous, renewable ocean energy resources, such as wave power;

    b. Concerns regarding climate change and related degradation or loss of marine resources and related human uses make development of and transition to use of renewable ocean energy resources consistent with sound stewardship of trust resources; and

    c. With provision for avoidance, minimization, and compensation for harms to existing public trust-related uses and resources, such as fishing and navigation; restoration of effected lands upon completion of authorized uses pursuant to permitting criteria; and adequate compensation to the public for use of its trust resources pursuant to state submerged lands leasing criteria, development of these renewable ocean energy resources in appropriate locations promises significant trust-related benefits to Maine people for whom the State holds and manages submerged lands and their resources.

2. Amend the Bureau of Parks and Lands' leasing statute (12 M.R.S. §1862) to specify that, as per Public Trust Doctrine-related legislative findings outlined above, the Bureau of Parks and Lands may lease state submerged lands to facilitate development of renewable ocean energy resources and direct the Bureau of Parks and Lands to amend its rules accordingly. As necessary, this amendment would clarify that wind power development on state submerged lands is to be considered a "water dependent use."

E. Facilitating Use of State Submerged Lands for Renewable Ocean Energy Development that Benefits Maine People

The Task Force believes that establishment of commercially reasonable fees that provide compensation to the public for use of state-owned submerged lands for renewable ocean energy development is integral to and serves the State's stewardship obligations under the Public Trust Doctrine. The Task Force also believes that the amount, nature, and schedule for payment of this compensation should reflect renewable ocean energy development's potential to provide significant energy, economic, and environmental benefits to Maine people, including environmental benefits, as well as the need for research and development and technological advancement to secure those benefits. Accordingly, the Task Force offers the following recommendations:

1. Coordinate and streamline the state submerged lands leasing process as follows:

    a. Amend the Bureau of Parks and Lands' submerged lands leasing statute (12 M.R.S. §1862) and other pertinent state laws to clarify that:

        i) The Bureau of Parks and Lands must adopt (or may condition its leasing decision on) pertinent findings and conclusions in the Department of Environmental Protection's Site Law and/or Natural Resources Protection Act permit (or Land Use Regulation Commission land use permit), as applicable; and

        ii) The Bureau of Parks and Lands retains authority to make findings on issues not addressed by the Department of Environmental Protection or Land Use Regulation Commission and require rent and compensation as discussed below.

    b. Amend state law to require an applicant for a renewable ocean energy development project to file pertinent state permit applications prior to or concurrently with a submerged lands lease application to facilitate the Bureau of Parks and Lands' review of lease applications as received (as under current law, without a competitive bidding process) in coordination with the Department of Environmental Protection or Land Use Regulation Commission permitting process, as applicable and to participate in a joint, interagency pre-application meeting regarding its lease and permit applications;

    c. Lease term: i) For "offshore commercial wind energy development," the Bureau of Parks and Lands may issue a 30-year, renewable lease[131] (dating from completion of project construction, with provision for phased development); and ii) authorize the Bureau of Parks and Lands to issue a longer operational lease (up to 50 years), equivalent with the Federal Energy Regulatory Commission license term, for a commercial tidal power development; and

    d. Prior to issuance of a 30-year lease, the Bureau of Parks and Lands may, if requested by the developer and with provision for public notice and comment, issue the following authorizations intended to allow a developer to maintain right, title, or interest in a submerged lands area throughout the development process and to discourage speculative and site banking:

        i) Up to 2-year lease option: granted to establish title, right, or interest for permitting only, if the complete project under consideration is described at least in concept;

        ii) A submerged lands lease, for up to three years, to allow a developer to undertake feasibility testing and pre-development monitoring for ecological and human use impacts, subject to provision of conceptual plans and conditioned on receipt of pertinent permit approvals; and

[131] Current Maine law allows for a 30-year submerged lands lease term.

iii) A submerged lands lease, for up to five years, to allow a developer to secure requisite permits and complete pre-operation construction, subject to provision of detailed development plans describing all operational conditions and restrictions.

2. Ensure commercially reasonable submerged lands leasing fees as follows:

Fees for demonstration projects

a. Amend the Bureau of Parks and Lands' submerged lands leasing statute to specify that for ocean energy demonstration projects the annual rent for the requisite submerged lands shall be as follows:

i) Wind energy demonstration project issued a general permit under 38 M.R.S. §480-HH: $10,000 per year for the term of the general permit;

ii) Tidal power pilot project issued a general permit under 38 M.R.S. §636-A: $100/acre of submerged lands occupied by the project per year for the term of the general project, provided the annual lease fee may not exceed $10,000. As used in this recommendation, the area "occupied" would include the sum of the area on which turbine(s), other testing and monitoring equipment, all anchoring or mooring lines or structures, and the connecting cable to shore are placed, and any other such areas where it is necessary to exclude transient Public Trust uses to avoid unreasonable interference with the project purposes; and

iii) No submerged lands leasing fee may be required for an ocean energy demonstration project located in the Maine Offshore Wind Energy Research Center, where non-commercial projects may only be tested by or in cooperation with the University of Maine.

Fees for commercial-scale projects; rulemaking

b. Direct the Bureau of Parks and Lands to amend its submerged lands leasing rules within one year to include a rental fee schedule for leasing submerged lands for tidal power development, wave power development, "offshore commercial wind energy development," and other wind energy development that is designed to balance state goals of assurance of fair compensation for use of and mitigation of potential adverse effects on or conflict with existing uses of state-owned submerged lands that are held in trust for the people of the State with related state goals of facilitating development of an in-state renewable ocean energy industry. Legislation mandating this rulemaking should specify that:

i) Lease fees must be commercially reasonable and comparable to pertinent lease fees in other jurisdictions both in terms of the fee amounts and provision for a graduated fee schedule that reflects consideration of energy production levels and debt service obligations in the initial years of a development;

ii) In developing the rules Bureau of Parks and Lands must consider ocean-energy related submerged lands leasing fees in other states; fees provided for by the Minerals Management Service's Alternative Energy Program for leasing Outer Continental Shelf areas; current market practices in the wind power industry regarding lease arrangements; and other pertinent information;

iii) The fee structure shall include an amount adequate to cover the Bureau of Parks and Lands pertinent administrative costs;

iv) The fee structure must allow the developer of a wind, tidal, wave, or other renewable ocean energy development to enter into a contract for sale or use of project-generated power that, through reduced rates or otherwise, provides the State or Maine electric consumers a portion of the dollar value of the pertinent rental fee for use of state submerged lands. The developer would be obligated to provide monetary payment to the State for the remaining portion of the rental amount.

v) The rules shall require the Bureau of Parks and Lands to consult with and consider the recommendations of the Public Utilities Commission regarding provision of energy as rent (see previous recommendation) and related permit terms and conditions for a lease for an "offshore commercial wind energy development," tidal power, wave power, or other renewable ocean energy development;

vi) The rules shall clarify that potential adverse effects on existing uses, such as fishing, are addressed through the rental fee structure and the Bureau of Parks and Lands may not require case-by-case payment of an amount in addition to rent as mitigation for such project-specific effects; and

vii) The rules must incorporate the statutorily established fees and exemption for ocean energy demonstration projects recommended above.

3. Establish a non-lapsing, dedicated fund, the Renewable Ocean Energy Trust Fund, into which the following funds would be deposited: 1) rental payments; and 2) state share of federal revenues from alternative energy leasing on the Outer Continental Shelf.[132]

4. Clarify that the Trust's funds will be dedicated to protection and enhancement of the integrity of Public Trust-related resources and uses, including renewable ocean energy development as per the legislative findings recommended above and will be used as follows:

   a. Cover pertinent administrative costs of the Bureau of Parks and Lands' submerged lands leasing program (administered by the Bureau of Parks and Lands);

[132] In accordance with the Energy Policy Act of 2005, the Minerals Management Service is required to provide eligible states 27 percent of the revenues from any offshore wind or other alternative projects on the federal Outer Continental Shelf that is located wholly or partially within the area extending three miles seaward of the State's three-mile limit (the so-called 8(g) zone under the Outer Continental Shelf Land Act). The Minerals Management Service's rules provide for distribution of shared revenue among coastal states that are within 15 miles of the geographic center of the project.

b. Distribute the remaining balance as follows:

i) 40 percent: Research, monitoring, and other efforts to avoid, minimize, and compensate for potential adverse effects of renewable ocean energy development on noncommercial fisheries, seabirds, shorebirds, migratory birds, and other coastal and marine natural resources, including but not limited to development, enhancement, and maintenance of the Coastal Atlas (map-based information resource to guide public and private decision making; see related recommendation above) and field research to provide baseline or other data to address siting issues presented by wind, tidal, wave, or other renewable ocean energy development (funds administered by the Department of Marine Resources, in consultation with the Maine State Planning Office and Department of Inland Fisheries and Wildlife);

ii) 40 percent: Resource enhancement, research on fish behavior, species abundance and distribution and other issues, or other efforts to avoid, minimize, and compensate for potential adverse effects of renewable ocean energy development on commercial fishing and related activities (funds administered by the Department of Marine Resources); and

iii) 20 percent: the Shore and Harbor Management Fund, for public infrastructure and municipal planning for harbor protection (current use of submerged lands funds in excess of the Bureau of Parks and Lands' administrative costs)[133](administered by the Bureau of Parks and Lands).

❖ *Part Three: Promoting and Supporting Development of a Renewable Ocean Energy Industry and Related Businesses in Maine*

While the Task Force acknowledges the value of the State's efforts to date to encourage the development of renewable ocean energy resources, it makes the following recommendations rooted in the four factors noted above that have provided a foundation for Europe's successes:

1. The Department of Economic and Community Development (Commissioner's Office, Office of Innovation, Office of Business Development, Maine Technology Institute**,** and the Maine International Trade Center), and related agencies including the Finance Authority of Maine, and the University of Maine System, should work collaboratively, as lead agencies, to support the development of an ocean energy cluster in Maine by:

a. Continued support for research and development of wind, tidal, wave, and potentially other promising renewable ocean energy technologies at the University and non-profit research institutions, as well as by individual companies, for new products, processes, materials, and other pertinent innovations;

[133] 12 M.R.S. §1863

b. Additional support for private investment in energy-related businesses to help bring these technologies to scale and to build necessary infrastructure for large scale manufacturing; and

c. Collaboration with other regional research efforts, such as the Nova Scotia Tidal Energy Initiative.

2. The Governor should designate the Department of Economic and Community Development as the initial point of contact in state government to assist entrepreneurs and/or developers seeking to develop ocean energy projects by helping make state agencies and programs more accessible and approval processes as transparent as possible.

3. The Finance Authority of Maine, Department of Economic and Community Development, Maine Technology Institute, Maine International Trade Center, the Public Utilities Commission, Efficiency Maine Trust and Small Enterprise Growth Fund should work collaboratively, as lead agencies, to provide state financial assistance to ocean energy-related projects and projects that reduce Maine's dependence on fossil fuels for heating and transportation by:

a. Establishing a moral obligation credit enhancement program, modeled on the Electric Rate Stabilization Program, to use the State's credit rating to reduce financing costs of electric ratepayer-backed projects that do not pose a significant risk of financial loss to the State and that will support the goals of assisting in the development of commercial scale renewable ocean energy projects or the conversion of homes and businesses away from the use of oil and gas as a primary energy source;

b. Supporting and expanding existing programs to encourage investment, including loan guarantees, the Maine Technology Institute's programs, the Seed Capital Tax Credit Program, and the Small Enterprise Growth Fund, and developing new initiatives to attract surging venture capital investment in the "clean energy" sector;

c. Aggressively pursuing federal financing options and partnerships to support renewable ocean energy-related businesses and research and development, including advocating for improvements to federal financing programs that help to attract capital;

d. Providing incentives and removing disincentives for developers to site projects in Maine, and for overseas investment by original equipment manufacturers such as wind turbine and platform vendors;

e. Assessing the appropriateness of existing Maine business financing programs for their suitability for renewable ocean energy development, and making changes and improvements where specific modifications are needed; and

f. Developing guidance for developers on potential public and private funding sources to support renewable ocean energy research and development, resource assessment, baseline environmental studies and evaluations, and on-going monitoring.

4. The Department of Labor, Department of Economic and Community Development, Maine Community College System, University of Maine System, Maine Maritime Academy, and the Boat School (an affiliate of Husson University) should work collaboratively as lead agencies to develop and supply adaptive training to Maine workers who could transfer to the renewable ocean energy industry. The Governor's Training Initiative should be expanded to include such training opportunities.

5. The Legislature should direct the Maine Port Authority to identify land parcels proximate to existing Maine port facilities, estimate their cost, and make a recommendation to the Legislature's joint standing committees on transportation and utilities and energy regarding acquisition of one or more of these parcels for purposes of facilitating renewable ocean energy development opportunities.

6. The Efficiency Maine Trust should:

   a. In consultation with the Public Utilities Commission, design and implement a program, along the lines of that described in Appendix 3 of this report, to convert Maine homes and businesses to more efficient electric air and ground source heat pumps, and to electric vehicles as they become available in the market, that will reduce Maine consumers' total (electricity, heat, transport) energy bills and help support the development of renewable ocean energy resources and minimize the ratepayer impacts of any above-market prices paid to support those resources;[134]

   b. Develop legislative recommendations, in consultation with the Maine State Planning Office, regarding:

      i. Expanding existing state tax credits for purchase of alternative energy resources to include heat pumps, geothermal systems, and hybrid or plug-in electric vehicles; and

      ii. Providing municipal tax incentives such as deducting from property valuations the difference between the cost of a heat pump/geothermal heating system and a typical oil heating system; and

   c. In collaboration with the Maine State Planning Office, develop reliable, objective information and educational materials for businesses and consumers that can encourage and permit them to make informed decisions about adopting new heating and transportation technologies.

[134] See Appendix 3 for a more detailed description of such a conversion program that would rely on on-bill financing with no up-front cost to the homeowner or business, and that would produce immediate savings to the consumer and revenues to help fund above-market costs of ocean energy projects.

7. Clarify that renewable ocean energy-generating machinery and related components, including but not limited to turbines and support structures, that are in transit to be located on or above state submerged lands but happen to be within a municipality on April 1 are exempt from municipal personal property taxation under existing exemptions in 36 M.R.S. § 655 regarding industrial inventories including goods in process and finished work on hand, stock-in-trade, property in possession of a common carrier held en route to a final destination, and/or vessels in the process of construction owned by persons residing out of the State.

8. Clarify that a municipality may not levy personal property tax on renewable ocean energy-generating machinery and related components, including but not limited to turbines and support structures, unless the personal property is deployed as part of a wind, tidal, wave, or other renewable ocean energy development that is located within the boundaries of that municipality as established by legislative charter prior to December 1, 2009.

9. Amend state law to: 1) provide an exemption from personal property taxation for personal property that is deployed as part of a wind, tidal, wave, or other renewable ocean energy development; and located in, on, or over Maine's coastal waters and within the unorganized areas of the State; and 2) remove the statutory provision requiring the State to provide reimbursement to the unorganized territories in relation to this exemption.

❖ *Part Four: Making Needed Changes in Energy Transmission Infrastructure and State Energy Policy*

1. Amend state law and state energy plan to explicitly incorporate the likely need for expansion of state transmission and delivery capacity to achieve the State's onshore and offshore wind goals.

    a. Amend 35-A M.R.S. § 3404 (1) to make it the policy of the State, that in furtherance of the State's wind power goals, the State take every reasonable action to encourage the attraction of appropriately sited development related to wind energy, including any additional transmission infrastructure needed to transport additional renewable energy to market to help the State achieve its on and offshore wind power goals.

    b. Encourage the expansion of transmission capacity not only to serve current load, but also to serve the reasonably anticipated future growth of generation to meet the State's on and offshore wind renewable energy goals by giving explicit authority to the Public Utilities Commission to authorize transmission capacity increases when it determines that they are expected to minimize long term transmission and distribution system costs.

    c. Amend the state energy plan to acknowledge the need for new transmission capacity to support development of significant amounts of offshore wind.

2. Direct the Public Utilities Commission to work within the ISO-NE and at the Federal Energy Regulatory Commission to change existing rules regarding cost recovery of generator lead lines by permitting rate recovery of interconnection facilities sited in designated areas and needed to serve renewable energy projects.

3. Explicitly recognize in state law and the State's energy plan the economic and environmental benefits of electrification of the heating and transportation sectors. Target conversion of homes and businesses to more efficient heat pumps only if they have already been weatherized or are in the process of being weatherized in accordance with the State's weatherization programs.

4. Ask the Legislature to direct the Public Utilities Commission to initiate a proceeding to explore mechanisms needed to achieve the State's electrification of home heat and transport policy and goal to promote and best utilize Maine's renewable energy generation potential, including examination of the following:

    a. Rate design structures that will encourage the use of intermittent renewable energy resources, including off peak time of use transmission and distribution rates;

    b. Changes to the standard offer pricing to include off peak time of use energy prices;

    c. The penetration of time of use meters;

    d. The long term needs for a "smart grid" that will enable the efficient usage and storage of energy produced by intermittent renewable resources; and

    e. Any other mechanisms that would encourage the development and usage of Maine's renewable energy resources to replace the use of fossil fuels for heat and transportation whenever conversion would reduce overall energy consumption, increase the State's energy independence, and reduce greenhouse gas emissions.

    The Public Utilities Commission should report to the Legislature, including recommendations for rate design changes, "smart grid" investments, and other mechanisms needed to promote electrification of the home heating and transport sectors.

5. Amend state law to direct the Public Utilities Commission to issue a Request for Proposals for renewable ocean energy projects and to direct a transmission and distribution utility to enter into a long term contract for the energy, capacity and renewable energy credits from an offshore wind facility if the ratepayer impact is reasonable based on a determination by the Legislature and Governor. The commission can take the risks associated with fossil fuel price volatility over the next 20 years, greenhouse gas emission reductions, and the State's offshore wind energy goals into consideration. The commission shall also consider the energy and cost savings from state programs to weatherize and convert homes to more efficient heat sources in determining the reasonableness of ratepayer impacts. Use existing system benefit charge level as benchmark for determination of reasonableness.

6. The Public Utilities Commission and the Office of Energy Independence and Security should continue to work through the ISO-NE, and the Governor's Office should continue to work through the New England Governors/Eastern Canadian Premiers Conference and other regional fora, to best achieve the State's wind goals in the lowest cost manner possible with a focus on regional cooperation. The adoption of rational cost allocation policies for transmission and distribution investments that further the regional system's reliability and help achieve its renewable energy and climate goals while minimizing litigation is essential.

❖ *Part Five: Facilitating Permitting of Appropriately-Sited Offshore Wind Energy Development*

As discussed above, the Task Force believes that existing state and federal environmental permitting requirements, while needed to assess and address potential adverse effects on coastal resources and related human uses, may unduly inhibit commercial-scale shallow and deepwater offshore wind development[135] and makes the following recommendations:

1. The Maine State Planning Office should work with the Minerals Management Service, Army Corps of Engineers, U.S. Fish and Wildlife Services, National Marine Fisheries Service, and other federal agencies to develop a Memorandum of Understanding (using the Memorandum of Understanding with the Federal Energy Regulatory Commission on tidal power development as a model) or other appropriate vehicle for inter-agency collaboration on planning for and leasing and permitting of wind energy development in Maine's coastal waters and on the Outer Continental Shelf that:

    a. Articulates that, to the extent consistent with their legal authority, each state and federal agency will work collaboratively to facilitate siting of offshore wind energy development;

    b. Clarifies information, including any pre-construction studies of existing conditions, that an applicant may be required to provide under pertinent state and federal authorities;

    c. Identifies ways, including but not limited to use of existing or development of general permits, to coordinate and streamline state and federal review procedures; and

    d. Identifies, as soon as possible, a standard set of license conditions for state and federal licenses and permits for offshore wind energy development.

2. Clarify and streamline state permitting requirements as follows:

[135] The recommendations cover projects that propose use of existing, demonstrated technologies designed for shallow water deployment as well as those proposing technologies currently under development and designed for deep water deployment.

a. Amend the Land Use Regulation Commission's authorizing legislation, the Site Location of Development Act and other pertinent state laws, to clarify that the Department of Environmental Protection is the lead state permitting agency (not the Land Use Regulation Commission permitting or rezoning required, except as recommended in section 3, below) for a wind energy development located in a "coastal wetland" as defined by the Natural Resources Protection Act;

b. Require the Department of Environmental Protection to consult with and consider comments of the Land Use Regulation Commission and neighboring municipalities in exercising its decision-making authority regarding wind energy development located in a "coastal wetland";

c. Amend state law to clarify that the Land Use Regulation Commission has land use permitting jurisdiction over a "community-based offshore wind energy development" that is "locally owned" (as defined by 35-A M.R.S. §3602) (community-based renewable energy project); is used primarily to offset part or all of the electricity requirements of the local owners or community in or adjacent to which the project is located; may be connected to the ISO-NE grid; employs generating facilities of a size commensurate with the pertinent community's need; and is located no more than one nautical mile from a coastal island in Land Use Regulation Commission jurisdiction;[136]

d. Clarify that a "community-based offshore wind energy development" is an allowable use in the limited areas, described above, where the Land Use Regulation Commission has land use permitting jurisdiction and direct the Land Use Regulation Commission to amend its rules accordingly;

e. Amend state law to make the administrative and judicial review processes for "wind energy development in a coastal development" (including such a project subject to the limited Land Use Regulation Commission jurisdiction described above) comparable to those applicable to land-based "grid-scale wind energy development", as follows: the Department of Environmental Protection (or the Land Use Regulation Commission) makes initial permitting decision (no original Board of Environmental Protection jurisdiction); the Board of Environmental Protection may hear an appeal of a Department of Environmental Protection decision on the record (no *de novo* review); 185 day permit review period (270 days if a public hearing is held) for site law-scale projects; the Department of Environmental Protection (or the Land Use Regulation Commission) may contract, at the applicant's expense, for expertise needed for timely review; and appeal direct to the Law Court;

f. Amend Site Law (38 M.R.S. §481, *et seq.*), and Natural Resources Protection Act (38 M.R.S. §480-A, *et seq.)* as follows:

[136] The Task Force intends that current law authorizing the Department of Environmental Protection to assume jurisdiction over projects located in both the organized and unorganized area would apply.

i. Clarify that a Site Law permit is required for an "offshore commercial wind energy development," meaning a "wind energy development" as defined by 35-A M.R.S. §3451(11), that has an aggregate generating capacity of 3 megawatts or more; is proposed to be located in whole or in part in a "coastal wetland;" and includes transmission lines and other "associated facilities"[137] as defined by 35-A M.R.S. §3451(1);[138]

ii. Authorize the Department of Environmental Protection, in its discretion, to address development of "associated facilities," including transmission lines, separately as provided for "grid-scale wind energy development" under 38 M.R.S. §344(2-A)(A);

iii. For wind energy development located in a "coastal wetland" that has an aggregate generating capacity under 3 megawatts and thus is not subject to Site Law permitting under the Task Force's proposal, amend the Natural Resources Protection Act to contain approval criteria regarding noise, safety-related setbacks, and shadow flicker that are comparable to the Department of Environmental Protection certification criteria for small-scale land based wind development under 35-A M.R.S. §3456 and tailored as appropriate to address ocean-based, offshore development;

iv. Clarify that the approach to scenic impact assessment applicable to "grid-scale wind energy development" under Natural Resources Protection Act and Site Law,[139] including the scenic impact standard, assessment method, and distance limitations, also applies to wind energy development proposed for location in a "coastal wetland;"

v. Require, as a Site Law approval criterion, demonstration that a proposed "offshore commercial wind energy development" would provide tangible benefits to communities in the project area in the manner that such benefits are required for land-based "grid-scale wind energy development," clarifying that project-related greenhouse gas emissions and related environmental benefits would likewise be presumed;

vi. Require project decommissioning and provision of related financial assurances for all wind energy development located in a "coastal wetland" in accordance with current approach for land-based "grid-scale wind energy development"; and

vii. Amend Site Law and Natural Resources Protection Act, and/or related Department of Environmental Protection rules, as needed, to include approval criteria that address issues, including but not limited to noise and effects on birds, bats, marine mammal

[137] "Associated facilities" means elements of a wind energy development other than its generating facilities that are necessary to the proper operation and maintenance of the wind energy development, including but not limited to buildings, access roads, generator lead lines and substations as used 35-A M.R.S. §3451(1)

[138] In some cases, project-related transmission lines may include upland as well as submerged power lines.

[139] See 35-A M.R.S. §3452 and related Site Law and Natural Resources Protection Act provisions.

species, and marine habitats as appropriate in an offshore, ocean environment, with due consideration of adaptive management, potential cumulative effects, and avoidance, minimization and compensation for undue adverse effects on biological resources;

g. Amend Land Use Regulation Commission's permitting laws and/or rules as appropriate to provide approval criteria and administrative review procedures for "community-scale offshore wind energy development" (see above) that are substantially similar to those recommended for the Site Law and Natural Resources Protection Act in sections 5 and 6, above;

h. Direct the Maine State Planning Office, within two years, to review and update as appropriate, considering pertinent criteria in the methodology adopted by rule pursuant to P.L. 2007 c. 661, the scenic resources of state or national significance identified in the coastal scenic inventories specified in the definition of "scenic resource of state or national significance."[140]

i. The Maine State Planning Office should submit for National Ocean Atmosphere Administration review and approval amendments to the Maine Coastal Program needed, if any, to clarify that renewable ocean energy development activities proposed on the federal Outer Continental Shelf are not subject to review under Maine's coastal zone management program under provisions of the Coastal Zone Management Act regarding listed federal activities, listed federal license or permit activities, or Outer Continental Shelf development activities but that the State would exercise its right to request Coastal Zone Management Act consistency review of any such Outer Continental Shelf activity if it determined that the activity may have adverse effects on resources or related human uses in its coastal zone.

3. Recognizing the evolving state of key technologies and related scientific knowledge on potential siting-related effects, the Governor should establish a standing, non-regulatory technical committee comprised of persons with pertinent scientific expertise on birds, bats, marine mammals, marine habitats, and other biological resources, including but not limited to academic professionals from the University of Maine, to advise the Department of Environmental Protection, Land Use Regulation Commission, and Bureau of Parks and Lands on development of rules, development of monitoring protocols, evaluation of monitoring reports, and scientific developments regarding offshore wind, tidal, wave, and other types of renewable ocean energy development. The Governor should designate one committee member to serve as chair whose responsibilities would include convening the committee and managing its work. In developing rules and monitoring protocols and evaluating monitoring reports regarding offshore wind, tidal, and other types of renewable ocean energy development, the Department of Environmental Protection, Land Use Regulation Commission, and Bureau of Parks and Lands, in coordination with the Department of Marine Resources, should in addition request the recommendations of the

[140] 35-A M.R.S. §3451(9)

Advisory Council of the Department of Marine Resources regarding potential adverse effects on commercial and recreational fisheries and other existing human uses of the marine environment.

4. As noted above, ambiguity regarding the precise location of municipalities' boundaries on state submerged lands creates significant potential for confusion over approval requirements, conflicting assertions of decision making authority, and resulting regulatory costs and complexities and delays. In making the following recommendation to address this problem, the Task Force notes that Maine municipalities do not have an established history of land use regulation of ocean-based development activities. The Task Force believes that ensuring state-level decision making is appropriate. Ocean energy development activities will occur principally on state-owned submerged lands held and managed under the Public Trust Doctrine in the interests of Maine people as a whole. Developers may be reluctant to invest the necessary time, effort, and capital without reasonable assurance that environmental siting and economic regulatory decisions will be made at the state level. Amend state law to clarify that a municipality:

    a. May not enact or enforce a zoning ordinance that prohibits siting of renewable ocean energy-related generation or associated facilities within the municipality and must make reasonable allowance for siting of such facilities at one or more locations within the municipality;

    b. May not enact or enforce any land use standard, or other requirement regarding renewable ocean energy development which, as applied to generating or associated facilities proposed for location on state submerged lands, imposes any requirement that is more restrictive than the Department of Environmental Protection standards under the Site Law, Natural Resources Protection Act, or the Maine Water Development and Conservation Act, as applicable;

    c. May only regulate renewable ocean energy development that is located within its boundaries as established by the Legislature prior to December 1, 2009; and

    d. Must take final action regarding all pertinent authorizations to site, construct, or operate a renewable ocean energy project within 60 days of final agency action by the Department of Environmental Protection on all related state permit applications.

5. Amend state law to clarify that, for purposes of municipal land use or zoning as applied to renewable ocean energy development, there is a rebuttable presumption that the boundaries of Maine municipalities do not extend below the mean low water line on waters subject to tidal influence.

6. Amend state law to authorize the Department of Environmental Protection to wholly or partially exempt a renewable ocean energy development from compliance with the terms of a local land use or zoning ordinance, including but not limited to a local shoreland zoning

ordinance, if the Department of Environmental Protection determines that such an exemption is reasonably necessary for public welfare or convenience.

❖ *Part Six: Facilitating Development of Appropriately-Sited Tidal Energy Projects*

The Task Force's tidal power subcommittee developed recommendations to address barriers to growth and development of Maine's fledgling tidal power industry. Reflecting the tidal industry's pioneering role in Maine, for the most part these recommendations touched on matters of concern to the renewable ocean energy industry as a whole. The Task Force incorporated key elements of the subcommittee's proposals into a number of its findings and recommendations, including those regarding coordination of federal-state decision making; "best practices" for stakeholder engagement; transmission and grid management improvement; and making the best available information available for public and private decision-making.

The Task Force makes the following additional recommendations specifically aimed at addressing challenges facing Maine's tidal power industry:[141]

1. Timely and efficient development of tidal energy resources at optimal locations in Maine's coastal waters, including but not limited to those in the Passamaquoddy Bay region.

   The Task Force believes that establishment of this goal will provide policy direction and support for agency initiatives to support needed research and development, advocate for needed federal collaboration, and pursue other related initiatives. Achievement of this goal would make Maine the first state in nation with a working, commercial-scale tidal power project and advance the tidal power industry generally.

2. The Department of Environmental Protection, in consultation with state resource agencies, should work with the appropriate federal agencies to ensure that the Federal Energy Regulatory Commission's hydrokinetic pilot project license process is fully implemented in Maine, including its provisions regarding a six-month application review process. The Department of Environmental Protection should work with the Federal Energy Regulatory Commission to encourage the U.S. Fish & Wildlife Service, National Marine Fisheries Service, Army Corps of Engineers, and other pertinent federal agencies to join as signatories to and supplement the Memorandum of Understanding, as appropriate, to:

   a. Articulate that, to the extent consistent with their legal authority, each state and federal agency will work collaboratively to facilitate siting of pilot and commercial-scale tidal power projects in furtherance of national, regional, and state renewable ocean energy-related goals;

[141] See also recommendation, above, regarding expansion of technical advisory committees to include pertinent expertise on tidal power development-related issues.

b. Clarify information, including any pre-construction studies of existing conditions, that an applicant may be required to provide under pertinent state and federal authorities;

c. Identify ways, including but not limited to use of existing or development of general permits, to coordinate and streamline state and federal review procedures; and

d. Identify, as soon as possible, a standard set of license conditions for state and federal licenses and permits for marine hydrokinetic projects.

3. Amend state law to make the administrative and judicial review processes for commercial-scale tidal power development under the Maine Waterway Conservation and Development Act the same as those applicable to land-based "grid-scale wind energy development" in Department of Environmental Protection jurisdiction, as follows: the Department of Environmental Protection makes initial permitting decision (no original Board of Environmental Protection jurisdiction); the Board of Environmental Protection may hear appeal on the record (no *de novo* review); 185 day permit review period; the Department of Environmental Protection may contract, at applicant's expense, for expertise needed for timely review; and appeal direct to the Law Court.

❖ *Part Seven: Supporting Wave Energy Development Opportunities*

In keeping with its understanding of the nature of wave power opportunities in Maine's coastal waters and adjacent federal waters, the Task Force recommends the following:

1. Encouragement for testing of wave power technology in conjunction with a wind power generation system as provided for 38 M.R.S. §480-HH (Department of Environmental Protection -administered general permit for a "wind energy demonstration project");

2. Amendment of the Maine Waterway Development and Conservation Act (38 M.R.S. §630, *et seq*.,) to clarify that the Department of Environmental Protection has statewide jurisdiction over wave power projects, as per P.L. 2009 c. 270 (clarifying the Department of Environmental Protection's statewide jurisdiction under the Maine Waterway Development and Conservation Act over tidal power projects).

❖ *Part Eight: Ensuring Well-informed and Effective State Consideration and Action Regarding Offshore Oil and Natural Gas Development*

The Department of Conservation and Maine State Planning Office, as lead agencies, should monitor proposed federal legislation and federal planning activities regarding oil and gas development on the Outer Continental Shelf, including the Minerals Management Service's preparation of five-year leasing plans pursuant to the Outer Continental Shelf Lands Act, and in consultation with the

Department of Marine Resources, other state agencies, and the Governor's Office, as appropriate, prepare state comments in accordance with the Task Force's finding that the Gulf of Maine, in comparison to other areas of the Outer Continental Shelf, has low potential and does not merit further oil and gas development efforts.

❖ *Part Nine: Form a Private Sector-led Entity to Spearhead Renewable Ocean Energy Development in Maine*

The Task Force acknowledges that its own efforts as reflected in this report represent only another milestone along the route to securing the benefits of Maine's renewable ocean energy resources for the people of the State as well as its natural environment. The Task Force tasked subcommittee 8 with evaluating the need for, and value of, creating a public/private entity to advance commercialization of Maine's renewable ocean energy after its own work is done. Subcommittee 8 met with leaders from academia, industry, utility companies, professional service providers, trade associations and nongovernmental organizations. This subcommittee concluded that a new private sector-led entity, attentive to the need for a strong public-private partnership, is an appropriate and necessary vehicle for spearheading renewable ocean energy development efforts in Maine. The subcommittee emphasized, and the Task Force concurs, that this new entity would supplement rather than supplant or duplicate pertinent existing efforts by state agencies, the University of Maine System, or various trade associations. This entity would focus on attracting private industry to the state and providing the type of industrial and professional services needed to develop Maine's tidal, wind, wave and potentially other renewable ocean energy resources.

In accordance with the recommendations of subcommittee 8, the Task Force makes the following recommendation aimed at ensuring effective advocacy to build on and enhance its own efforts to date:

> The private sector should create an industry-led, development-oriented entity dedicated to advancement of the renewable ocean energy industry as a whole in furtherance of the goals and policies recommended by the Task Force and any resulting legislative directives. The entity's objectives, in addition to support for tidal and wave power initiatives, should include siting of commercial-scale offshore wind energy development in Maine's coastal waters or adjoining federal waters by 2015. The Task Force recommends that this entity develop its own organizational structure and governing practices. The Task Force suggests provision for non-voting, *ex officio* representation of the State to optimize opportunities for private-public collaboration.

CONCLUSION

Environmental, economic, and energy security considerations all support and decisive action to carry out a strategy to encourage creation of conditions that favor implementation of a Maine-based five gigawatt-scale offshore wind generation industry. Well-concerted action to advance federal and state policies that promote conversion to cleaner and more efficient forms of energy for home heating and transportation needs to be a core element of this strategy.

Renewable ocean energy resources located off Maine's shores have tremendous potential to meet the lion's share of Maine's energy needs while providing significant business development and job growth opportunities. Offshore wind resources, particularly those in deep-water areas in state and adjacent federal waters, are of particular significance. Development of these resources has potential, in time, to substantially reduce the risky reliance of Maine families and businesses on fossil fuels while establishing new renewable energy-related industries with substantial opportunities for job creation.

Technological and energy infrastructure limitations, current economic conditions, regulatory complexities, and related cost considerations are significant but not insurmountable barriers to harnessing deep-water wind and other renewable ocean energy resources. Essential technologies are rapidly evolving. Federal and state leasing and permitting processes can be fine-tuned, streamlined and harmonized to facilitate siting while avoiding, minimizing, and compensating as appropriate for adverse effects on natural resources and related human uses. Precisely-targeted economic development efforts, including support for research and development and project financing, can foster growth and expansion of a robust renewable ocean energy industry.

Fuel price spikes in 2008 spotlighted the intertwined economic, environmental, and energy challenges Maine faces, and the economic and social peril our state will face if these challenges are not vigorously addressed. Breaking our dependence on of fossil fuels requires vision for the future and decisive action at present. Looking to future as well as present needs, the State needs to make realization of the vast potential of its renewable ocean energy resources a top priority. Acting now, through strong public-private partnerships, Maine can secure nearer term benefits, such as those stemming from growth of our already emerging tidal power industry, and position the state for the investment needed to establish, grow, and reap the enormous promise of our offshore wind industry.

APPENDICES

Final Report of the Ocean Energy Task Force
to
Governor John E. Baldacci

December 2009

Photo credits (clockwise from top center): Solberg/Statoil; Maine Coastal Program; Ocean Renewable Power Company; Principle Power; Blue H. Center photo: Global Marine Systems, Ltd.

APPENDICES

to the

Final Report of the Ocean Energy Task Force

to

Governor John E. Baldacci

December 2009

Financial assistance for this document was provided by a grant from the Maine Coastal Program at the Maine State Planning Office, through funding provided by the U.S. Department of Commerce, Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act of 1972, as amended.

Additional financial assistance was provided by the Efficiency Maine Trust (Efficiency Maine Trust is a statewide effort to promote the more efficient use of electricity, help Maine residents and businesses reduce energy costs, and improve Maine's environment), and by the American Recovery and Reinvestment Act of 2009.

This publication was produced under appropriation number 020-07B-008205

TABLE OF CONTENTS

Appendix 1: Executive Order

OFFICE OF
THE GOVERNOR

NO. 20 FY 08/09
DATE November 7, 2008

AN EXECUTIVE ORDER ESTABLISING THE OCEAN ENERGY TASK FORCE

WHEREAS, Maine has a strong interest in developing Maine's vast indigenous and renewable ocean energy potential and recognizes its enormous promise to address state and regional energy-related needs, including: increasing the State's energy independence and security; limiting Maine's vulnerability to the unpredictable costs and possibly supplies of fossil fuels; attaining the state's overall goal to reduce greenhouse gas emissions to sustainable levels by mid-century and of the Regional Greenhouse Gas Initiative's ("RGGI") CO2 reduction targets; and stimulating and growing diverse and vibrant ocean energy-related economic opportunities; and

WHEREAS, information prepared by the Department of Energy's National Renewable Energy Research Laboratory ("NREL") and Minerals Management Service ("MMS") shows that the Gulf of Maine is a world-class wind power resource, which the Ocean Energy Institute estimates could equal around 100,000 MW (100 Gigawatts) of theoretical electric capacity, an amount that is 3 times larger than the total current installed capacity in New England; and

WHEREAS, the Governor's 2007 Task Force on Wind Power Development found that Maine can become a leader in wind power development while protecting Maine's quality of place and natural resources, and that Maine should seek to host at least 2,000 megawatts (MW) of installed wind power capacity by 2015, and at least 3,000 by 2020, of which at least 300 MW can be achieved with projects built offshore; and

WHEREAS, the fuel price from offshore wind power, tidal power and wave power is low and steady, enabling long term contracts with these clean sources of electricity at stable prices, as distinguished from generation of electricity from fossil fuels, whose prices fluctuate widely; and

WHEREAS, wind power is the fastest growing utility-scale source of energy in the United States and internationally, and offshore wind is the fastest growing component of the wind energy segment; and

WHEREAS, improvements in turbines and related wind technologies, with support from federal renewable energy tax credits, are now making wind energy competitive in many markets with conventional power source; and

WHEREAS, ongoing technological developments hold promise that wind power, and to a lesser extent tidal and wave power, can also come to play a vital role in addressing transportation and home heating needs as well as traditional electric power demands; and

WHEREAS, Maine's universities and independent research institutions provide the specialized research and development capabilities, and established marine construction firms provide the required industrial infrastructure, vital to support a robust offshore wind energy industry; and

WHEREAS, the State of Maine has the highly-skilled and productive workforce, developed waterfront industry, and hospitable business climate to serve as a national center for offshore wind energy development; and

WHEREAS, the Governor's 2007 Task Force on Wind Power Development recognized the potential for ocean-based wind energy development to contribute to achievement of state wind energy and related economic development goals, called attention to significant technological, financial and knowledge-based challenges and, to that end, recommended follow-up actions requiring heightened collaborative efforts among several partners including federal regulatory agencies; and

WHEREAS, subsequent to completion of the work of the Governor's 2007 Task Force on Wind Power Development, Congress did not extend the long-standing moratorium on oil and gas development on the nation's Outer Continental Shelf (OCS) and the Mineral Management Service is moving forward with its program for leasing OCS areas for alternative energy development and initiation of a new five-year plan for OCS oil and gas development; and

WHEREAS, information prepared by the MMS indicates that the Gulf of Maine does not appear to have significant commercially recoverable oil and natural gas reserves, while it does hold a significant potential for large-scale development of wind power, the development of which would help the state achieve its interrelated energy, environmental and economic goals; and

WHEREAS, Congress is likely to take up legislation this session pertaining to offshore oil and gas leasing, exploration, and development for federal waters, making it essential that Maine fully explore and understand the resource as well as the risks and benefits of harnessing that resource;

NOW, THEREFORE, I, John E. Baldacci, Governor of the State of Maine, do hereby establish the Ocean Energy Task Force (hereinafter "Task Force").

Purpose and Duties

The Task Force is established to develop a strategy aimed at meeting or exceeding the goal established in the Maine Energy Act, Title 35-A, section 3404(2)(B), for ocean-based wind energy capacity as expeditiously as practicable, including a specific plan of action for implementation of that strategy. This strategy shall identify and recommend solutions to overcome potential economic, technical, regulatory, and other obstacles to vigorous and expeditious development of grid-scale wind energy generation facilities in Maine's coastal waters

and adjacent federal waters. In developing the strategy, the Task Force shall consider and make recommendations regarding the following:

A. Technological Development: research and testing to facilitate siting of offshore wind generation facilities.

   1. The merits of and options for establishing an ocean-based testing area in the Gulf of Maine to foster and expedite research and development of offshore wind energy facilities in a manner that addresses potential siting issues; and,

   2. Specific research and development initiatives critical to facilitating siting of ocean-based wind energy generation facilities at appropriate locations in the Gulf of Maine, with due consideration of natural resources and existing uses.

B. Wind Power-related Economic Development: fostering in-state growth of diverse wind energy-related businesses.

   1. Options, including public-private partnerships, for facilitating financing and/or siting and operation of offshore, grid-scale wind energy generation facilities located at appropriate locations on the Outer Continental Shelf proximate to Maine and built at a scale commensurate with the State's wind power and related renewable energy objectives, pertinent electric power demand, demand for wind assisted heating and transportation, and the available wind resource; and

   2. Specific opportunities and means to facilitate creation of economic development clusters related to construction and operation of ocean-based wind development, manufacturing of wind generation-related components, provision of engineering and other professional services and basic and applied scientific research, and other enterprises to support growth of a diverse wind energy industry in Maine.

C. Tidal and Wave Power: encouraging ocean-based tidal and wave energy development where appropriate.

   1. Compile existing information on potential locations in Maine's coastal waters for tidal and wave power generation and the primary technical, economic and natural resources-related constraints on their development; and

   2. Identify ways in which the State can support continued research and development of tidal and wave power at ocean sites compatibly with Maine's overall energy, economic, and environmental goals and existing uses, including commercial fishing.

D. Potential Oil and Gas Exploration on the Outer Continental Shelf: updating information regarding offshore oil and gas resources and evaluating federal initiatives regarding exploration for oil and gas in the Outer Continental Shelf.

1. Compile objective, credible and scientific information on the offshore oil and gas resource, including: the latest technologies available for oil and gas exploration and extraction; the adverse environmental risks associated with development of this resource; the economic benefits Maine people would likely realize from developing this resource; the compatibility of offshore oil and gas exploration with development of the offshore wind power resource and existing uses, including commercial fishing; and the compatibility of developing this resource with Maine's overall energy, economic and environmental goals; and,

2. Identify ways in which state agencies can ensure well-informed and effective state participation in federal decision-making regarding energy development of both renewable and fossil fuel resources on OCS areas proximate to Maine.

Membership

The Governor shall appoint seventeen (17) members to serve on the Task Force, who shall serve at the pleasure of the Governor. Membership is as follows:

- Commissioner of the Department of Environmental Protection, or Commissioner's designee;
- Commissioner of the Department of Conservation, or Commissioner's designee;
- Commissioner of the Department of Marine Resources, or Commissioner's designee;
- Commissioner of the Department of Economic and Community Development or Commissioner's Designee;
- Director, Office of Energy Independence and Security or Director's designee;
- Director, State Planning Office or Director's designee;
- Eleven (11) members shall include diverse members with relevant knowledge and experience in technological, engineering, financing and regulatory issues regarding ocean wind energy generation; marine resources management and conservation; and potential natural resources and environmental effects of wind energy generation.

The President of the Senate may appoint a member of the Senate, and the Speaker of the House may appoint two members of the House of Representatives. Members appointed by the President of the Senate and the Speaker of the House shall serve at the pleasure of their appointing authority.

The Governor shall appoint two co-chairs of the Task Force from among the members. The chairs will schedule and set the agenda for, and preside at Task Force meetings. The members of the Task Force shall serve without compensation.

Staff

The State Planning Office, the Governor's Office of Energy Independence and Security, the Department of Conservation through the Maine Geological Survey and the Bureau of Public Lands and the Department of Economic and Community Development shall provide staff

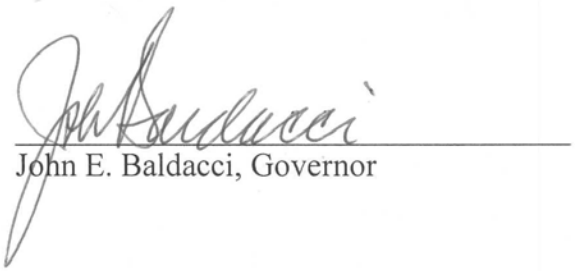
assistance to the Task Force. At the Task Force's request, other state agencies shall provide information and analysis to assist the Task Force in its deliberations.

Reporting

The Task Force shall prepare a written report to the Governor outlining its interim findings no later than April 1, 2009. The Task Force shall prepare a written report of its final recommendations to the Governor, including any recommended legislation, by October 31, 2009.

Effective Date

The effective date of this Executive Order is November 7, 2008.



John E. Baldacci, Governor

OFFICE OF
THE GOVERNOR

NO. 22 FY 08/09

DATE December 5, 2008

AN ORDER AMENDING THE ORDER ESTABLISHING THE OCEAN ENERGY TASK FORCE

WHEREAS, the process of selecting the membership to the Ocean Energy Task Force is an important one that must ensure that balanced and informed perspectives are represented on the Task Force; and

WHEREAS, Executive Order 20 FY 08/09 (dated November 7, 2008), titled "An Executive Order Establishing the Ocean Energy Task Force," requires minor clarification in which membership to the Task Force is achieved:

NOW, THEREFORE, I, John E. Baldacci, Governor of the State of Maine, do hereby amend Executive Order 20 FY 08/09 in the following manner:

By amending the Membership section to read as follows:

> *The President of the Senate may appoint two members of the Senate, and the Speaker of the House may appoint two members of the House of Representatives. Members appointed by the President of the Senate and the Speaker of the House shall serve at the pleasure of their appointing authority.*

In all other respects, the terms of Executive Order 20 FY 08/09 remain the same.

Effective Date

The effective date of this Executive Order is December 5, 2008.

John E. Baldacci, Governor

Appendix 2: Ocean Energy Task Force Members

Representative Herb Adams
Portland

Tim Agnew
Masthead Venture Partners

George Baker
Fox Islands Wind, LLC

Professor Habib Dagher
University of Maine

Representative Stacey Fitts
Pittsfield

David Flanagan
Manchester

W. Parker Hadlock
Cianbro Corp.

Leslie A. Harroun
Oak Foundation

George Hart
Ocean Energy Institute
(resigned August 2009)

Senator Barry Hobbins
Saco

John Kerry
Director, Office of Energy Independence & Security

Angus S. King, Jr.
Independence Wind

George LaPointe
Commissioner, Maine Department of Marine Resources

Kathleen Leyden
Director, Maine Coastal Program

Sean Mahoney,
Director, Maine Advocacy Center
Conservation Law Foundation

Dr. Robert Marvinney
State Geologist, Maine Geological Survey

Patrick McGowan
Commissioner, Department of Conservation

Beth Nagusky, Co-chair
Director, Innovation and Assistance, Maine Department of Environmental Protection

Don Perkins, Co-chair
President, Gulf of Maine Research Institute

Senator Kevin Raye
Perry

Dr. Catherine Renault
Director, Office of Innovation, Department of Economic and Community Development

Pat White
President, Gulf of Maine Lobster Foundation

Appendix 3: Final Report of Economic Analyses

Final Report of Economic Analyses
Performed by Waine Whittier
for the Ocean Energy Task Force

Summary
Electricity from deep offshore wind energy is likely to be more expensive than that from natural gas fired power plants for several years. However, if construction regimes can be developed to keep the cost relatively low, wind could become competitive in ten to fifteen years. Even if somewhat more expensive than the natural gas alternative, wind has the advantage of no fuel price uncertainty, eliminates carbon emissions except for those associated with construction and maintenance, and has the potential for returning some of the cost to Maine through local jobs. Coupled with a heat pump conversion program and an electric vehicle strategy, this could yield a much cleaner and more secure energy future for the citizens of Maine. A reasonable strategy could be to:

- Immediately begin an oil to electric heat pump conversion program with tariffs set at marginal costs, with a premium to subsidize wind development.
- Establish a fund to support wind energy development or the T&D infrastructure necessary for an electrification program from any excess revenues that may be generated from the electrification program.
- Invest heavily in research and development of deep offshore wind technology so that costs and the impact on jobs in Maine can become known.
- Initiate studies to determine how to integrate new intermittent energy technologies, electrification of heating and transportation, T&D expansion, and smart grid technologies for the most efficient system.
- Prepare to implement an electric vehicle program as soon as the industry provides reasonably priced plug in vehicles.

Note: Analyses presented here do not assume any government subsidies to wind energy, heat pump, or electric vehicle programs. To the extent that investment tax credits or other incentives can be utilized, they will improve program economics.

Overview of the Analysis

Five different but interrelated analyses were performed:

1. Calculations of the cost of electricity from wind turbines at various construction costs were compared to the electricity cost from natural gas fired combined cycle power plants at various prices of fuel.
2. A comparison of heating homes with electric heat pumps or heating with oil.
3. A 20-year build out case for offshore wind energy.
4. Analysis of a heat pump conversion program coupled with an RFP for building 200 MW of offshore wind energy turbines.
5. A 20-year build out case with both a heat pump conversion program and an electric vehicle program.

Results suggest that electricity from offshore wind turbines is likely to be more expensive than from combined cycle natural gas fired power plants for several years. The crossover point is largely dependent on the cost to construct wind turbines and the cost of natural gas.

Conversion of home heating from oil furnaces to electric heat pumps is economic now. A home heating conversion program coupled with a twenty-year contract for wind energy could offer several advantages.

- Heating customers would see lower bills immediately and would have prices guaranteed for twenty years.
- Much of the resulting heating energy payments would go to Maine businesses.
- Greenhouse gas and particulate emissions would be reduced.
- Wind energy suppliers would have a twenty-year contract for the sale of their energy.
- Some of the resulting heating savings would be used to help pay for the higher cost of wind energy compared to the alternative standard offer electricity supply, at least during the first several years of the contract term.

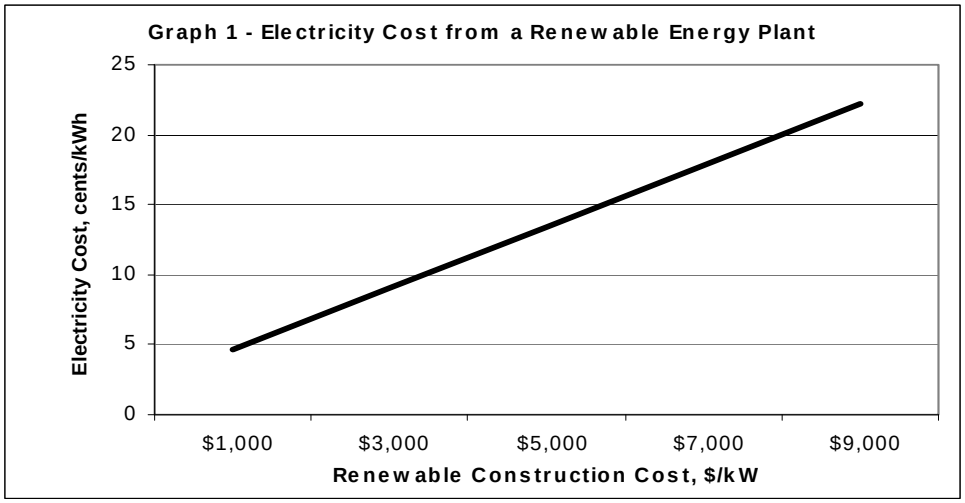
The economics of an electric vehicle program will be largely dependent on the purchase price of electric vehicles. A premium of at least $10,000 would likely be economic for the vehicle owner due to the net lower energy costs of electricity compared to gasoline. An electric vehicle program coupled with a twenty-year contract for wind energy could offer advantages similar to those cited above for home heating customers.

The analysis of a combined heat pump conversion and electric vehicle program presented here assumes that offshore wind could be built at a rate of 123 MW per year beginning in 2012 and increasing to 218 MW per year by 2015. This may be a very difficult schedule to meet considering both the permitting requirements and technology development that must occur. The electrification program could proceed regardless of the wind energy schedule. Marginal energy costs may be low for the next several years, and if they are, an electrification program could generate revenues greater than program costs. Those excess revenues could be dedicated to a fund to support wind energy development or the T&D infrastructure necessary for the program.

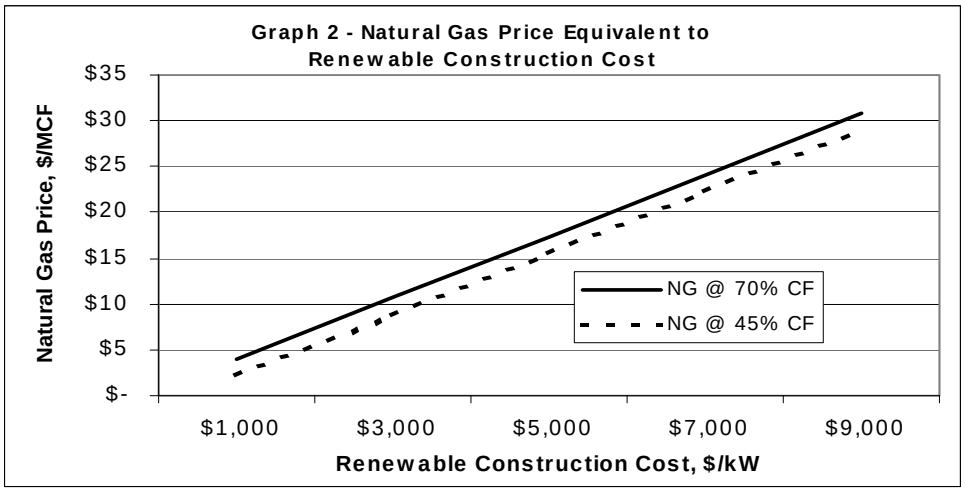
Results of the Analysis

1. Electricity Cost Comparison – Wind vs. Natural Gas

The cost of electricity from an offshore wind turbine, or any renewable resource, was calculated for a range of construction costs from $1,000 per kilowatt to $9,000 per kilowatt. Graph 1 shows that the cost of electricity would vary linearly over this range from about 5 cents per kilowatt hour (kWh) to about 22 cents/kWh. Some onshore wind turbine projects have been constructed for about $2,500 which would equate to an electricity cost of about 8 cents/kWh.



The price for natural gas that would result in equivalent electricity costs from a new combined cycle power plant was then calculated. Graph 2 shows that, for a plant operating at a 70% capacity factor, the equivalent natural gas price would vary from about $4 per thousand cubic feet (MCF) at wind construction costs of $1,000/kW to over $30/MCF at wind construction cost of $9,000/kW. A comparison was all performed with a combined cycle plant operating at a 45% capacity factor, the same as assumed for wind energy. This results in slightly lower equivalent natural gas prices.

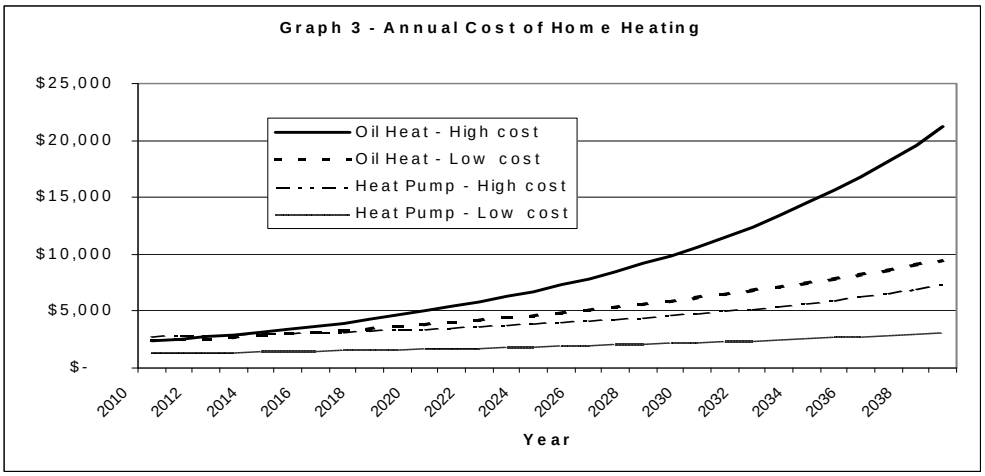


2. Home Heating Comparison – Oil vs. Electric Heat Pumps

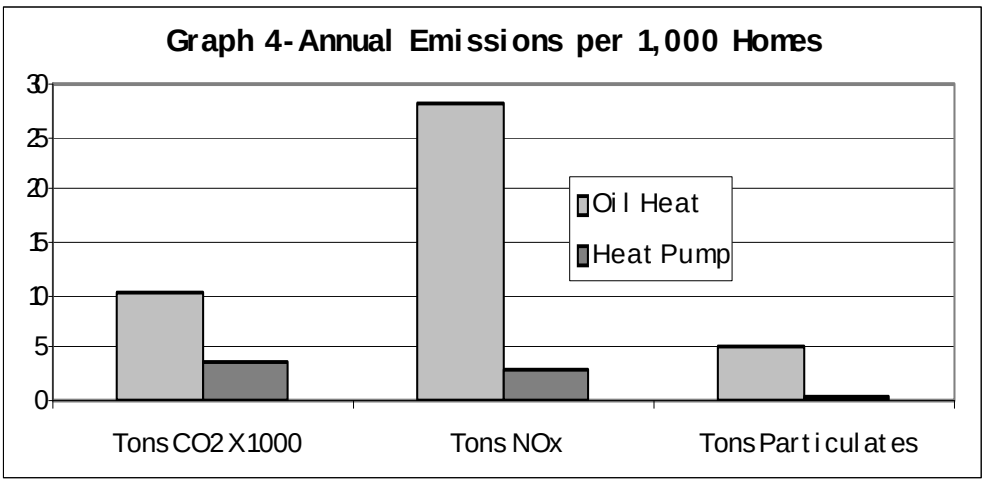
One possible use of electricity from offshore wind is the conversion of space heating from oil furnaces to electric heat pumps. The annual heating bill for a representative home was calculated for four scenarios:

1. Oil Heat – High cost – fuel oil escalating 8% per year.
2. Oil Heat – Low cost – fuel oil escalating 5% per year.
3. Heat Pump – High cost – installation at $30,000.
4. Heat Pump – Low cost – installation at $10,000.

The marginal cost of electric energy is assumed to be 5 cents/kWh in both of the heat pump cases, escalating at 8% per year in the high heat pump case and 5% per year in the low heat pump case. Marginal transmission and distribution costs are assumed to be 1 cent/kWh escalating at 3% per year for both heat pump cases. Graph 3 shows that the low heat pump cost scenario is lower cost than oil heat from the first year. The high heat pump cost scenario becomes equal to the high oil scenario in 2013 and the high cost scenario in 2016.



Another advantage of electric heat pump home heating is the reduction in emissions, even if the source of electricity is a natural gas fired power plant. Graph 4 shows that comparison per 1,000 homes converted. Wind energy would have zero emissions except for the small amount of fuel consumed for construction and maintenance.

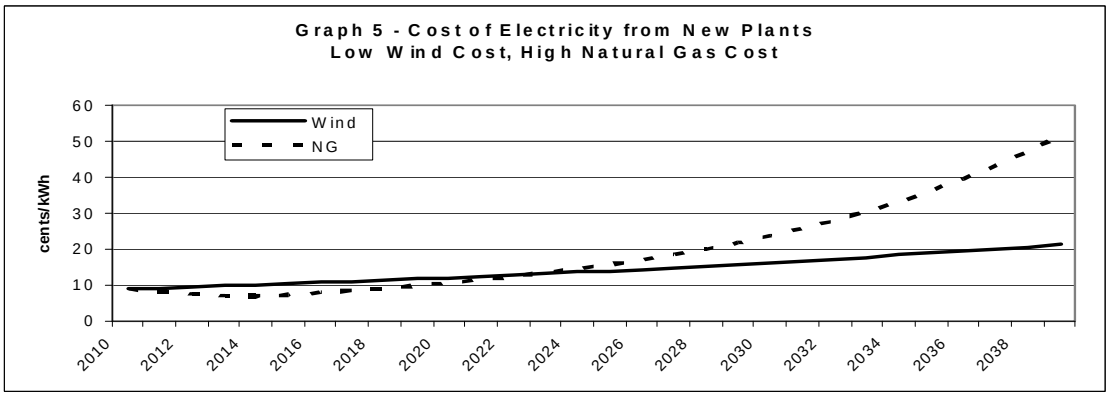


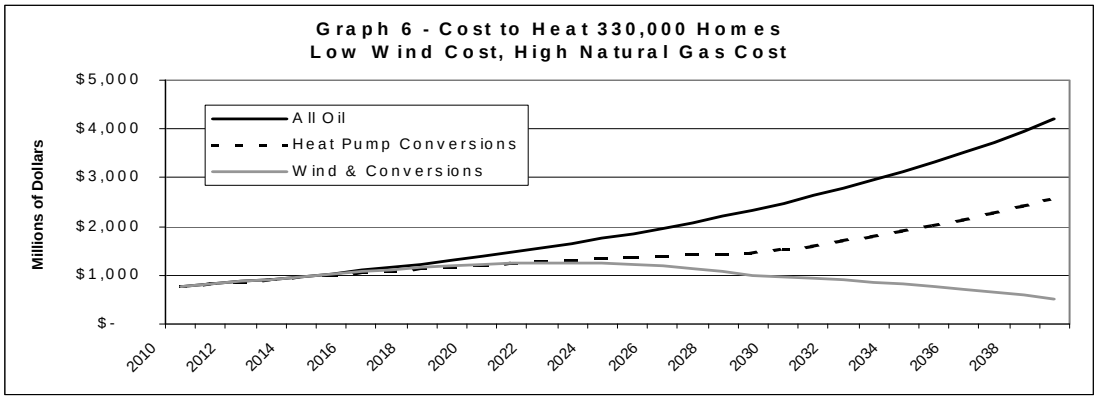
3. Twenty-Year Build Out of Offshore Wind

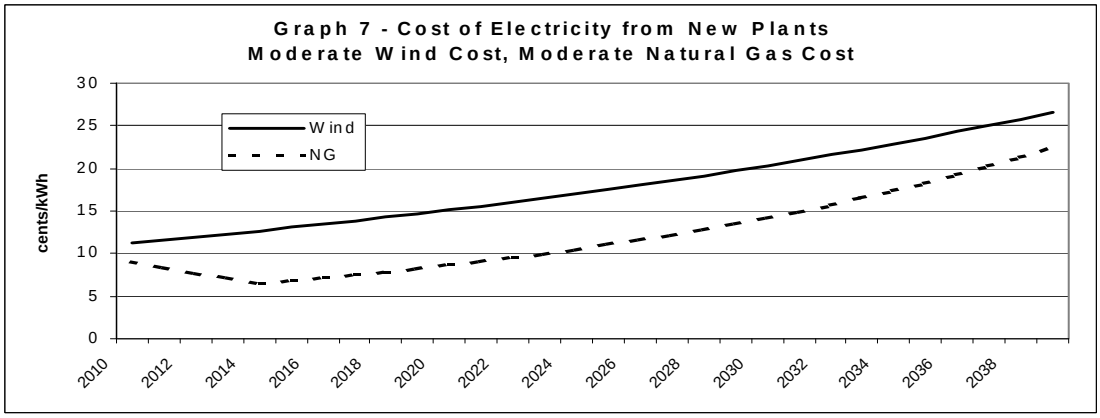
A twenty year program of building wind energy to provide the needs of a heat pump conversion program was evaluated for two different sets of assumptions regarding natural gas prices and offshore wind construction costs. Case 1 assumes low offshore wind construction costs, $3000/kW, and high natural gas prices, escalating at 7% above inflation. Case 2 assumes moderate offshore wind construction costs, $4000/kW, and moderate natural gas prices, escalating at 3% above inflation. Both cases assume the same number of conversions from oil heat to electric heat pumps, reaching an equivalent of 330,000 homes by 2029. This could actually be both commercial and residential conversions that total to the same energy. Both cases also assume wind energy is constructed to serve that new heating load, and that 65% of the energy from the wind turbines is coincident with heating load. Excess wind energy is assumed sold at market prices equivalent to the cost of energy from a new combined cycle natural gas plant. Neither case has assumed additional mainland transmission and distribution or smart grid investment to utilize the new energy, either natural gas or wind, or to implement heating conversions, except that a one cent per kWh marginal transmission rate has been assumed for heat pump conversions. Both cases assume that the electricity energy cost for heat pumps would be priced at the marginal cost of energy from a natural gas fired plant.

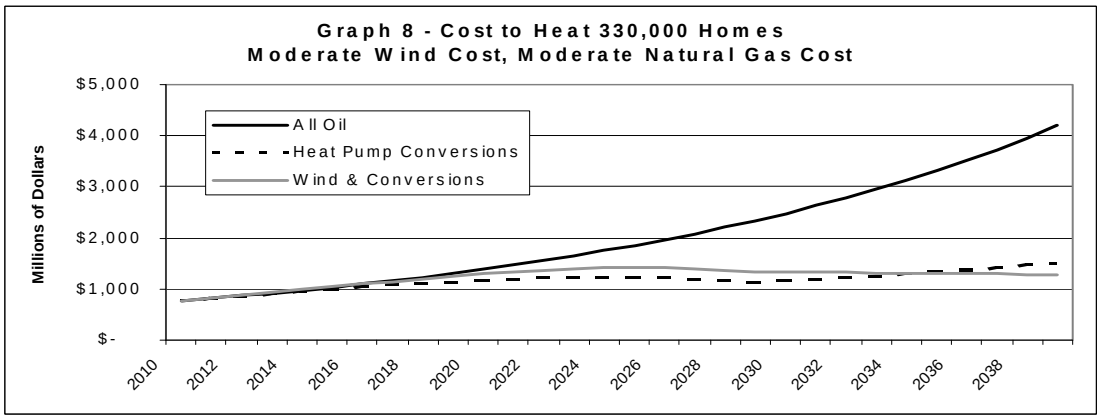
Results for Case 1 are shown in Graphs 5 and 6 and results for Case 2 are shown in Graphs 7 and 8. Graph 5 shows that even with the low construction cost assumptions of Case 1, electricity from offshore wind will likely be more expensive than from natural gas for the next 15 years. With the higher construction costs and lower gas prices of Case 2, those prices don't converge over the next 30 years, as shown in Graph 7. However, Graphs 6 and 8 show that, in either case, conversion to electric heat pumps can save money from the beginning. If those savings could be used to offset the higher cost of wind energy, then the total cost is not largely higher than if homeowners were to stay with oil heat. This "premium" could be viewed as an insurance payment to mitigate fuel price risk. The reason Graphs 6 and 8 show a drop in total costs in later years is that the savings resulting from excess wind energy is credited against the cost of home heating. The energy would of course be used for something else, perhaps electric vehicles.

The assumed conversion rate form oil heat to electric heat pumps reaches a maximum of 22,000 households per year by 2020 and terminates in 2029. This corresponds to a maximum wind turbine construction rate of 97 MW per year by 2020, and a cumulative wind capacity of about 1.4 GW by 2029. If this construction rate were to be extended through 2039, the cumulative wind capacity would be about 2.4 GW.


Graph 5 - Cost of Electricity from New Plants
Low Wind Cost, High Natural Gas Cost
cents/kWh
Wind
NG
0
10
20
30
40
50
60
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
2036
2038


Graph 6 - Cost to Heat 330,000 Homes
Low Wind Cost, High Natural Gas Cost
Millions of Dollars
All Oil
Heat Pump Conversions
Wind & Conversions
$-
$1,000
$2,000
$3,000
$4,000
$5,000
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
2036
2038

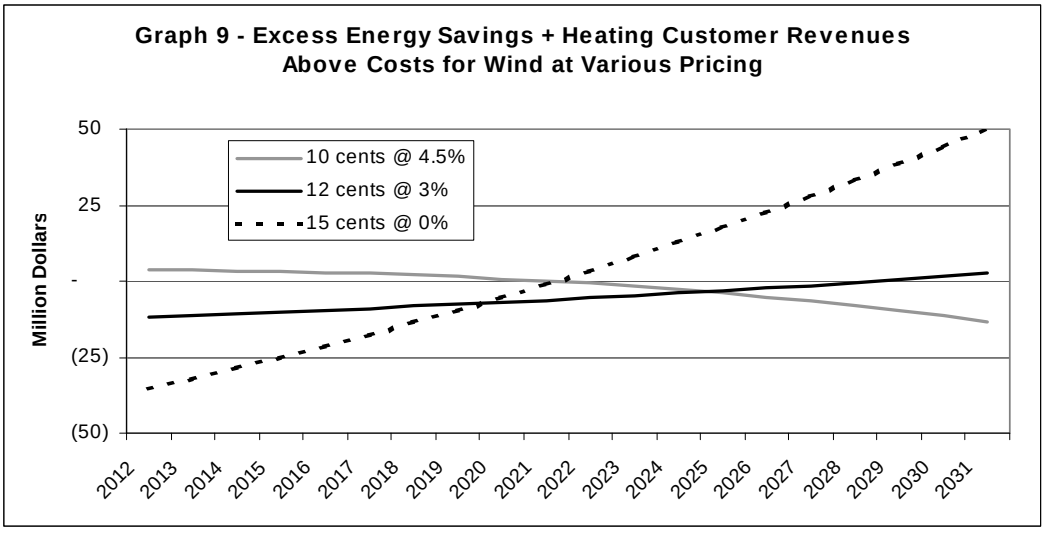

Graph 7 - Cost of Electricity from New Plants
Moderate Wind Cost, Moderate Natural Gas Cost
cents/kWh
Wind
NG
0
5
10
15
20
25
30
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
2036
2038


Graph 8 - Cost to Heat 330,000 Homes
Moderate Wind Cost, Moderate Natural Gas Cost
Millions of Dollars
All Oil
Heat Pump Conversions
Wind & Conversions
$-
$1,000
$2,000
$3,000
$4,000
$5,000
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
2036
2038

4. Pilot Program with 200 MW of Wind Energy

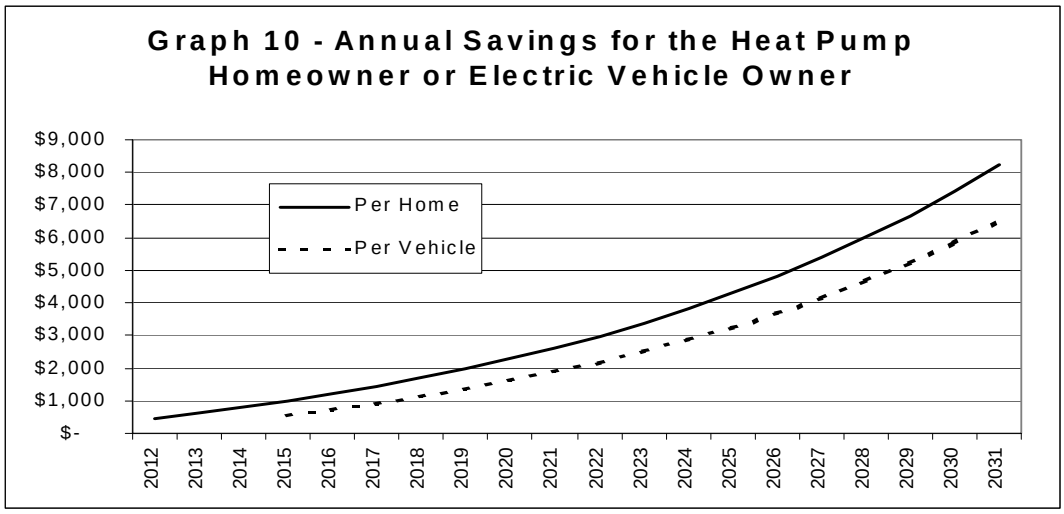
The Task Force asked for an examination of a program to have the Maine PUC solicit bids for 200 MW of offshore wind energy with a 20-year contract. It was assumed that this capacity could be in service by 2012 and that conversions from oil to electric heat pumps would be performed in about 45 thousand homes to use the resulting energy. Calculations were performed for three different pricing scenarios for the wind energy: 1) 15 cents per kWh with no escalation; 2) 12 cents per kWh with 3% per year escalation, and; 3) 10 cents per kilowatt hour with 4.5% per year escalation.

Excess wind energy not used by the heat pumps was assumed to displace standard offer electricity supply. That displaced energy would likely be lower cost than wind energy during the early years of the program, but higher in later years. Graph 9 shows the results at the three different wind pricing scenarios with the heating customers revenues above the cost of the wind energy added to the excess wind energy savings or loss. The result is effectively the subsidy to, in the case of negative amounts, or benefit derived from, in the case of positive amounts, wind energy from other electricity customers.

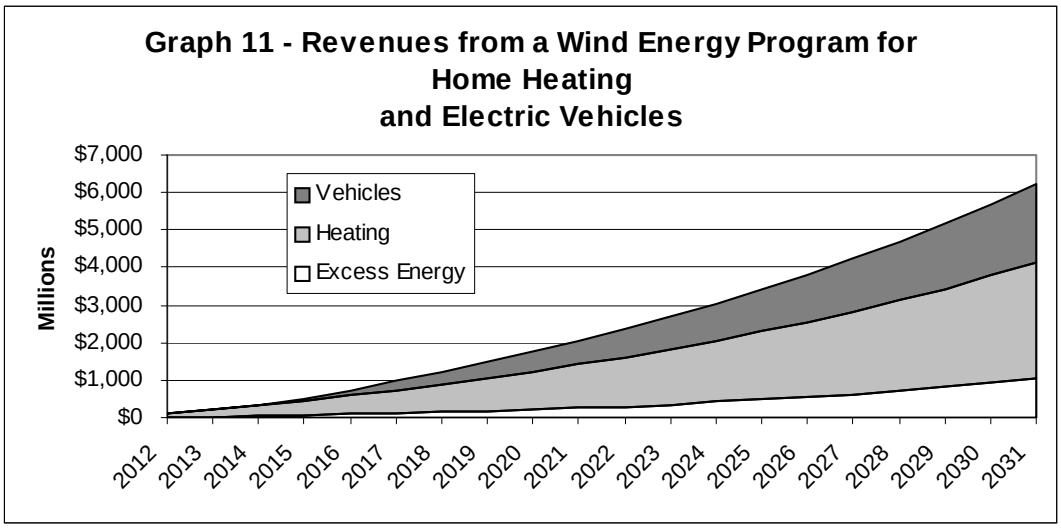


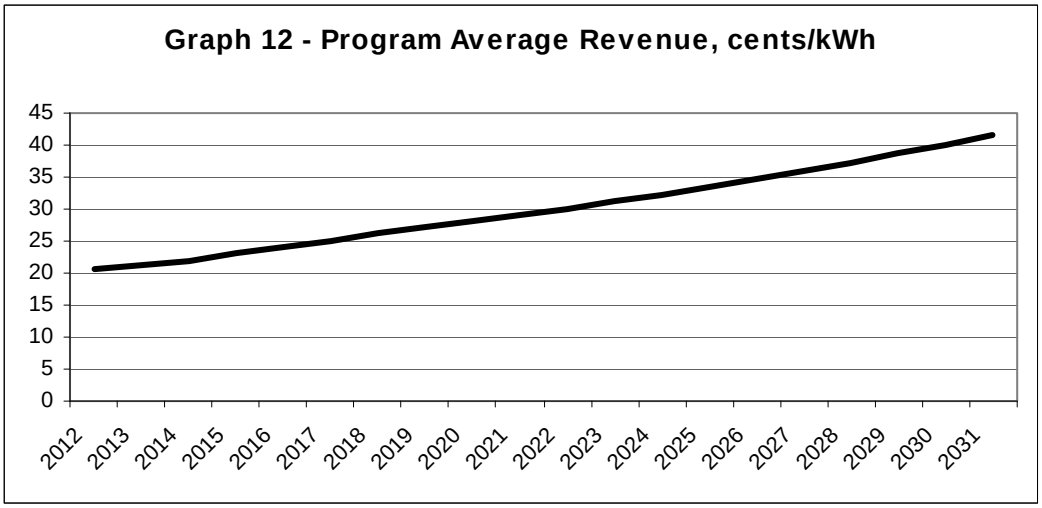
5. Heat Pump Conversion and Electric Vehicle Program Supplied by Wind

An aggressive program of heat pump conversions and electric vehicle sales coupled with the electricity provided from offshore wind was investigated. It was assumed that 35,000 homes per year, or equivalent businesses, would be converted to electric heat pumps beginning in 2012, that 30,000 electric vehicles would be sold per year beginning in 2015, and that 123 MW of wind energy would be installed per year beginning in 2012, increasing to 218 MW per year in 2015. This results in 700,000 home heating conversions, 510,000 electric vehicles sold, and 3.8 GW of new wind capacity by 2031. Graph 10 shows that the homeowner or vehicle owner would enjoy savings from the beginning of the program.

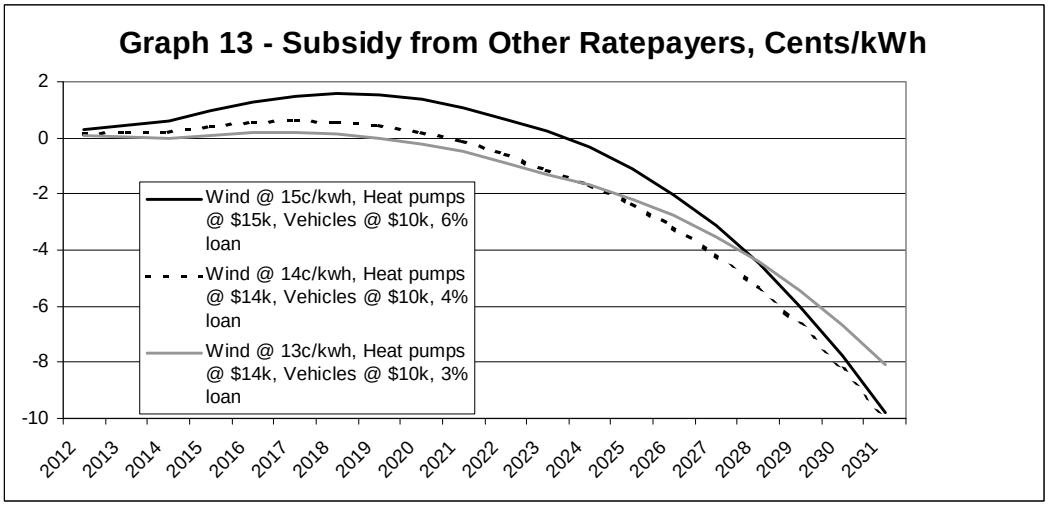


Excess wind energy not consumed by home heating or electric vehicles was assumed sold at market price. The resulting sources of revenue are shown in Graph 11, and the average revenue per kWh of wind energy sold is shown in Graph 12.

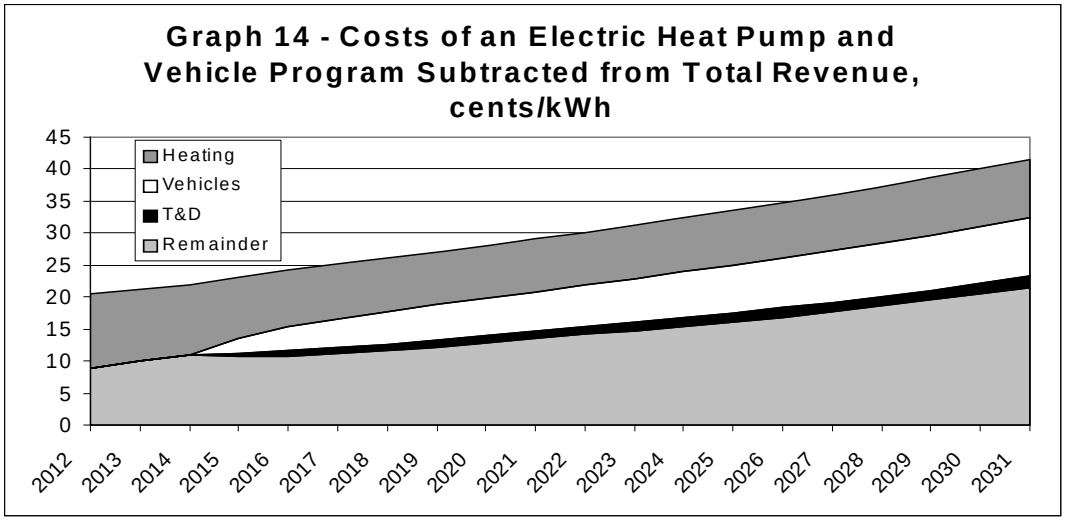


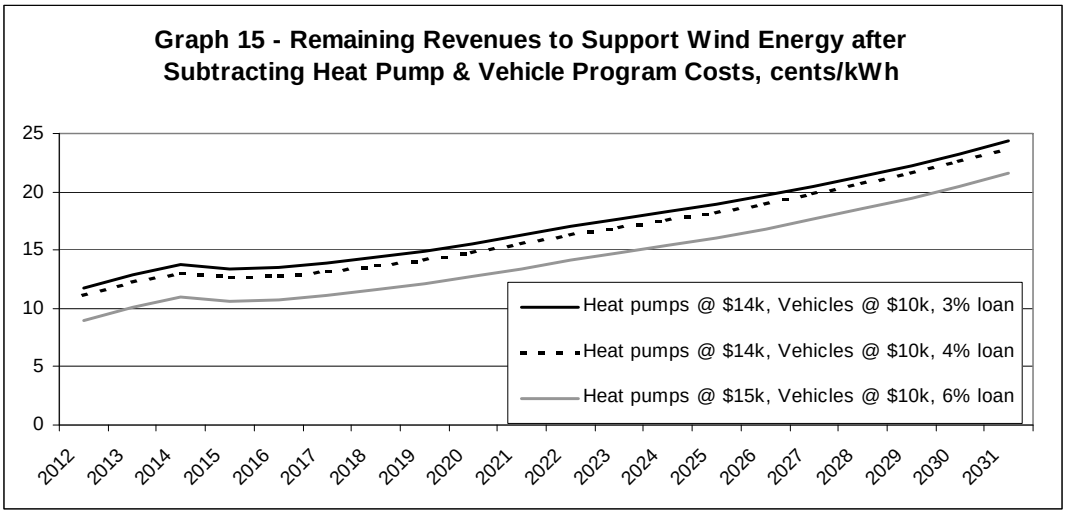


In addition to supporting the wind generators, the revenues from the sale of the wind energy would have to service the loans for the heat pump conversions and the electric vehicle purchase subsidy, and cover the costs of any resulting incremental T&D improvements. Depending on the price of the wind energy, this could result in the need for a subsidy from all other electric customers. The possible impact on other customers at different wind pricing scenarios is shown in Graph 13.



Another way to view the economics of the home heating and electric vehicle program is to subtract program costs from program revenues to determine the residual that could be available for supporting wind energy. Graph 14 shows those components for a program with loans of $15,000 for heat pump conversion and $10,000 for electric vehicle purchases at 6% and about $3 billion incremental investment in T&D. Graph 15 shows how that remaining revenue might vary at different program costs.





The estimated annual emissions reductions resulting from this combined heat pump and vehicle program supplied by wind energy, with no credit given to reductions that might result from excess energy sales, are:

	Heating	Vehicles	Total
Thousand tons of CO2	7,175	3,488	10,663
Tons of NOx	19,600	Not calculated	
Tons of Particulates	3,675	Not calculated	

Elements of an Example Heat Pump/Wind Energy Program

A pilot program of conversion of home heating from oil furnaces to electric heat pumps coupled with offshore wind energy production would accomplish several important goals:

- Cost savings and stabilization for the participating homeowners.
- An immediate reduction in greenhouse gas and particulate emissions.
- A stimulus to offshore wind production.
- Operating experience and data to guide a larger program.

A program could be designed that would be at no cost to the homeowner. Homes would have to pass a qualifying energy audit and building suitability inspection. New construction could be qualified based on building design. The cost of conversion or construction could be rolled into the monthly electricity bill through a loan attached to the house, so that if the house were sold, the obligation would be to the new owners. All system maintenance and repairs would be guaranteed for 20 years. A special tariff would be created for the heat pump load and it would be guaranteed not to increase faster than some portion of inflation, for example, 75%, for twenty years. The tariff would not include embedded T&D company costs, but would include a nominal component to cover T&D company marginal costs. The tariff would be set above program costs for the first several years to subsidize excess wind energy costs higher than the alternative standard offer rates.

Offshore wind energy companies would bid to provide up to 200 MW of capacity. The Maine PUC, or another agency, would enter into a 20 year unilateral contract to purchase the energy at fixed prices. Preference might be given to bids that start out lower but escalate at a faster rate than others, although this option might not be attractive to the generators.

The T&D companies, the Maine PUC, or another agency would administer the program. This would involve qualifying homeowners to participate, providing financing for the program, and managing the installation and maintenance of the heat pump systems. Different options for financing the conversions should be explored. Any federal or state efficiency grants available should be used. Additional funding might come from a federal loan program, or a state bond could be issued to cover the costs. Regardless of the source, payback would be from savings realized by the homeowners, not from taxpayers.

The excess wind energy not used by heat pump customers would be rolled into the remaining standard offer tariff. This might result in higher tariffs the first several years, but lower tariffs later.

Guide to the Excel Workbooks
Five Excel workbooks support the graphs presented here. Their titles match the graphs that they support. All input assumptions are highlighted with shaded cells. Changing one of the shaded cells will propagate that assumption throughout all of the worksheets within that workbook.

Workbook "Graphs 1 & 2"
This spreadsheet calculates the cost of electricity from a renewable energy plant over a wide range of construction costs. It can be assumed that the generator lead cost to get the electricity to the grid is included in the construction cost so that the comparison to a mainland natural gas fired combined cycle plant is at the same point. The amount of the capacity assumed installed has no impact on the cost of electricity per kWh calculation, but it impacts the total construction cost and the total annual costs. The spreadsheet back calculates natural gas prices that result in electricity cost equivalent to the renewable energy plant.

Workbook "Graph 3 & 4"
This workbook includes three tabs. The "Low costs" tab includes calculations for heating a home with low oil cost escalation and alternatively heating a home with a low cost heat pump. The "High costs" tab includes calculations for heating a home with high oil cost escalation and alternatively heating a home with a high cost heat pump. The results are summarized on the "Graphs" tab. Calculations are also performed for the emissions from heating with oil or using an electric heat pump with the electricity generated at a natural gas fired plant.

Workbooks "Graphs 5&6" and "Graphs 7&8"
The "30 Yr Wind vs. NG" tabs of theses workbooks calculate the electricity cost from a wind turbine or from a natural gas fired plant installed in each year. The "Heat buildout" tabs calculate the impact on the heating customers. The "Required Wind" tabs calculate the amount of wind capacity necessary to serve the specified number of homes and also calculate the net value of the excess wind energy not used for heating. Results are on the "Graphs" tabs.

Workbook "Graph 9"
The "10 cents", "12 cents", and "15 cents" tabs each calculate the cost of a 200 MW wind energy program, in place by 2012, to serve 45,545 homes converted to heat pumps. The net value of excess wind energy not used for heating is also calculated as is the individual homeowner impact. The only differences between the three tabs are the wind energy pricing assumptions. Results are on the "Graph" tab.

Workbook "Graphs 10 through 15"
This workbook analyzes a heat pump conversion and electric vehicle program supplied by wind. The tab titles are self explanatory.

Major Assumptions

Parameter	Value	Source
Wind capacity factor	45%	General literature
Renewable annual carrying charge	8.6%	80% debt @ 6.5%, 20% equity @ 10%, 20 year life
Wind O&M cost	$100/kW-yr	$50 Vinal Haven per George Baker, double for offshore
Wind coincidence with heat load	65%	George Hart data base
NG plant capacity factor	45% and 70%	See note 1
NG plant cost	$1000 per kW	ISO New England
NG annual carrying charge	8.2%	80% debt @ 6.5%, 20% equity @ 10%, 30 year life
NG plant O&M	$50/kW-yr	George Hart
NG plant heat rate	6500 BYU/kWh	ISO New England
Natural gas cost	$4.00 per MCF	Recent experience
Furnace efficiency	80%	General literature
Heating oil cost in 2012	$3.00 per gallon	Recent experience
Cost of heat pumps	$10,000 to $30,000	Discussions with vendors and homeowners
Heat pump coefficient of performance	2.8	Air source published at 3.1, ground source at 5
Electric vehicle loan	$10,000	
Heat pump and vehicle loan rate	6%	
Gasoline cost in 2010	$3.00 per gallon	
Gasoline escalation	8% per year	
Gasoline consumption per vehicle	700 gallons/year	
Incremental T&D investment for heat pump & vehicle program	$3 billion by 2031	
Cost of wind turbines	$1000 to $9000/kW	See note 2

Notes

1. One way to evaluate the value of generation provided by a renewable energy source is to compare the cost of electricity produced by that source to the cost of electricity produced by new alternative non-renewable generation. A natural gas fired combined cycle unit was chosen for this comparison. One comparison is shown with the natural gas plant operated at the same capacity factor as the renewable resource. This is an extreme case because the combined cycle plant has load following capabilities and availability assumed at 90% by ISO New England. Therefore, a 70% capacity factor for the combined cycle plant was also considered.
2. Onshore experience has been $2,500 or less per kW. European shallow water has been 2,200 Euros per kW. Deep water is uncertain. Habib Dahger postulates that dry dock construction and material advances could actually cause deep water to cost less than shallow water. Turbine and power train advances to lighten the machines could also reduce the per unit cost due to more capacity on the same size tower.

Appendix 4: Subcommittees – Members and Topical Focus

Subcommittee #1: Environmental and Human Impacts

Focus: Compilation in GIS format all available data on fish and wildlife and human uses of the Gulf of Maine; identification of critical data gaps; development of criteria to help select sites for ocean renewable energy projects; and related public outreach to potentially affected communities and stakeholders. Map-based information resources developed by subcommittee #1, in consultation with University of Maine researchers, have informed and facilitated SPO and DOC efforts under P.L. 2009 c. 270 (see below) to identify areas in Maine's coastal waters in which siting of wind energy demonstration projects is facilitated under the terms of a DEP-administered general permit.

Chair: Sean Mahoney

Members: Rep. Herb Adams, Leslie Harroun, George Lapointe, Kathleen Leyden

Staff: Linda Mercer, Matt Nixon

Subcommittee #2: Regulatory and Permitting Process

Focus: Identification of legislation needed to improve the efficiency of the state permitting and submerged lands leasing processes governing the siting and permitting of commercial offshore wind, wave, and tidal projects, including the associated transmission infrastructure; and continuation of discussions with federal agencies to ensure coordination and collaboration aimed at improving the efficiency of the permitting of ocean energy projects in both state and federal waters.

Chair: Kathleen Leyden

Members: Habib Dagher, Dick Davies, Rep. Stacey Fitts, Angus King, George Lapointe, David Littell, Sean Mahoney, Pat McGowan, Dan Prichard

Staff: Todd Burrowes

Subcommittee #3: Transmission, Grid Access, Utility Incentives

Focus: Identification of potential electric transmission and energy policy-related hurdles facing development of Maine's offshore wind, wave, and tidal power resources and the actions needed at the state, regional, and federal levels to incentivize such development. Questions explored include: existing transmission capacity and constraints; transmission requirements and costs; integration of large quantities of intermittent resources into the electric grid; smart grid needs and penetration; and generator financial requirements and mechanisms to address them (e.g., contract issues, federal and state incentives).

Chair: David Flanagan

Members: George Baker, Parker Hadlock, George Hart, Sen. Barry Hobbins, John Kerry, Sharon Reishus

Staff: Denis Bergeron, Jennifer Puser, Mitch Tannenbaum

Subcommittee #4: Economic Development Opportunities and New Technologies

Focus: Examination of job creation and workforce development issues associated with growth anad development of the ocean energy industry in Maine and its ocean energy business cluster; identification of incentives Maine currently provides and should provide to attract offshore renewable energy development and the manufacture of platforms, turbines and component parts; and exploration of actions to expand penetration of emerging technologies that will enable use of renewable energy to heat homes and power the transportation sector in Maine.

Chair: Tim Agnew

Members: Habib Dagher, Parker Hadlock, Leslie Harroun, George Hart, Sen. Kevin Raye, Cathy Renault

Staff: Cathy Renault

Subcommittee #5: Tidal Power

Focus: Identification of Maine's tidal generation potential and the human and ecosystem impacts of tidal power development; review of pertinent state and federal permitting and submerged lands leasing requirements and recommendation of any changes needed to streamline and improve the efficiency of the permitting process for commercial tidal projects.

Chair: Parker Hadlock

Members: Rep. Herb Adams, Rep. Stacey Fitts, John Kerry, Sen. Kevin Raye

Staff: Jennifer Puser

Subcommittee #6: Oil and Gas

Focus: Assessment of the oil and gas resource for Maine's Outer Continental Shelf and George's Bank as well as the costs and benefits of the exploration and development of that resource, including the compatibility of such exploration and development with other existing and potential uses of the OCS and George's Bank.

Chair: Robert Marvinney

Members: Rep. Stacey Fitts, Sen. Barry Hobbins, Sean Mahoney

Staff: Bob Marvinney

Subcommittee #7: Interim Steps/Coordination

Focus:. Identify and facilitate resolution of differences among recommendations of the topically-focused subcommittees

Chair: Angus King

Members: Rep. Herb Adams, Tim Agnew, Rep. Stacey Fitts, David Flanagan, Parker Hadlock, Sen. Barry Hobbins, Kathleen Leyden, Sean Mahoney, Bob Marvinney, Beth Nagusky, Don Perkins, Sen. Kevin Raye

Subcommittee #8: Post OETF Entity

Focus: Develop a recommendation regarding establishment of a public-private entity to coordinate and lead ocean renewable energy development efforts in the State, building on the Task Force's work to date and other pertinent public and private initiatives.

Chair: Sean Mahoney

Members: Angus King, David Flanagan, Parker Hadlock, Beth Nagusky, Karin Tilberg

Appendix 5: Maine's Ocean Energy Business Cluster

Note: This list of company names is illustrative only, and is not intended to and does not reflect an endorsement of the listed entity or its products or services by the State or the Task Force.

Cluster Element	Description	Examples of Maine Companies
Component Manufacturing	Manufacturers of components that make up the final ocean energy project	US Windblades, Bath Kenway Corporation, Augusta Lyman Morse, Thomaston Custom Composites Technologies, Bath Harbor Technologies, Brunswick Mid-State Machines, Winslow Newport Industrial Fabrication, Newport Northeast CNC, Portland
Manufacturing and Construction	Assembly of components, staging of systems, fabrication of structures	Bath Iron Works, Bath Cianbro, Brewer Reed and Reed, Woolwich
Developers	Technology and project development, financing, siting and permitting	Ocean Renewable Power Company, Portland and Eastport First Wind, Newton, MA and Portland Blue Water, Hoboken, NJ Principle Power, Seattle, WA and Camden
Installation, Repair, Operations and Maintenance	All activities related to the installation, ongoing operations, repair and maintenance	
Production Services	Engineering and other professional services, data gathering for permitting, material testing	HDR - Devine Tarbell, Portland Stantec- Portland, Topsham, Presque Isle Maritime Applied Physics Corporation Alion Science and Technology Bernstein Shur-Portland, Augusta Pierce Atwood- Portland, Augusta
Institutional and Regional Assets	University and nonprofit research and development, trade associations, ports	University of Maine activities in environment and energy, marine research and aquaculture, composites and advanced materials. E2Tech Maine Composites Alliance Maine Wind Industry Alliance Maine Manufacturing Association Maine Port Authority Larkin Enterprises Delorme, Yarmouth Northern Maine Community College (training) Northeast Technical Institute (training)

Appendix 6: Assessment of Oil and Gas Development Potential in the Gulf of Maine

Oil and Gas Potential in Maine
Onshore and Offshore

Compiled by R.G. Marvinney, State Geologist, Maine Geological Survey, November 2009

Executive Summary

- Many decades of geologic mapping reveal that there is very little potential for oil and gas accumulations onshore in Maine. With the possible exception of a small area in northernmost Maine, through multiple mountain-building episodes, the rocks of Maine have been subjected to temperatures higher than that which generates and preserves hydrocarbons.
- The onshore oil and gas province in southeastern New Brunswick is in geological units that are younger and less deformed than those found in Maine.
- State coastal waters (to here nautical miles from the mainland and coastal islands) are underlain with geology similar to that of the mainland. There is no potential for oil and gas accumulations in state waters.
- Geologists have investigated the deeper portions of the Gulf of Maine through various geophysical techniques and surveys. Most of the geology is interpreted to be similar to the onshore geology of coastal New England has little potential for oil and gas generation and accumulation. Triassic basins in part of the Gulf may have some potential, but similar basins in eastern North America, both onshore and offshore, have no known economic reserves.
- There is potential for oil and gas accumulations on the Georges Bank. The most recent estimates of undiscovered reserves by the Minerals Management Service are 2 billion barrels of oil and 18 Tcf natural gas for the entire North Atlantic Planning area, which extends from offshore New Jersey through the Gulf of Maine.
- Due to proximity, most potential benefits from the development of oil and gas on the Georges Bank would be to states other than Maine.
- There is some risk to Maine's coastal environment from potential oil and gas development activities on the Georges Bank, but these risks are probably no greater than those posed by current hydrocarbon transportation activities in the Gulf of Maine.
- Recommendation: DOC and SPO, as lead agencies, should monitor proposed federal legislation and federal planning activities regarding oil and gas development on the OCS, including the MMS' preparation of 5-year leasing plans pursuant to the Outer Continental Shelf Lands Act, and in consultation with DMR, other state agencies, and the Governor's office, as appropriate, prepare state comments in accordance with the Task Force's finding that the Gulf of Maine, in comparison to other areas of the OCS, has low potential and does not merit further oil and gas development efforts.

Introduction

Geological Investigations: Over many decades of investigations, geologists have developed a robust framework for the geology of Maine and the waters of the Gulf of Maine. During the period 1836-1839 at the direction of the Maine Legislature, Charles Thomas Jackson conducted the first comprehensive geological survey of the State (Jackson, 1837; 1838; 1839), although he produced no map from this work. The first geologic map of the state, authored by Charles H. Hitchcock (1885) outlined the nature of Maine's bedrock that has been subsequently refined by many later studies. This early work identified the high-grade metamorphic rocks of western and southwestern Maine, enormous granitic and related intrusive rock bodies, particularly along the eastern coast, and the fossiliferous slates of northern Maine. Among the first modern geologic maps was that produced by U.S. Geological Survey geologists Smith, Bastin and Brown (1907) on the geology of Penobscot Bay. Since then, an army of academic, government, and consulting geologists have developed a clear and enduring understanding of the geology of Maine, as summarized in two statewide maps (Hussey, 1967; Osberg and others, 1985). Investigations ranging from basic geologic mapping to sophisticated deep-seismic reflection studies continue to improve our understanding of Maine's geology.

General geology

The geologic history recorded in Maine's bedrock covers more than half a billion years. Over this period of time the geologic processes of erosion and sedimentation, mountain-building, deformation (folding and faulting), metamorphism, and igneous activity, have acted to produce the complex bedrock of the state, dominated by metamorphic and igneous rocks. Geologists have identified hundreds of bedrock formations and igneous intrusions distinguished on the basis of age and rock type. For the purpose of this summary, these rocks have been grouped into eight major units (Figure 1). Seven groups of stratified rocks (layered rocks, including both sedimentary and volcanic rocks) are differentiated here. These are grouped on the basis of their age and possible place of origin. The eighth unit comprises all the major igneous plutons in the state. Maine plutons range in age from Ordovician through Cretaceous (500 to 65 million years old), with the preponderance being Late Silurian to Devonian (430 to 360 million years) in age, and all crystallized from molten magma of various compositions. Each of the major rock groups will be discussed briefly in the following summary.

Over the hundreds of millions of years of time recorded in the geology of Maine, the rocks we now recognize as bedrock have been involved in several significant tectonic events. Plate tectonics is the theory that the crust of the earth is composed of large, mobile plates. As they move across the globe, plates interact in fundamental ways. In places one plate may plunge or subduct beneath another. Current examples are where the Pacific plate is plunging beneath the Bering Sea, producing the Aleutian Islands. Where the Pacific Plate plunges beneath the continent of South America, it results in the volcanoes of the Andes Mountains. Where two plate of continental crust collide, mountain ranges, such as the Himalayas, are thrust up. In other places, plates are being pulled apart, or rifted, producing large volumes of volcanic rocks. The mid-Atlantic rift system, including Iceland, is an example in oceanic crust. An example in continental crust is the east African rift system. The geology of Maine records multiple episodes of subduction with attendant volcanic rocks, minor rifting, and collisions of subduction-related volcanic islands and micro-continental plates with the eastern margin of ancestral North America.

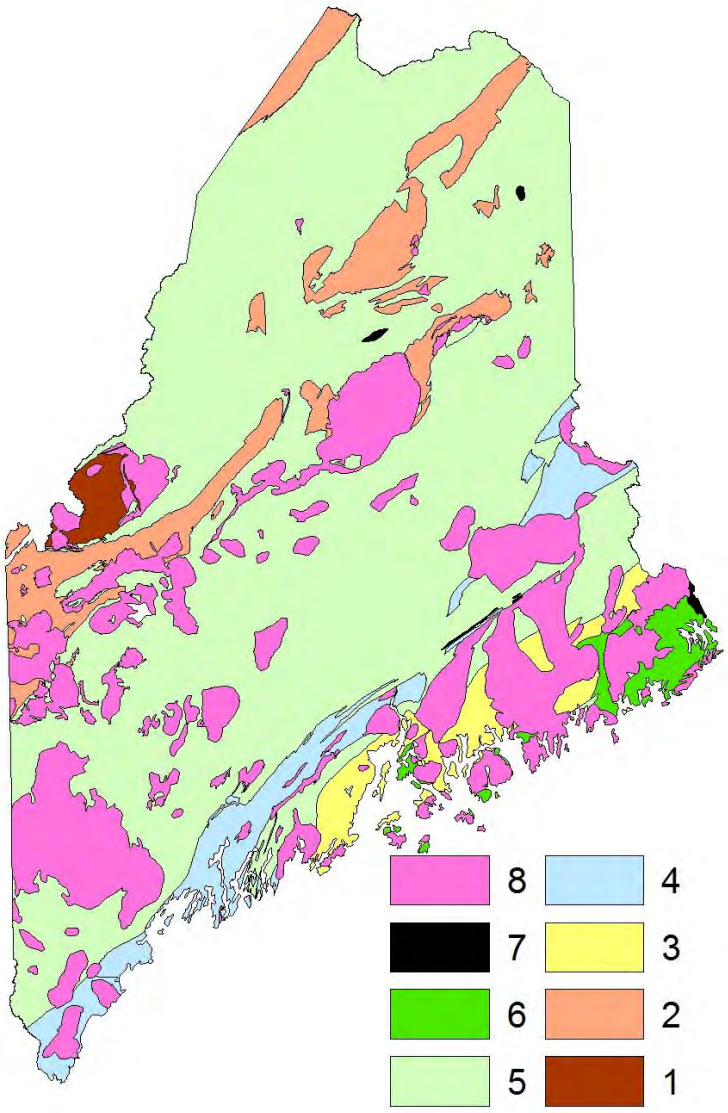


Figure 1.
Generalized geologic map of Maine. Modified from Osberg and others, 1985.

Precambrian geology (older than 545 million years), Unit 1: The primary area of Precambrian rocks is in northwestern Maine (Figure 1). The geology there contains a complex sequence of metamorphosed sedimentary and volcanic rocks long thought to include the oldest rocks in Maine. Some of these rocks may be as old as 1.5 billion years, significantly older than the Precambrian rocks of the closest North American crust to the west (Boone and Boudette, 1989). Some sedimentary and volcanic rocks on islands in Penobscot Bay were metamorphosed and cut by a pegmatite dated at 647 ± 4 million years old (Stewart and others, 1998), and are therefore also Precambrian.

Early Paleozoic rocks (545 to 443 million years ago,) Unit 2 and Unit 4: During the earliest Paleozoic time, several island chains composed of volcanic and sedimentary rocks formed through subduction within the ancestral Atlantic Ocean. These island chains or arcs collided with the older rocks of Unit 1 in the first generally recognized orogenic (mountain building) event in Maine, the

Penobscottian orogeny (Neuman, 1967). Deformation (folding and faulting) and low-grade metamorphism associated with this event are recorded in Precambrian through Upper Cambrian and lowest Ordovician rocks throughout the central portion of the state (Boone and Boudette, 1989).

Following rapidly on the heels of this event was the Taconian orogeny of Middle Ordovician time (~ 450 million years ago). As originally described by Zen (1972) and Rodgers (1971), during this event the various sedimentary rocks (sandstone, shale, limestone) of the continental shelf and slope were sliced and essentially stacked up on the continental margin. In Maine, the Cambrian through Ordovician rocks of northernmost Maine, primarily, (Unit 2, Figure 1) show the effects of this event. Most geologists recognize this event as the collision of one or more island arc terranes with the eastern margin of North America (see Drake and others, 1989; Boone and Boudette, 1989). Limited igneous activity accompanied the Taconian orogeny and several significant Ordovician plutons are included in unit 8 (Figure 1).

Unit 4 consists of Cambrian through Ordovician volcanic and sedimentary rocks that were part of a terrane which collided with North America during the Taconian orogeny. They have been metamorphosed to such high degree that most of the rocks are now gneisses.

Early Paleozoic Events Preserved in Coastal Maine (545 to 443 million years ago), Unit 3: Geologists' understanding of the older rocks of coastal Maine has been complicated by more recent high grade metamorphism, which has obscured much of the evidence for their early history of the rocks. A general lack of age constraints in the form of fossils or datable rocks compounds the problem. In spite of this, a distinct geologic terrane has been identified through careful mapping. It is composed of highly metamorphosed volcanic and sedimentary rocks. The tectonic origin of these units is even more speculative than that of the northern Maine rocks partly because any rocks related to subduction processes which brought these terranes together either have not been recognized or were later destroyed.

Uncertainty as to place of origin and mode of emplacement also extends to the Silurian and Lower Devonian volcanic rocks (440-390 million years) of coastal Maine (Unit 6, Figure 1). The character of the volcanic rocks of the eastern part of this group indicates a rifting or divergence event that occurred elsewhere along a margin of the ancestral Atlantic Ocean (Gates and Moench, 1981). Likewise, the volcanic rocks of the central coastal portion of this group have some characteristics indicative of an island arc (subduction) setting.

Middle Paleozoic (443 to 360 million years ago) Unit 5: The orogenic events of the Early Paleozoic caused regional uplift which led to an unknown amount of erosion of the older rocks. In Late Ordovician time there was subsidence and renewed deposition along the eastern North American margin. In fact, geologists now can demonstrate evidence in Silurian rocks for rifting or divergence of plates, which is superimposed on the convergence structures of the older rocks (see Osberg and others, 1989). The ancestral Atlantic Ocean then consisted of a narrow basin which received sediment through Silurian and Devonian times from both the east and west.

The Silurian and Devonian rocks throughout central Maine are characterized by sandstone and slate which were originally sediments deposited in a deep-sea setting (see for example Hanson and Bradley, 1989). That much of these rocks have an eastern source means that in the east there must have been an uplifted, mountainous area which was shedding material through erosion. Initiation of an eastern source area is interpreted by many to herald the beginning of the next and most significant orogenic episode, the Acadian orogeny. This represented a collision in the Early

Devonian between North America and a very significant land mass to the east, either the combined European/African continent, or a large intervening plate, or both. The dominant structural "grain" in Maine, the northeast-southwest trending belts that characterize the distribution of rock types, is due to the Acadian orogeny. Osberg and others (1989) review this development in detail. Another important geologic feature caused by this event is the high-grade metamorphism exhibited by the rocks in southwestern and coastal Maine. Original sandstones, shales, and volcanic rocks in these regions have been metamorphosed to high-grade gneisses and in places have even melted because they were up to 9 miles beneath the mountains hurled upward in this event. The vast majority of igneous plutons in the state owe their existence to the Acadian orogeny (Unit 8).

Following the Acadian orogeny in the Early Devonian, limited deposition of post-orogenic sediments occurred in scattered locales, providing evidence of geologic conditions in Middle and Late Devonian time. These scattered deposits form the last major group of stratified rocks shown on the geologic map (Unit 7) and represent erosion of the mountains built during the Acadian orogeny. These rocks consist mostly of sandstones and conglomerates deposited on land.

Maine's geology contains no stratified rock units younger than the Devonian, about 360 million years in age. There are a few younger igneous intrusions in southern Maine.

Metamorphism and its bearing on the preservation of hydrocarbons: All of the tectonic events described in the previous section included components of metamorphism. Through the application of heat and pressure, the original mineral components of rocks change to forms more stable under the specific conditions, usually with the expulsion of water, CO_2, and other gases. This is the process of metamorphism. Therefore, geologists can use characteristic suites of minerals to establish the metamorphic conditions that acted on rock units in the geologic past.

Guidotti (1989) provides an excellent overview of the metamorphic history of Maine rocks, based on characteristic mineral suites. From southwest to northeast across the state, metamorphic grade progressively decreases from highly metamorphosed rocks to those that are weakly metamorphosed rock (Figure 2). The highest-grade metamorphic rocks in southern Maine contain various amphibole minerals plus K-feldspar and were heated to at least 600°C. In some areas of the south, rocks have been heated beyond the melting point. Progressing to the northeast, the amphibolite grade rocks experienced at least 500°C. Much of the central and eastern parts of the state experienced greenschist-grade metamorphism with the development of abundant chlorite at between 350°C and 500°C. From about the latitude of Mt. Katahdin northward, the rocks are only weakly metamorphosed, having experienced temperatures in about the 200°C range. There are three small rock bodies that post-date the significant metamorphic events and they are all terrestrial in origin – the Trout Valley formation of Baxter State Park, the Mapleton Sandstone near Presque Isle, and the Perry Formation on the St. Croix River near Eastport.

It has been well documented by petroleum geologists that the optimum temperature range for the development of hydrocarbons from the naturally occurring organic material in sedimentary rocks is about 100-200°C (Figure 3). Above about 225°C, organic carbon is converted to graphite. In fact, graphite is a common mineral in many of the metamorphosed sedimentary rocks of Maine.

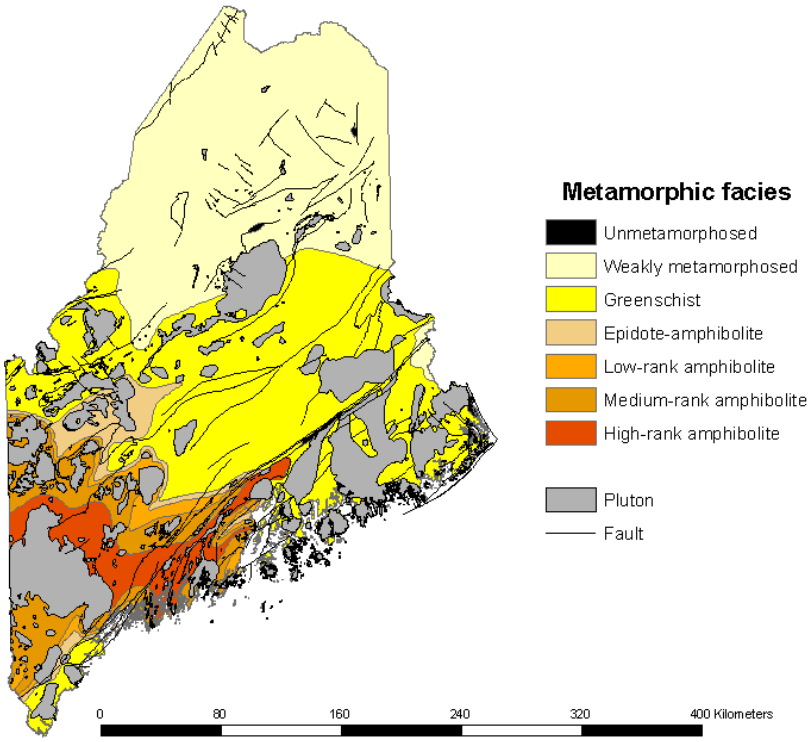


Figure 2.
Generalized metamorphic map of Maine. Modified from Guidotti, 1985. Metamorphic grade increases from light yellow to dark red colors. Intrusive igneous rocks (mainly granites) are shown in gray

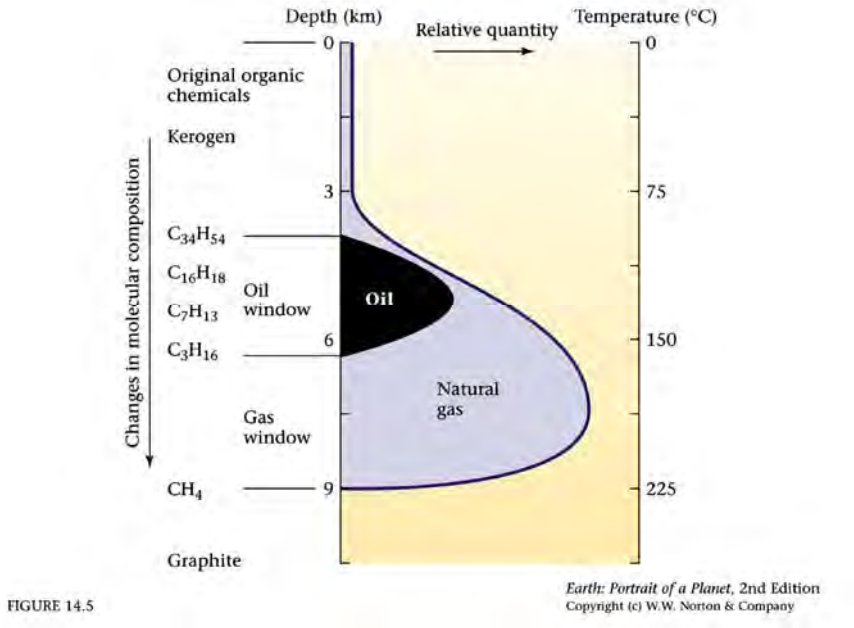


Figure 3.
Conditions for oil and gas generation in organically rich sedimentary rocks. Oil is generated between ~80-150°C. Above 225°C, all the organic components in rocks are converted to graphite. Graphite is a common component of Maine's metamorphic rocks.

In a study of the reflectance of graptolites (a common fossil type), Malinconico and Roy (1993) established a small zone in northern Maine that may not have exceeded the thermal conditions for hydrocarbon generation. (Assessing "reflectance" of organic materials in rocks is a well-accepted method of establishing their thermal maturity.) In the map (Figure 4), the areas in green experienced the thermal conditions required for gas generation, and the light blue for oil. The lavender area near the northern border did not achieve temperatures high enough for hydrocarbon generation. Therefore, if there are sufficiently organic rich source rocks in this section of northern Maine, there may be limited hydrocarbon potential. In New Brunswick, there has been some hydrocarbon exploration near Campbellton on Chaleur Bay in similar rocks.

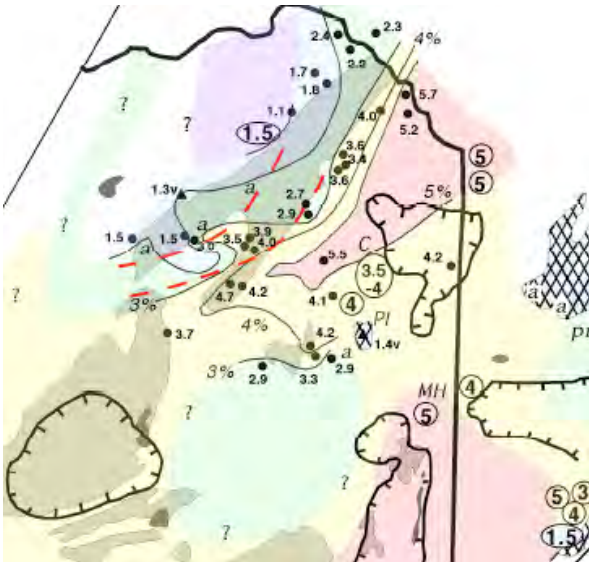


Figure 4.
Map of northern Maine showing thermal maturity of rock units based on graptolite reflectance and other thermal indices. Areas shown in yellow and orange have been heated beyond the temperatures necessary for oil and gas generation. From Malinconico and Roy (1993).

Gas Province of Coastal New Brunswick: The coastal area of New Brunswick in the area of Moncton is experiencing resurgence in gas exploration. Several fields have been producing gas and small quantities of oil in the past several years, most notably the McCully field (Figure 5). These fields are located within the Maritimes Basin of eastern New Brunswick – a thick sequence of unmetamorphosed sedimentary rocks that rest unconformably above the highly metamorphosed older rocks of western New Brunswick and eastern Maine. The Maritimes Basin contains lacustrine and fluvial sandstones, terrestrial red beds, and marine carbonates. These units are of Carboniferous age (290-354 million years ago). Rocks of this province do not extend westward into Maine.

Figure 5.
The extent of Carboniferous basin rocks with oil and gas potential are shown in yellow. Areas shown in dark brown and blue are metamorphosed older rocks. From New Brunswick Dept. Mineral Resources.

Summary of onshore hydrocarbon potential

Due to significant tectonic events with attendant weak to high-grade metamorphism, almost all of Maine's rocks have been heated well above the temperature required for hydrocarbon generation. The one exception is a small area of northernmost Maine that may have escaped these high temperatures. The productive gas province of eastern coastal New Brunswick is in unmetamorphosed younger sedimentary rocks that do not extend into Maine.

Offshore Oil and Gas potential

Hydrocarbon potential of Maine's Coastal Waters: Maine's coastal waters extend to three nautical miles offshore from the mainland and coastal islands. Beyond three miles, waters of the Gulf of Maine are in federal jurisdiction. Geologists know a great deal about the geology of the State's marine waters. Well-exposed rocks on Maine's coast have attracted geologists for centuries. Some particularly detailed investigations of coastal geology are Hussey and others (2008) in southern Maine, Gates (2001) in central coastal Maine, Gilman and others (1988) at Mount Desert Island, and Gates (1977) in eastern coastal Maine. All of these efforts and many more confirm that the immediate coastal areas and coastal islands have experienced a similar geologic history to the remainder of Maine. Multiple tectonic and metamorphic events have affected these rocks. They have been heated to between 300-500^{o}C and have been intruded by numerous igneous rocks, including the Vinalhaven granite (Devonian), the Cadillac granite (Silurian), and the gabbro that makes up most of Monhegan Island (Devonian).

Geologists have also investigated the submarine geology of Maine's state waters. Kelley and others (1998) summarize a multiyear effort to characterize the ocean bottom using side-scan sonar and seismic reflection profiling. Side-scan sonar images reveal a rocky bottom that shows the same northeast-southwest orientation of rocky ridges as are found onshore. High-frequency seismic surveys reveal a thin (10s of meters thick) veneer of marine mud and glacial deposits overlying deformed rocks. In places, the thin marine mud generates gas from decaying organic material, such as in Belfast Bay (Kelley and others, 1994) where pockmarks develop in the seafloor through gas-escape processes. Similar to swamp gas or landfill gas, there is no economical way to exploit the disseminated gas in the thin marine mud.

Because of the high degree of metamorphism and intrusion of numerous bodies of molten magma, Maine's state waters to three miles offshore has no potential for economically exploitable hydrocarbons.

Gulf of Maine hydrocarbon potential – between three miles offshore and the northern margin of the Georges Bank: While geologists know less about the deeper portions of the Gulf of Maine, there is still considerable information on which to develop a framework of the general geology. One of the very first applications of seismic refraction techniques in the Gulf of Maine was by Katz and others (1953). Their work investigated the nature of the crust along a traverse that extended from about 25 miles seaward of Yarmouth to about 35 miles seaward of Mount Desert Island. The compressional wave velocities they determined with this experiment are consistent with granite similar to that exposed on the coast of Maine.

Ballard and Uchupi (1972) summarized some of the early seismic reflection and refraction work done in the Gulf of Maine. This work helped delineate several Triassic basins within the Gulf of Maine, part of the Fundy rift system that developed in the early stages of the opening of the Atlantic Ocean. These rift basins are largely filled with terrestrial deposits.

The work of Hutchinson and others (1988) summarizes much of what is known about the geology of the Gulf of Maine. Their map (Figure 6), based on seismic reflection profiles and aeromagnetic surveys, delineates several Triassic rift basins related to the Fundy rift system. Due to a series of sidestepping faults, the rift basins are located progressively farther offshore as one moves from the Bay of Fundy to the southwest. Based on aeromagnetic signatures similar in strength and pattern to those of the subaerial igneous and metamorphic terranes, on seismic refraction velocities, and interpreted seismic reflection profiles, Hutchinson and others (1988) conclude that most of the Gulf of Maine inboard of the Triassic basins is underlain with the extension of the terranes of igneous and metamorphic rocks that geologists have mapped throughout New England.

With regard to oil and gas potential of this region of the Gulf, most is underlain with high-grade metamorphic rocks that have been heated beyond the optimum conditions for ouil and gas generation and accumulation. There is potential for oil and gas in the Triassic basins of the Gulf, but analogous basins elsewhere in eastern North America, both onshore and offshore have no known economic reserves of hydrocarbons (Paul Post, Minerals Management Service, personal communication, October, 2008).

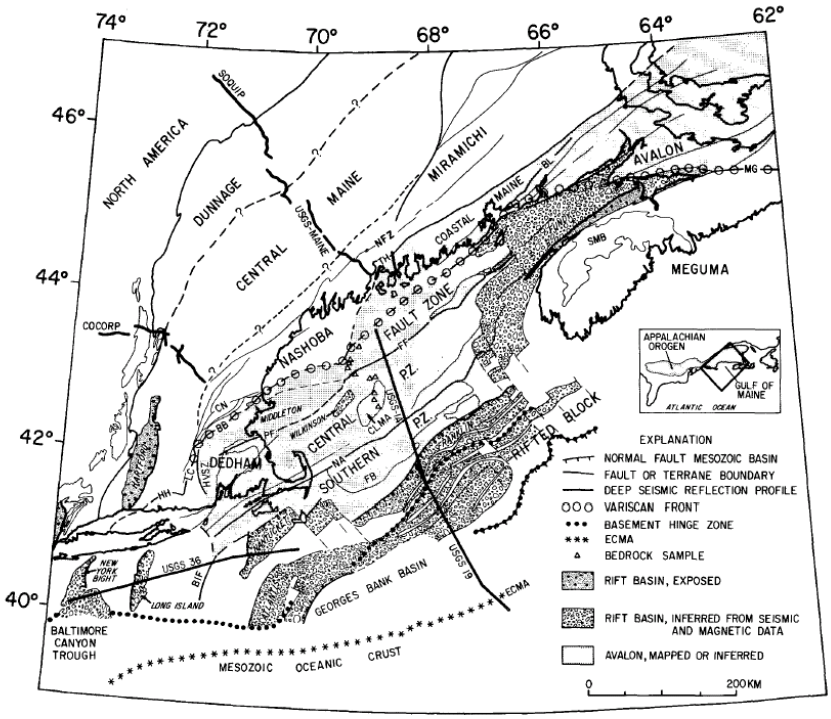


Figure 6. Generalized tectonic map of the Gulf of Maine from Hutchinson and others (1988). Dark gray areas are Triassic rift basins. Areas labeled "P.Z." are dominated by intrusive igneous rocks (plutons).

Georges Bank Area: The area with the highest potential for oil and gas reserves is the Georges Bank, a relatively shallow plateau situated more than 100 miles southeastward from the Maine coast. The oval shaped Bank is approximately 150 miles long, 75 miles wide, and with waters as shallow as 30 meters along its northwest edge, forms a barrier to the deeper Gulf of Maine waters to the north (Figure 7). The Georges Bank is underlain with a sequence of Upper Triassic through Cretaceous sedimentary rocks that include interlayered sandstones, limestones, and anhydrite (Edson and others, 2000). The northeastern most portion of the Georges Bank falls within Canada's territorial waters.

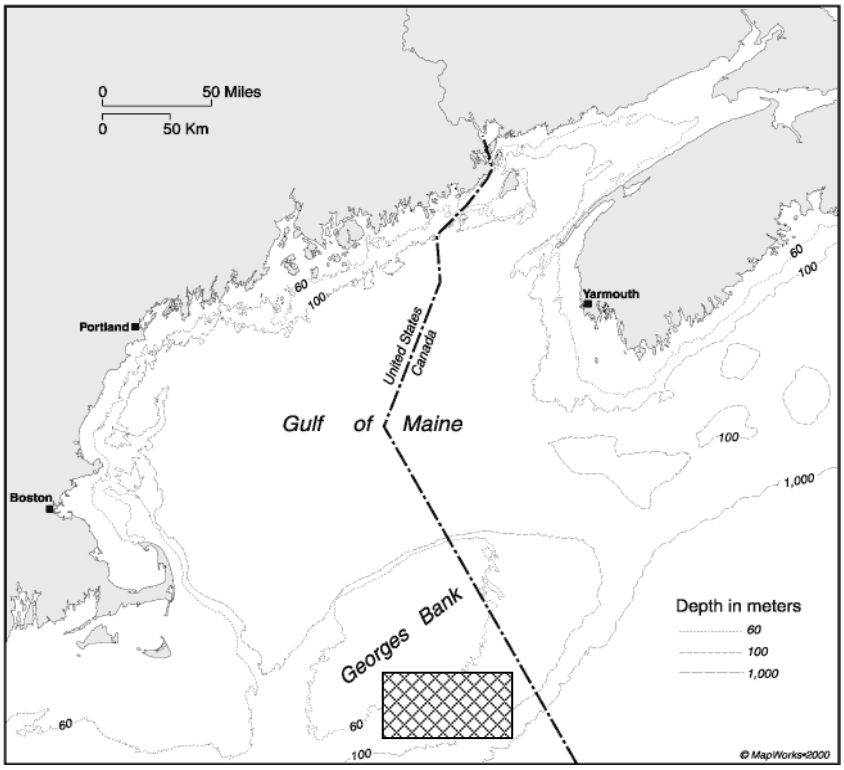


Figure 7. Outline map of the Gulf of Maine and Georges Bank. Cross-hatched box shows the approximate location of leases and exploration wells of the 1970s and 1980s. Modified from Gulf of Maine Times (2000).

The only oil and gas exploration activity on the Georges Bank was conducted during the 1970s and early 1980s when 10 wells were drilled in the most promising areas identified through the best exploration methods then available. In a summary report, the Minerals Management Service indicated that hydrocarbons were not discovered in these wells, that thermally mature source rocks are lean in the organic material necessary to generate hydrocarbons, and that other units lacked adequate porosity to be considered good reservoir rocks (Edson and others, 2000). The Georges Bank was under annual congressional moratoria on oil and gas leasing from 1982 to 2008. No wells have been drilled on the Canadian portion of the Georges Bank and a leasing moratorium has also been in effect there since 1988.

In neighboring Nova Scotia, however, the industry has demonstrated that geology similar to that of the Georges Bank can be productive. Since exploration began on the Scotian shelf in the 1950s, 24 significant hydrocarbon discoveries have been made in this part of Canada's outer continental shelf (Canada-Nova Scotia Petroleum Board). These have been mostly natural gas discoveries. The most notable, Sable Island, may eventually produce a total of 2 trillion cubic feet (Tcf) of gas, although estimates vary widely. Since the Sable Island discovery over 30 years ago, a very active exploration program has brought little additional reserve forward. With improved technologies, exploration is advancing toward deeper waters, which may hold the best potential for significant new reserves.

The government of Nova Scotia is actively supporting exploration activities on the Scotian Shelf due, in part, to the revenue sharing agreement with Canada's national government that brings to the province $500 million in royalties annually (Canada-Nova Scotia Petroleum Board). In 2010, the governments of Canada and Nova Scotia will decide whether or not to extend the moratorium on Georges Bank leasing which is set to expire at the end of 2012.

While past exploration has not uncovered notable reserves, nor found conditions generally favorable for hydrocarbon accumulation, there is some potential for petroleum discoveries on Georges Bank and elsewhere in the North Atlantic. The Minerals Management Service (MMS) periodically conducts assessments of undiscovered hydrocarbon reserves of the outer continental shelf nationwide, most recently in 2006 (MMS, 2006). These assessments take into account past exploration data and information from new discoveries in areas with analogous geology, which for the Georges Bank include the Scotian Shelf. The assessment of undiscovered, technically recoverable reserves for the entire North Atlantic Planning Area, which extends from the border with Nova Scotia in the Gulf of Maine to the Delaware border, has a mean of 2 billion barrels of oil and 18 Tcf natural gas (Table 1). The greater proportion of this potential is probably in the southern part of this region near New Jersey where earlier exploration wells discovered gas. For comparison purposes, this same assessment indicates that the Gulf of Mexico area contains undiscovered reserves of 45 billion barrels of oil and 230 Tcf of gas – over 20 times more oil and 12 times more gas than the entire North Atlantic Planning Area. Additionally, Gulf of Mexico states already have in place the infrastructure necessary to support exploration and development activities.

Oil and gas exploration and development techniques have improved dramatically in the past 30 years, and if applied to the Georges Bank could possibly generate new discoveries, but these would likely be small compared to other areas of the Outer Continental Shelf.

Table 1.
Estimates of undiscovered oil and gas for the Atlantic and Gulf of Mexico planning areas (MMS 2006)

Region / Planning Area	Undiscovered Technically Recoverable Oil and Gas Resources (UTRR)									Undiscovered Economically Recoverable Oil and Gas Resources (UERR)					
	Oil (Bbo)			Gas (Tcfg)			BOE (Bbo)			$46/Bbl $6.96/Mcf		$60/Bbl $9.07/Mcf		$80/Bbl $12.10/Mcf	
										Oil (Bbo)	Gas (Tcfg)	Oil (Bbo)	Gas (Tcfg)	Oil (Bbo)	Gas (Tcfg)
	95%	Mean	5%	95%	Mean	5%	95%	Mean	5%	Mean		Mean		Mean	
Atlantic OCS	**1.12**	**3.82**	**7.57**	**14.30**	**36.99**	**66.46**	**3.67**	**10.40**	**19.39**	**2.23**	**13.70**	**2.57**	**17.28**	**2.84**	**20.75**
North Atlantic	0.57	1.91	3.80	7.18	17.99	32.17	1.85	5.12	9.52	1.15	6.91	1.32	8.65	1.45	10.32
Mid-Atlantic	0.43	1.50	2.96	5.44	15.13	27.53	1.39	4.19	7.85	0.81	5.12	0.94	6.60	1.06	8.05
South Atlantic	0.13	0.41	0.81	1.67	3.86	6.76	0.43	1.10	2.01	0.27	1.67	0.30	2.04	0.33	2.38
Gulf of Mexico OCS	**41.21**	**44.92**	**49.11**	**218.83**	**232.54**	**249.08**	**80.15**	**86.30**	**93.43**	**35.79**	**162.83**	**38.20**	**184.79**	**40.21**	**201.55**
Western Gulf of Mexico	9.80	10.70	11.80	62.65	66.25	70.17	20.95	22.49	24.28	8.69	51.86	9.25	56.47	9.71	59.87
Central Gulf of Mexico	28.41	30.32	32.77	134.49	144.77	156.56	52.33	56.08	60.62	24.23	101.00	25.82	114.98	27.16	125.67
Eastern Gulf of Mexico	2.76	3.88	5.51	18.06	21.51	25.98	5.97	7.71	10.13	2.85	9.96	3.11	13.32	3.33	16.00
Straits of Florida	0.01	0.02	0.03	0.01	0.02	0.02	0.01	0.02	0.04	0.01	0.01	0.01	0.01	0.01	0.01

Summary oil and gas potential, offshore Gulf of Maine

The geology of the marine waters of the State of Maine (3 nautical miles offshore) is an extension of the immediate coastal geology mapped by geologists for decades. The high degree of metamorphism and numerous igneous intrusions preclude any oil and gas accumulations in this area.

Farther offshore, but still north of the Georges Bank, most of the Gulf is underlain with similar geology to that which has been mapped by geologists throughout New England. For the same reasons noted above it is highly unlikely that significant oil and gas reserves occur here. The exceptions are the Triassic basins, but analog basins on land and offshore have no known economic reserves.

The Georges Bank has clear potential for oil and gas generation and accumulation, although early exploration work was not encouraging. The geology of the Georges Bank is similar to gas producing areas of the Scotia Shelf. Minerals Management Service estimates of undiscovered reserves in the Georges Bank are small in comparison to other areas of the outer continental shelf of the United States.

Potential benefits of Georges Bank oil and gas development

Georges Bank oil and gas development could provide benefits to the state of Maine, the Northeast region, and the U.S. Although a substantial period of time is necessary for exploration and development activities, eventually, new hydrocarbon resources could be brought on line that, in small measure, reduce dependence on unstable foreign sources. In addition to the exploration and development jobs themselves, such activities would generate on-shore support jobs. However, it is unlikely that such development will bring substantial direct benefits to Maine. The proximity of the Georges Bank is such that any support base for exploration and development activities there would likely be situated in Massachusetts or Rhode Island. However, Maine has a track record of benefiting from petroleum exploration. One Maine corporation recently constructed two semi-submersible platforms for petroleum development; their work would certainly be enhanced by Georges Bank development. However, this corporation has also demonstrated that they can compete globally since those two rigs were deployed in waters off Brazil.

Potential risks oil and gas development

Oil and gas development poses risks to the marine environment, as summarized in a report from the National Research Council, *Oil in the Sea III: Inputs, Fates, and Effects* (2003). This report catalogs the sources of petroleum in the seas in these groups: natural seepage, petroleum extraction, petroleum transportation, and petroleum consumption.

Natural seepage: In perhaps its most controversial conclusion, the report identifies natural seepage as the source of about 60% of the petroleum entering North American waters. Because it is difficult to directly measure natural seeps, this estimate has high uncertainty compared to others in the report. By their nature, petroleum releases from natural seeps tend to be chronic and at low rates.

Extraction activities: While extraction activities are responsible for far smaller quantities of petroleum in marine waters (about 3% of anthropogenic releases), extraction-related spills can be large and catastrophic. Improved equipment and safety training in the past several decades has reduced the incidence of extraction-related releases in the marine environment.

Transportation activities: Petroleum transportation also results in significant releases to the marine environment, for North American waters representing 9% of anthropogenic releases. However, by their very nature such releases are catastrophic and often in large volumes along sensitive coastal areas. Currently, the largest threats to Maine coasts come from two sources: transportation of petroleum to and by the Portland-Montreal pipeline, and Irving's oil refinery in St. John, NB. The Portland-Montreal pipeline has a capacity of over 500,000 barrels of petroleum products each day, all of which comes to Portland via ship (Pipeline website, 2009). While there have been relatively few spills there, the notable *Julie N.* spill of 1996 released about 4,000 barrels of oil into the Fore River, requiring a $43 million clean-up effort (National Transportation Safety Board, 1998). [Note that this spill was unrelated to activities of the Portland-Montreal pipeline.] Irving Oil refines about 110 million barrels of crude oil in St. John annually (Irving Oil, 2009), most of which arrives via ship. In the period 1989-2007, Irving reported no spills greater than 1,000 barrels at its refinery (St. Ross Environmental Research, 2008).

Consumption activities: Petroleum releases related to consumption activities form the largest proportion of anthropogenic releases to North American waters, about 85%. These are very small, chronic releases, and mostly on land but introduced to marine waters through run-off, and storm and waste water systems.

Georges Bank: Georges Bank is the most westward of the great Atlantic fishing banks - those now-submerged portions of the North American mainland that extend from the Grand Banks of Newfoundland to Georges Bank. They rank among the world's most productive fisheries. Lying adjacent to New England's famous seaports, Georges Bank is single-handedly responsible for the development of coastal fisheries in towns such as Gloucester, Massachusetts and Portland, Maine. The varied nature of sedimentary environments on Georges Bank is a key element in the development of the biological community. Seafloor sediment originally was transported to the bank by glaciers. During and after glacial retreat, the rise of sea level and the action of tidal and storm currents marked the start of an erosional episode on the bank that continues today. Gravel formed through this process is an important habitat for the spawning and survival of several fishery species (USGS). For instance, distribution patterns of juvenile cod indicate that the gravel habitat is where they are best able to avoid predators and to find food sources. The topography and position of the

bank result in upwelling of nutrient-rich waters circulating in the Gulf of Maine. These nutrients, introduced into the sunlit waters over the bank, and interaction with warm Gulf Stream currents on the southern edge of the Banks, support exceptional rates of productivity, including many species of commercial importance. These are important spawning, juvenile and feeding grounds for cod, haddock, herring, and other commercial species. The scallop resource on Georges Bank is also very productive and valuable. In Maine, a substantial portion of the fishing fleet is dependent on the Georges Bank, and the largest dollar value of the commercial catch brought to Maine ports comes from this location.

Certainly, there are issues with over-fishing the Georges Bank, but government efforts focus on managing the fishery to rebuild stocks. Under current conditions, the fishery resources of Georges Bank are important to the economy of Maine and New England. With rebuilding of these resources, their economic value will be increased very significantly.

Summary Recommendation

Our nation needs sources of oil and gas for the near term that are not vulnerable to foreign ownership and control, including sources from the federal Outer Continental Shelf (OCS). Oil and gas development efforts on the OCS should be focused in the areas with the greatest potential, and where the potential environmental impacts are minimized. Furthermore, the geology of the Gulf of Maine precludes direct comparisons with hydrocarbon production areas on the Scotian Shelf, such as Sable Island.

The Department of Conservation and the State Planning Office, as lead agencies, should monitor proposed federal legislation and federal planning activities regarding oil and gas development on the OCS, including the MMS' preparation of 5-year leasing plans pursuant to the Outer Continental Shelf Lands Act, and in consultation with DMR, other state agencies, and the Governor's office, as appropriate, prepare state comments in accordance with the Task Force's finding that the Gulf of Maine, in comparison to other areas of the OCS, has low potential and does not merit further oil and gas development efforts.

References

Ballard, R. D., and Uchupi, E., 1972, Carboniferous and Triassic rifting: A preliminary outline of the tectonic history of the Gulf of Maine, Geological Society of America, Bulletin, v. 83, no. 8, p. 2285-2302

Boone, G. M., and Boudette, E. L., 1989, Accretion of the Boundary Mountains terrane within the northern Appalachian orthotectonic zone, *in* Horton, J. W., Jr., and Rast, N. (eds.), Melanges and olistostromes in the U.S. Appalachians: Geological Society of America, Special Paper 228, p. 17-42.

Canada-Nova Scotia Offshore Petroleum Board: http://www.cnsopb.ns.ca/

Drake, A. A., Jr., Sinha, A. K., Laird, J., and Guy, R. E., 1989, The Taconic orogen, *in* Hatcher, R. D., Jr., Thomas, W. A., and Viele, G. W. (editors), The Appalachian-Ouachita orogen in the United States: Geological Society of America, The Geology of North America, v. F-2, p. 101-177.

Edson, G.M., Olson, D.L., and Petty, A.J., 2000, Georges Bank Petroleum Exploration: Minerals Management Service OCS Report 2000-031, 20 p.

Gates, O., 1977, Geologic map and cross sections of the Eastport quadrangle, Maine, Maine Geological Survey, Geologic Map GM-3, 19 p. (map, scale 1:48,000)

Gates, O., 2001, Bedrock geology of North Haven and Vinalhaven Islands, Maine Geological Survey, Open-File Map 01-352, scale 1:24000

Gates, O., and Moench, R. H., 1981, Bimodal Silurian and Lower Devonian volcanic rock assemblages in the Machias-Eastport area, Maine: U.S. Geological Survey, Professional Paper 1184, 32 p.

Gilman, R.A., Chapman, C.A., Lowell, T.V., and Borns, H.W., Jr., 1988, The geology of Mount Desert Island; a visitor's guide to the geology of Acadia National Park, Maine Geological Survey, Bulletin 38, 50 p.

Guidotti, C. V., 1985, Generalized map of regional metamorphic zones, *in* Osberg, P. H., Hussey, A. M., II, and Boone, G. M., 1985, Bedrock geologic map of Maine: Maine Geological Survey, scale 1:500,000.

Guidotti, C. V., 1989, Metamorphism in Maine: an overview, *in* Tucker, R. D., and Marvinney, R. G. (editors), Studies in Maine geology: Volume 3 - igneous and metamorphic geology: Maine Geological Survey, p. 1-17.

Gulf of Maine Times, 2000, Vol. 4, No. 1, map copyright MapWorks 2000.

Hanson, L. S., and Bradley, D. C., 1989, Sedimentary facies and tectonic interpretation of the Lower Devonian Carrabassett Formation, north-central Maine, *in* Tucker, R. D., and Marvinney, R. G. (editors), Studies in Maine geology: Volume 2 - structure and stratigraphy: Maine Geological Survey, p. 101-126.

Hitchcock, C. H., 1885, Geological map of Maine, in [Colby's] Atlas of the State of Maine: George N. Colby & Co., Houlton, Maine, p. 27 (scale approximately 1:1,267,200)

Hussey, A.M., II, 1967, compiler, Preliminary bedrock geologic map of Maine: Maine Geological Survey, 1:500,000.

Hussey, A.M., II, Bothner, W.A., and Thompson, P.J., 2008, Bedrock geology of the Kittery 1:100,000 quadrangle, Maine and New Hampshire, Maine Geological Survey, Open-File Map 08-78, scale 1:100000

Hutchinson, D. R., Klitgord, K. D., Lee, M. W., and Trehu, A. M., 1988, U. S. Geological Survey deep seismic reflection profile across the Gulf of Maine, Geological Society of America, Bulletin, v. 100, no. 2, p. 172-184.

Irving Oil website, 2009, http://www.irvingoil.com/company/refinery.asp

Jackson, C.T., 1837, First report on the geology of the State of Maine, Smith & Robinson, Printers to the State, Augusta, Maine, 128 p.

Jackson, C.T., 1838, Second report on the geology of the State of Maine, Luther Severance, Printer, Augusta, Maine, 168 p.

Jackson, C.T., 1839, Third annual report on the geology of the State of Maine, Smith & Robinson, Printers to the State, Augusta, Maine, 276 p.

Katz, S., Edwards, R.S., and Press, F., 1953, Seismic refraction profiles across the Gulf of Maine, Geological Society of America, Bulletin, v. 64, no. 2, p. 249-251.

Kelley, J.T., Barnhardt, W.A., Belknap, D.F., Dickson, S.M., and Kelley, A.R., 1998, The seafloor revealed: The geology of the northwestern Gulf of Maine inner continental shelf, Maine Geological Survey, Open-File Report 96-6, 55 p.

Kelley, J.T., Dickson, S.M., Belknap, D.F., Barnhardt, W.A., and Henderson, M., 1994, Giant sea-bed pockmarks; evidence for gas escape from Belfast Bay, Maine: Geology, v. 22, no. 1, p. 59-62

Malinconico, MaryAnn L., and Roy, David C., 1993, Tectono-metamorphic history of northern Maine based on graptolite reflectance and other low grade metamorphic indicators (abstract), Geological Society of America, 1993 Annual Meeting, Abstracts with Programs, v. 25, no. 6, p. 31

Minerals Management Service, 2006, Planning Area Resources Addendum to Assessment of Undiscovered Technically Recoverable Oil and Gas Resources of the Nation's Outer Continental Shelf, 2006.

National Research Council, 2003, *Oil in the Sea III: Inputs, Fates, and Effects*, 280 p.

National Transportation Safety Board, 1998, Special Investigation Report, PB98-917003, http://www.ntsb.gov/publictn/1998/sir9802.pdf

Neuman, R. B., 1967, Bedrock geology of the Shin Pond and Staceyville quadrangles, Penobscot County, Maine: U.S. Geological Survey, Professional Paper 524-I, 37 p.

New Brunswick Department of Mineral Resources, http://www.gnb.ca/0078/minerals/Geology_Sedimentary_Basin-e.aspx#Maritime

Osberg, P. H., Hussey, A. M., II, and Boone, G. M., 1985, Bedrock geologic map of Maine: Maine Geological Survey, scale 1:500,000.

Osberg, P. H., Tull, J. F., Robinson, P., Hon, R., and Butler, J. R., 1989, The Acadian orogen, *in* Hatcher, R. D., Jr., Thomas, W. A., and Viele, G. W. (editors), The Appalachian-Ouachita orogen in the United States: Geological Society of America, The Geology of North America, v. F-2, p. 179-232.

Portland-Montreal Pipeline website: http://www.pmpl.com/index.php.

Rodgers, J., 1971, The Taconic orogeny: Geological Society of America, Bulletin, v. 82, p. 1141-1178.

St. Ross Environmental Research, Ltd., 2008, Marine Oil Spill Probability, Response Planning, and Fate and Trajectory Modelling, http://www.ntsb.gov/publictn/1998/sir9802.pdf

Smith, G.O., Bastin, E. S., and Brown, C. W., 1907, Description of the Penobscot Bay quadrangle, Maine, U. S. Geological Survey, Geologic Atlas, Folio 149, 14 p. (scale - 1:125,000)

Stewart, D. B., Tucker, R. D., Ayuso, R. A., and Lux, D. R., 1998, Tectonic setting of the Islesboro terrane and a minimum age of the Seven Hundred Acre Island Formation, the oldest rocks in Maine: Geological Society of America, Abstracts with Program, v. 30, p. 76.

USGS Fact Sheet, Geology and the fishery of Georges Bank, http://pubs.usgs.gov/fs/georges-bank/

Zen, E-an, 1972, The Taconide zone and the Taconic orogeny in the western part of the northern Appalachian orogen: Geological Society of America, Special Paper 135, 72 p.

Appendix 7: Other States' Offshore Wind Initiatives

Offshore Wind State Summaries

November 2009

Nick Lund, University of Maine School of Law

NEW JERSEY

Planning / Strategy

New Jersey has implemented elements of both the planning approach and the development-led approach to offshore wind development. When New Jersey began to consider offshore energy, it convened a Blue Ribbon Panel to, in part, study both the economic and environmental impacts of offshore wind. To this end, the Panel issued a Solicitation for Research Proposals (SRP) for comprehensive ecological baseline studies of its offshore area in the spring of 2007. A final set of studies is due in December 2009, while several interim reports have been released.

At the same time, New Jersey has courted developers and prepared itself to begin construction once the ecological information is collected. As mentioned above, New Jersey offered an RFP and selected Garden State Offshore Energy to construct a 350MW farm.

Financial Incentives

The primary financial incentives for offshore wind projects in New Jersey were included in the state's Request for Proposal (see below).

Request for Proposal

In October 2007, the state of New Jersey issued a Request for Proposal offering a $19 million, 5-year production credit for construction and operation of an offshore wind facility up to 350MW. The New Jersey RFP made $1.9 million available up front for studies and permitting.

The state received five proposals. In October 2008, New Jersey's Board of Public Utilities selected Garden State Offshore Energy (GSOE), a joint venture between Deepwater Wind and PSEG Renewable Generation, to build an offshore wind farm off the New Jersey coast. GSOE proposed a 350MW farm, and was given $4 million to help cover permitting costs and to spur project financing.

Submerged lands leasing

The State of New Jersey owns submerged lands, called *tidelands* or *riparian lands*, under state waters up to the mean high tide line, except where those lands have been sold by the state. Public trust rights in New Jersey include fishing, boating, recreation, and access to the shore, tidelands and tidal waters.

Shoreline owners have rights to be the first to apply to use tidelands bordering their property, but must pay for a grant, lease or license to do so. Grants are most often made in areas already filled. Licenses generally cover temporary structures, such as docks and mooring piers, and dredging operations, for a term of three to five years. Leases, most often used for marinas and homes over water, generally have a term of 20 years. Such leases are the responsibility of the Bureau of Tidelands Management, part of the Division of Land Use Regulation in the NJ DEP.

Under Title 12, Chapter 3 of New Jersey state law, Leases are determined by the Tidelands Resource Council, with lease decisions approved by the Commissioner of the NJ DEP, the NJ AG, and the Governor of New Jersey. Prices are based on the fair market value of the land, but there are "many other factors which determine final consideration." (N.J.S.A. 12:3-7)

In June of 2009, the Department of the Interior issued an offshore exploration lease for wind development to Bluewater Wind New Jersey Energy.

Environmental Regulations

New Jersey's Blue Ribbon Panel was convened to study the economic and environmental impacts of potential offshore wind projects off the state's coast. The comprehensive ecological baseline studies that are in progress are part of New Jersey's generally cautious approach to environmental issues and offshore wind. Most recently, the NJ Department of Environmental Protection has proposed regulations that would amend its Coastal Zone Management rules to require comprehensive ocean mapping to identify appropriate locations for potential offshore turbines and set forth environmental monitoring requirements. Additionally, the state has produced a technical manual that lays out evaluation, assessment and monitoring requirements for both offshore and terrestrial wind projects.

DELAWARE

Planning / Strategy

Delaware has exercised a development-led strategy for offshore energy development. Unlike some other states, Delaware has a real need for new sources of electricity: the 2006 RFP called for proposals for power plants of any type. An offshore wind plant was selected in part

because of its novel use of Delaware's limited natural resources, and also because of an unpredicted groundswell of public support. As a result, Delaware was the first state to enter into a long-term power purchase agreement with an offshore wind developer, and is now the first state to host a meeting of the MMS ocean renewable energy Task Force.

Financial Incentives

The Delaware Green Energy Research Program offers grants for projects that develop or improve renewable energy projects for the state. Delaware offers up to 35% of the cost of qualifying projects, capping the grant at $250,000. Additionally, Delaware's Green Energy Fund collects approximately $3.2 million per year for efficiency and renewables programs including wind power. The funds are generated by a 0.000356 per kWh electricity surcharge.

Request for Proposal

On November 1, 2006, Delaware issued a Request for Proposal for a new power plant in the state. The state received bids from power companies employing various technologies, but eventually chose a proposal for an offshore wind farm by Bluewater Wind, with backup power to be supplied by NRG and Conectiv. Terms of the deal were negotiated heatedly, but Delaware Power & Light filed a potential Power Purchase Agreement on December 10, 2007. On December 18, however, the state agencies voted unanimously to table the matter. It was not until June of 2008 that Bluewater Wind signed a 200MW Power Purchase Agreement with Delmarva Power.

Submerged lands leasing

In Delaware, *tidelands* are those lands lying between the mean high water line and mean low water line while *submerged lands* are those lands lying between the mean low tide line and three-mile seaward extent of the state's jurisdictional limit. Together, tidelands and submerged lands are referred to as *subaqueous lands*. The Wetlands and Subaqueous Lands Section in the Department of Natural Resources and Environmental Control, Division of Water Resources, issues leases and permits for activities affecting tidal wetlands and subaqueous lands. Currently, the subaqueous lands leasing program is not well-developed, but the department has granted terrestrial conservation easements and leases in the past, and is interested in the idea of subaqueous lands leasing for conservation and restoration purposes. Also, the division can grant one-year leases of shellfish grounds. (7 Del.C. § 7201 et. seq.)

The Regulations for Title 7 of the Delaware Natural Resources Code provides that: "Lease fees shall be established by the General Assembly for all commercial and noncommercial projects over public subaqueous lands. The lease and fee requirements of these Regulations shall be applicable to all activities and structures, including previously leased lands, where no fee was required. Lease fees shall apply to any lease that has expired until such time as the structure is removed pursuant to a denial or revocation, or until such time as a new lease has been issued."

In June of 2009, the Department of the Interior issued an offshore exploration lease for wind development to Bluewater Wind Delaware.

Environmental Regulations

In lieu of more comprehensive management plans like those in Rhode Island and Massachusetts, the winner of Delaware's RFP, Bluewater Wind, hired the environmental consulting firm Tetra Tech to perform a series of environmental studies in preparation for the project. Tetra Tech performed a comprehensive avian survey of the federal waters off the coast of Delaware as well as a preliminary environmental resource analysis for an underground cable site determination. Delaware plans to continue its environmental analysis through the NEPA process.

RHODE ISLAND

Planning / Strategy

Like Massachusetts, Rhode Island has also decided to undertake a planning process for offshore development. The state plans to define use zones for Rhode Island state ocean waters through its Special Areas Management Plan (SAMP) process. The project is led by the state's Coastal Resources Management Council, the agency currently charged with managing the state's submerged lands. Assisting the CRMC is the University of Rhode Island, the R.I. Department of Environmental Management, and various Federal agencies. The SAMP process, which is targeted for completion in 2010, will be influenced by a group of stakeholders representing a variety of interests in Rhode Island.

Financial Incentives

Funding for the SAMP process will come from two sources. First, $666,050 will come from the $410 billion spending bill signed by President Obama last month. The rest of the funds, totaling $3.2 million, will come from the Rhode Island Renewable Energy Fund (REF), financed by a $0.0023/kWh surcharge on electricity consumption. The Rhode Island REF helps support a number of different programs, and provides money for "technical and feasibility studies."

Again, like many other states, Rhode Island has a variety of programs such as net metering, renewable portfolio standards and generation disclosure that help spur and sustain interest in renewable energy generation.

Request for Proposal

In April 2008, Rhode Island issued a Request for Proposal for a 1.3 million megawatt offshore project to be located in an area south of Block Island. Factors to be considered in the

bid review include the final costs to the state's ratepayers, the experience of the bidder and the total number of jobs created. The RFP also asks bidders to ensure that the Block Island town of New Shoreham benefits from the project.

In September 2008, the state selected Deepwater Wind to develop a $2 billion project off the coast of Rhode Island that would be able to produce up to 15% of the state's energy needs from 100 offshore turbines. The state is in the process of identifying potential development sites for Deepwater.

Submerged lands leasing

The terms used to describe the lands lying below the mean high water line in Rhode Island can be confusing. Rhode Island refers to the lands lying between the mean high water line and the seaward extent of the state's jurisdictional limit (three nautical miles) as *tidal lands*. However, the terms *submerged lands* and *tidelands* are also used to describe this area. The term *submersible lands* is used to describe the area lying between the mean high water line and the mean low water line. S*ubtidal lands* and *submerged lands* can be used interchangeably to describe the area lying between the mean low water line and the seaward extent of the state's jurisdictional limit. While the total acreage is unclear, the state owns nearly all tidal lands in Rhode Island. There is, however, no formally designated tidal lands leasing program in Rhode Island (other than for aquaculture, see Gen.Laws 1956, § 20-10-6).

Environmental Regulations

Environmental concerns are an important factor considered by Rhode Island as it works to develop an ocean plan as part of its Special Areas Management Plan (SAMP) process. Through SAMP, Rhode Island will look at all uses of the ocean to develop use zones. Avian migration patterns, the movement of marine mammals and fish stocks, and other environmental concerns will be taken into account when developing these use zones. Additionally, under the Rhode Island Endangered Species Act, the Department of Environmental Management has the authority to declare animal and plant species endangered, and then acquire or control land for the protection of those species.

MASSACHUSETTS

Planning / Strategy

The Cape Wind controversy has driven Massachusetts to adopt a planned, cautious approach to offshore development. In 2008, the state passed the Massachusetts Ocean Act, which requires the Secretary of Energy and Environmental Affairs (an existing department), along with an Ocean Advisory Commission and an Ocean Science Advisory Council, to create an Ocean Management Plan for state waters by December, 2009. The Plan aims for a balance

between the capitalization of sustainable uses of the ocean and the maintenance of high environmental standards. The Plan was designed, in part, to "identify appropriate locations and performance standards for activities, uses and facilities" in state waters, including electric generating stations, offshore drilling, etc. Once the Secretary has adopted the Plan, "all certificates, licenses, permits and approvals for any proposed structures uses or activities in areas subject to the [Plan] shall be consistent, to the maximum extent practicable, with the plan." Review of the Plan is conducted by the Joint Committee on State Administration and Regulatory Oversight. The Massachusetts Office of Energy and Environmental Affairs released an initial draft of the Ocean Management Plan in June of 2009 and remains on track to meet the December 2009 promulgation deadline.

Financial Incentives

Massachusetts raises nearly $25 million per year for renewable energy grants, loans and investments as a result of the Massachusetts Renewable Energy Trust (MRET). The funds are raised via a $0.0005/kWh surcharge on the state's electric consumers. The statute establishing the fund specifies that the purpose of MRET is, in part, "financing in the development and application of related technologies at all levels, including … basic and applied research and commercialization activities." (M.G.L.A. 40J § 4E) MRET provides funds to a variety of recipients, including individuals, businesses, nonprofits, entrepreneurs, communities and schools.

Additionally, Massachusetts has economic incentives common to states looking to encourage renewable energy development and energy efficiency. These include net metering, renewable portfolio standards, green power purchasing, and more. See DSIRE.org for details.

Request for Proposal

Massachusetts has not issued an RFP for an offshore wind project. The Cape Wind project was instead proposed by private developers. In January 2009, however, the state issued an RFP for a study to be done on port and support infrastructure to facilitate offshore energy projects.

Submerged lands leasing

Massachusetts generally refers to intertidal lands as the *intertidal zone* or *tidal flats*, and calls subtidal lands *submerged lands*. Collectively, the intertidal zone and submerged lands make up *tidelands*, which is the most common term used to refer to these areas. In Massachusetts, commonwealth tidelands usually begin at the historic low water line and extend to the limit of Massachusetts territorial waters. These extend three nautical miles from shore, and include all of Cape Cod and Massachusetts Bays. With exceptions in port areas and areas of coastal fill, commonwealth tidelands are owned by the commonwealth in public trust. Private tidelands include most intertidal lands (from the mean high water line out to the historic low water line or a maximum distance of 1,650 feet (100 rods), whichever is landward), and usually belong to the adjacent upland owner. Both commonwealth and private tidelands are subject to the public trust

rights of fishing, fowling, and navigation. No public trust rights of recreation apply to private tidelands.

Construction, structural maintenance, dredging and dredge disposal on tidelands (whether commonwealth or private) require a license or permit under the Chapter 91 Waterways Program, administered by the Massachusetts Department of Environment Protection. The Waterways Program favors water-dependent uses and seeks to protect and expand public access to the shore.

According to The Nature Conservancy, "Massachusetts has no statewide leasing process, so each county bases submerged land leases based on different criteria."

Environmental Regulations

The Draft Massachusetts Ocean Management Plan, authorized under the Massachusetts Oceans Act of 2008, considers many environmental impacts when making its determination of how to best manage the state's ocean resources. The Oceans Act amended the state's Ocean Sanctuaries Act to allow renewable energy projects to be cited within ocean sanctuaries (except for the Cape Cod Ocean Sanctuary) so long as the project is consistent with the ocean management plan and is of the appropriate scale.

An offshore wind facility would also be subject to a host of state environmental statutes, including the Massachusetts Environmental Policy Act, the Wetlands Protection Act, the Coastal Wetlands Restriction Act, the state Endangered Species Act and the Massachusetts Underwater Archaeological Resources law.

Appendix 8: Possible Incentives to Support Offshore Wind and Other Renewable Ocean Energy Development

Incentive	Potential impact	Implications	Maine's Position
Investment/production tax credits and tax depreciation	Immediate	New investment and production tax credits authorized under ARRA	
Capital grants	Immediate	High cost to state	Maine Technology Asset Fund a model, but significantly higher funds per project will be required
Reduce specific project risks	Immediate	Reduces uncertainty	
Soft loans/credit guarantees	Immediate	Useful for new entrants and smaller developers	Extend existing loan programs to ocean energy projects
Non-financial support for Maine ocean-energy related manufacturing	Medium-term	Could help build capacity over time (3-5 years)	Expedited permitting a la onshore, land banks
R&D funding	Long-term	Advances in new technology likely to see commercialization 10+ years later	Maine Technology Institute, University of Maine
Other, e.g. feed-in tariff	Long term	New legislation required; secondary impacts of higher electricity costs?	

Source: Adapted by Maine Office of Innovation from Ernst and Young, "Cost of and Financial Support for Offshore Wind," A Report for the Department of Energy and Climate Change (United Kingdom), April 2009.

Appendix 9: Matrix of Economic Development Policies in Select States

Economic Development Policy	**Maine**	**Massachusetts**	**Rhode Island**	**New Jersey**	**Delaware**
Research and development funding	Maine Technology Institute funds R&D&C in all sectors including energy: $12.7 million since 2006; Advanced Engineered Wood Composites Center with capacity to test large wind blades	Renewable Energy Trust created in 1998 in MA Technology Collaborative; strategic research, marine energy offshore test and development facilities. $10 million for NREL Wind Technology Testing Center in Charlestown.	Renewable Energy Fund run by RI Economic Development Corporation; Center of Excellence in Research for Offshore Renewable Energy at URI	Rutgers University Energy Institute; Edison Renewable Energy Technologies Fund, New Jersey Commission on Science and Technology for R&D	Center for Carbon-free Power Integration at UD. Green Energy Research and Development Program pays up to 35% of projects such as engineering, adaptation or development of products and processes that relate to renewable energy technology
Cluster development	Maine Technology Institute funds cluster development including in energy. Has funded Ocean Energy Cluster project through E2Tech	MA Technology Collaborative – directory of all renewable energy companies in MA; cluster development			
Project funding		Renewable Energy Trust, Green Communities Act of 2008 grants, loans and equity investments including commercial scale, community scale and small scale wind projects.	Municipal renewable energy investment program to fund qualified municipal projects; similar fund for affordable housing projects. Run by RI Economic Development Corporation		Green Energy Fund, Delaware Energy Office, up to 50% of the installed cost of renewable energy systems.

Economic Development Policy	Maine	Massachusetts	Rhode Island	New Jersey	Delaware
Financial incentives	Pine Tree Zone should apply to land part of projects; TIF allowable for energy projects	Corporate deductions and excise and sales tax exemptions for solar or wind powered systems; support for moving to the state to set up a new renewable energy business		$19 million in production incentives paid over five years, making bond financing available and also tradeable renewable energy certificates for developer.	
Stimulate demand side	Efficiency Maine, various measures before the legislature e.g. LD 1181	Green Communities Act of 2008 – utility companies required to purchase all energy efficiency improvements; required to entered into 10-15 year contracts with renewable energy developers; net metering allowed	Net metering	Clean Energy Program promotes increased energy efficiency and the use of renewable energy. $141 mm in financial incentives to residential customers, businesses, schools, and municipalities. Net metering.	House Bill 6, (2006) long-term contracts, self-generation, programs by utilities to reduce or shift electric consumption. Net metering. Tax credit (Green Industries Program) use of recycled materials and reduction of waste generation through source reduction.
Renewable Portfolio Standard	Class I: 10% by 2017; Class II: 30% by 2000	Green Communities Act of 2008 increases rate of increase to 25% in 2030	Enacted in 2004, 16% by 2019	22.5% by 2021	20% by 2019
RGGI	In	In	In	In	In
Use of State Waters	Maine Submerged Lands Program	Oceans Act of 2008 – by 12/31/09 have comprehensive plan to manage development in state waters	Offshore Wind Stakeholders Report decided that formal environmental impact analysis and permitting process will be used to choose sites.		
Pre-approved site(s)					

Economic Development Policy	**Maine**	**Massachusetts**	**Rhode Island**	**New Jersey**	**Delaware**
Request for Proposal		No. Cape Wind proposed by private developers.	Yes. Joint development agreement with Deepwater Wind Rhode Island – state will identify approved sites and company will select one for development.	Yes. Garden State Offshore Energy chosen.	Yes. Wind Power Purchase Agreement with Babcock and Brown
Study of Role of Wind in Supplying Power	Gov's Task force on Offshore Wind		Yes, 2007	Gov's Blue Ribbon Panel 2004; cost and benefits study of Offshore Wind 2007	
Stakeholder Report			Yes		
Stakeholder Council			Energy Efficiency and Resource Management Council		
Ecological Baseline Study				In progress due 9/09	

Appendix 10: Overview of Current State Economic Development Initiatives

Maine has already taken a number of important steps to incent and support growth of offshore wind, tidal and other aspects of the State's nascent ocean energy business cluster. Key actions to date include the following:

- *Funding for renewable energy projects and other clean technology sectors* such as environmental technologies, precision manufacturing, composites and advanced materials, and marine technologies through the Maine Technology Institute. Maine Technology Institute investments have totaled over $15 million for clean technology-related research and development, including $5 million for expansion of AEWC for wind blade testing facility, and $1.5 for the ORPC tidal energy project.
- *$6 million bond initiative*, proposed by Governor Baldacci and passed by the Legislature for a public vote in June 2010, to support development of the University of Maine Marine Wind Energy Demonstration Site (LD 913, section D-6, 124th Maine Legislature, First Regular Session).
- *Maine Wind Energy Industry Initiative* was established in 2009 by the Maine Composites Alliance in collaboration with the University of Maine AEWC, First Wind, CIANBRO, and the Maine Port Authority to develop Maine industry's competitiveness and opportunities in the growing wind industry in the North East United States. The focus of this initiative is on both on-shore and off-shore wind development. Maine Wind Industry Initiative is an industry lead and driven collaborative effort to organize the interests currently involved in the wind energy industry to identify common needs, pursue market opportunities on behalf of Maine industry, document the industry's needs, and assist the State in leveraging the considerable natural resources of the state to the benefit of the State. The initiative intends to participate in the leadership of the development of these resources to the benefit of the Maine economy.
- *Maine Technology Institute awarded $50,000 to the Environmental and Energy Technology Council (E2Tech).* Along with $58,000 in matching funds, E2Tech used the award to launch a new ocean energy cluster. The organization took advantage of the global EnergyOcean 2009 Conference that took place in June 2009 in Rockland, to lay the groundwork for this emerging cluster. E2Tech is developing a strategic plan to showcase existing Maine businesses and assets, including the state's independent research institutions and universities, attract outside investment, and build on policy momentum from the Governor's Ocean Energy Task Force to secure Maine's place in this growing industry.
- The U.S. Department of Energy awarded $8 million for a University-Industry Collaborative in October 2009. The University of Maine plans to design and deploy two 10 kW and one 100 kW floating offshore turbine prototypes. Two turbines will be located at the University of Maine's Deepwater Offshore Wind Test Site that will be located in a pre-selected site in state waters and one turbine will be operated at an offshore test site in the Isle of Shoals by the University of New Hampshire. The University consortium's research and development

plan includes optimization of designs for floating platforms by evaluating: (1) options for using more durable, lighter, hybrid composite materials; (2) manufacturability; and (3) deployment logistics. Educational initiatives include a model Master of Science Degree in Renewable Energy and the Environment with a focus on deepwater wind energy and a new undergraduate minor in Deepwater Wind Energy. The University will target educational grants at individuals who are participating in Maine-based wind energy education and training in order to enter the job market.

- The Department of Energy is providing $951,500 to the Maine Tidal Power Initiative, a partnership of the University of Maine, Maine Maritime Academy and the Ocean Renewable Power Company The resources were obtained through an earmark initiative supported by Maine's Congressional Delegation.
- The Department of Energy has awarded $ 1, 184,545 to Ocean Renewable power Company through two separate competitive grant application processes in support of the company's research and development efforts in Maine.
- Draft Memorandum of Understanding among Nova Scotia Offshore Energy Environmental Research Association, Nova Scotia Department of Energy, Maine Office of Innovation and University of Maine. When executed, this MOU will complement the University of Maine research collaborations with the University of New Hampshire to form a network of research test sites for deepwater (University of Maine), shallow water (University of New Hampshire) and tidal (Nova Scotia) ocean energy.
- Pine Tree Zones: The Pine Tree Development Zone (PTDZ) program was expanded statewide, effective September, 2009. This program rewards start-up and expansion activity for qualified businesses. Wind and tidal energy projects which include a substation or other facility located on the mainland would generally be considered as a manufacturer and would be considered a qualified business. Even though ancillary items (i.e., turbines, would be located outside of the mainland facility, they would be considered part of the business' qualified activity. Once a business is PTDZ certified, benefits are conveyed on a performance basis; they do not receive any incentive until they create the quality jobs and purchase/construct property. The benefits include corporate income tax credits, insurance premiums tax credits, income tax reimbursement for net new jobs created, and sales and use tax exemptions.

In addition to the above noted initiatives, Governor Baldacci and his administration have been providing leadership in the public policy area, as evidenced by the Governor's September 2009 renewable energy-focused trade mission to Spain and Germany. In June, 2009, Governor John Baldacci joined Senators Olympia Snowe and Susan Collins and Representatives Mike Michaud and Chellie Pingree at a meeting with Energy Secretary Steven Chu to propose and request federal funding needed to initiate and maintain a National Deepwater Offshore Wind Research Center to be operated by the University of Maine.

Appendix 11: Overview of Wind, Tidal and Wave Power Permitting Requirements

Wind Energy Development Maine Regulatory Matrix				
	Review Authority/Agency/Approval	**Maine's Coastal Waters**		**Federal Waters[1]**
		Organized Areas	**Unorganized Areas**	
State	Site Location of Development Act - DEP - Permit[2]	X		
	Natural Resources Protection Act - DEP - Permit	X		
	Stormwater/Erosion and Sedimentation Control Laws - DEP - Permit/ Requirement[3]	X	X	
	Maine Endangered Species Act - DIFW and/or DMR - Review; Requirement[4]	X	X	
	Submerged Lands Lease - Bureau of Public Lands - Lease	X	X	
	Maine Historic Preservation - Maine Historic Preservation Commission - Review[5]	X	X	
	Coastal Zone Management Act - SPO - Federal Consistency Review[6]	X	X	X
	Wind Energy Act - DEP - Certification[7]	X		
	Rezoning - LURC - Rezoning Approval[8]		X	
	Land Use Standards - LURC - Permit		X	
	Clean Water Act, Sec. 401 - DEP or LURC - Water Quality Certification[9]	X	X	
Municipal	Mandatory Shoreland Zoning Act - Municipality - Permit[10]	X		
Federal	Rivers and Harbors Act; Sec. 10, CWA, Sec. 404 - Army Corps of Engineers - Permit	X	X	X
	Outer Continental Shelf Lands Act - Minerals Management Service (MMS) - Lease or ROW			X
	Executive Order 10485; Federal Power Act - Department of Energy/Federal Energy Regulatory Commission - Permit/Interconnection Approval[11]	X	X	X
	FAA Circular I-864 - Federal Aviation Administration - Guidance Conformity	X	X	X
	Federal Navigation Laws - U.S. Coast Guard - Permit	X	X	X
	National Environmental Policy Act - ACOE or MMS - Review[12]	X	X	X
	Additional Federal Reviews: Endangered Species Act - U.S. Fish and Wildlife Service (USFWS) and	X[16]	X[16]	X[16]

	National Marine Fisheries Service (NMFS)[13], Marine Mammal Protection Act - NMFS and USFWS[14], Migratory Bird Treaty Act - USFWS, Magnuson-Stevens Fisheries Conservation and Management Act - NMFS[15], Naval operations laws - U.S. Navy			

NOTE: A qualified "offshore wind energy demonstration project" in state waters is eligible for streamlined state approval under 38 M.R.S. §480-HH.

[1]Federal requirements apply in both Maine's coastal waters and federal waters. State permitting and leasing requirements apply to project elements, e.g, transmission line, located on state-owned submerged lands.

[2]DEP evaluating approach to measuring project area.

[3]DEP evaluating applicability. In practice, administered by LURC in unorganized areas.

[4]Provision for "incidental take" under certain conditions for DIFW - managed species. No "take" provision applies to DMR - managed marine listed species.

[5]Applicable under Site Law and NEPA

[6]Activities in state waters are reviewed through pertinent permit processe(s). Activities in federal waters may be subject to review for consistency with applicable state enforceable policies, including, e.g., Site Law and NRPA, as applicable

[7]Applies only to small scale wind energy development (<100KW).

[8]Except as provided by PL 2007 c. 661, wind energy development is not an allowed use in LURC subdistricts.

[9]As Applicable

[10]Local land use permit and building permit may also be required for land-based elements

[11]DOE approval is required under Executive Order for international export of power. Must meet FERC's minimum interconnection standards.

[12]Preparation of Environmental Impact Statement or Environmental Assesment; "hard look" at wide range of issues. Lead agency is ACOE when within state waters and MMS when within federal waters

[13]Incidental take provision review if applicable

[14]Incidental take provision review if applicable

[15]"Essential fish habitat" review

[16]Review agencies comments considered in NEPA process and various permit reviews

Tidal and Wave Energy Development Regulatory Matrix Maine's Coastal Waters[1]			
	Review Authority/Agency/Approval	**Organized Areas**	**Unorganized Areas**
State	Maine Waterway Development and Conservation Act – DEP or LURC - Permit[2]	X	X
	Clean Water Act, Sec. 401 - DEP - Water Quality Certification	X	X
	Submerged Lands Lease - Bureau of Public Lands - Lease	X	X
	Maine Endangered Species Act - DIFW and/or DMR - Review; Requirement[3]	X	X
	Maine Historic Preservation - Maine Historic Preservation Commission - Review[4]	X	X
	Coastal Zone Management Act - State Planning Office - Federal Consistency Review[5]	X	X
Municipal	Mandatory Shoreland Zoning Act - Municipality - Permit[6]	X	
Federal	Federal Power Act - FERC - Hydropower License	X	X
	National Environmental Policy Act (NEPA) - FERC (lead agency) - Review[7]	X	X
	Executive Order 10485; Federal Power Act - Department of Energy/Federal Energy Regulatory Commission - Permit/Interconnection Approval[8]	X	X
	Rivers and Harbors Act, Sec. 10; CWA, Sec. 404 - ACOE - Permit	X	X
	Federal Navigation Laws - U.S. Coast Guard - Permit	X	X
	Additional Federal Reviews: Endangered Species Act - US Fish & Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS)[9]; Marine Mammal Protection Act - NMFS and USFWS[10]; Migratory Bird Treaty Act - USFWS; Magnuson-Stevens Fisheries Conservation and Management Act - NMFS[11]; Naval operations laws - Navy	X[12]	X[12]

[1]Studies indicate development potential is inshore, within state waters.
[2]DEP has statewide jurisdiction over tidal power. Note: Under current law LURC has MWDCA juriscition over wave power projects in the unorganized areas of the State. LURC rezoning approval would also be required for such projects. A qualified tidal power demonstration project is eligible for a DEP-administered general permit under 38 MRS §636-A.
[3]Provision for "incidental take" under certain conditions for DIFW-managed species. No "take" provision applies to DMR-managed species.
[4]Applicable under MWDCA and NEPA.
[5]Implemented through MWDCA process.
[6]Local land use permit and building permit may also be required for land-based elements.
[7]Preparation of Environmental Impact Statement or Environmental Assessment; "hard look" at wide range of issues.
[8]DOE approval is required under Executive Order for international export of power. Must meet FERC's minimum interconnection standards.
[9]Incidental take provision review if applicable.
[10]Incidental take provision review if applicable.
[11]"Essential fish habitat" review.
[12]Review agencies' comments considered in NEPA process and various permit reviews.

Appendix 12: FERC/State Tidal Power MOU

MEMORANDUM OF UNDERSTANDING
BETWEEN
THE FEDERAL ENERGY REGULATORY COMMISSION
AND
THE STATE OF MAINE
BY AND THROUGH ITS GOVERNOR AND DEPARTMENTS OF CONSERVATION, ENVIRONMENTAL PROTECTION, INLAND FISHERIES AND WILDLIFE, AND MARINE RESOURCES, STATE PLANNING OFFICE, AND GOVERNOR'S OFFICE OF ENERGY INDEPENDENCE AND SECURITY

The State of Maine (Maine) by and through its Governor and Departments of Conservation, Environmental Protection, Inland Fisheries and Wildlife, and Marine Resources, State Planning Office, and Governor's Office of Energy Independence and Security, and the Federal Energy Regulatory Commission (Commission), as Parties to this Memorandum of Understanding (MOU), hereby acknowledge and declare as follows:

A. The Commission issues licenses under Part I of the Federal Power Act, 16 U.S.C. §§ 791a *et seq.* (FPA) for non-federal tidal energy projects also referred to as hydrokinetic technologies. This includes, but is not limited to, tidal energy projects that are or may in the future be proposed to be located in Maine state waters or in federal waters in the Gulf of Maine. The Commission's staff has established several possible means of authorizing tidal energy projects, including procedures for issuing short-term licenses for pilot projects with appropriate environmental safeguards.

B. Maine has authorities with respect to tidal energy projects that are proposed to be located in its state waters, or in federal waters where the projects affect coastal resources or coastal uses in Maine's designated coastal area, including authorities under the following federal laws: the Coastal Zone Management Act, 16 U.S.C. §§ 1451 *et seq.* (CZMA); the Clean Water Act, 33 U.S.C. §§ 1251-1387 (CWA); the National Historic Preservation Act, 16 U.S.C. §§470 *et seq.* (NHPA); as well as the FPA. Maine state law also includes provisions applicable to tidal energy projects that are proposed to be located in its state waters, affecting state waters, and upon state-owned submerged lands, including proprietary authorization, and regulatory authorization to construct and operate a tidal energy project.

C. Maine State waters and federal waters in the Gulf of Maine contain vast, untapped renewable ocean energy resources, including tidal power resources with significant potential to contribute to Maine's renewable energy mix and create related business opportunities while reducing greenhouse gas emissions that contribute to climate change.

D. Maine has enacted legislation (P.L. 2009, ch. 270) to streamline and coordinate state permitting and submerged lands leasing requirements for renewable ocean energy demonstration projects, including tidal energy demonstration projects, so

that Maine can become an international proving ground for testing promising new technologies in state waters in an environmentally responsible manner.

E. The Parties have a mutual interest in the timely processing of applications for regulatory and other approvals required for tidal energy projects using innovative hydrokinetic technologies in Maine State waters, or in federal waters where the projects affect coastal resources or coastal uses in Maine's designated coastal area, to promote clean, renewable sources of energy.

F. The Parties also desire to create a process to make it possible for developers of tidal energy projects using hydrokinetic technologies to establish short-term pilot (demonstration) projects in Maine state waters, or in federal waters where the projects affect coastal resources or coastal uses in Maine's designated coastal area, in order to study, monitor, and evaluate the economic and technical feasibility and environmental, cultural, and other effects of these technologies. The Parties intend that information developed during the pilot project licensing process will assist in the decision-making process if requests for any long-term authorizations for commercial-scale hydrokinetic tidal energy projects in Maine state waters, or in federal waters where the projects affect coastal resources or coastal uses in Maine's designated coastal area, are made.

G. The purpose of this MOU is to coordinate the procedures and schedules for review of tidal energy projects using hydrokinetic technologies in Maine state waters, or in federal waters where the projects affect coastal resources or coastal uses in Maine's designated coastal area, to ensure that there is a coordinated review of proposed hydrokinetic tidal energy projects that is responsive to environmental, economic, and cultural concerns while providing a timely, stable, and predictable means for developers of such projects to seek necessary regulatory and other approvals.

Now, therefore, the Commission and Maine agree that:

1. Maine supports the efforts by Commission staff to establish procedures to allow short-term demonstration hydrokinetic tidal energy projects with environmental safeguards through the pilot project licensing process. These procedures may, in appropriate cases, allow the licensing of hydrokinetic tidal energy projects by the Commission in a significantly shorter period than a full licensing process would require. The Parties agree that the pilot licensing process may be appropriate as a short-term means of allowing hydrokinetic tidal energy projects to proceed on a pilot (demonstration) basis while additional economic, environmental, and technical data concerning the effects and operation of such projects are gathered. The Parties also agree to share and make publicly available in accordance with applicable law and regulations all economic, environmental, and technical data gathered on these pilot projects. The Parties also agree that any shorter licensing approach established must incorporate appropriate safeguards, limitations, and monitoring to ensure that there are no significant adverse environmental, economic, or social impacts.

2. Maine and the Commission recognize that there is currently limited information available on the economic and technical feasibility and environmental, cultural, and other effects of hydrokinetic tidal energy projects, and that considerable economic, technical, and environmental analysis must occur before any proposed commercial-scale project can be approved. However, Maine and the Commission also recognize that, without *in situ* evaluation of pilot (demonstration) hydrokinetic tidal energy projects, the feasibility and effects of these projects cannot be determined. Therefore, Maine and the Commission agree that any required pre- and post-licensing studies for these pilot (demonstration) projects should be reasonable in scope, commensurate with the limited size and duration of the projects, and designed to provide information that will be relevant to the evaluation of the impacts of any proposed commercial-scale projects.

3. When Maine or the Commission becomes aware of a prospective applicant seeking a preliminary permit, pilot project license, or other license from the Commission to study or develop a hydrokinetic tidal energy project in Maine state waters, or in federal waters where the project affects coastal resources or coastal uses in Maine's designated coastal area, the party obtaining the information will promptly notify the other party to enable coordinated review of the project between Maine and the Commission. In such cases, Maine and the Commission will work together to the maximum extent feasible, with the prospective applicant and other participants in the Commission's prefiling process to identify potential issues, to determine what information is needed, and what studies must be conducted in order to meet the requirements set forth by state and federal laws. Coordination among the Commission, Maine, and the applicant will set expectations and assist with the information needs on a proposal that will greatly assist the review process.

4. Under the Commission's "strict scrutiny" policy for processing preliminary permits for hydrokinetic projects, the Commission will process preliminary permit applications for hydrokinetic energy projects to be located in Maine state waters, or in federal waters where the projects affect coastal resources or coastal uses in Maine's designated coastal area, with a view towards limiting the boundaries of the permits, including in any areas identified by Maine as offshore wind energy test areas pursuant to state legislation (P.L. 2009, ch. 270), to prevent site-banking, and to promote competition.

5. When a prospective applicant seeks to use the pilot project license process or any other licensing process for a hydrokinetic tidal energy project to be located in Maine state waters, or in federal waters where the project affects coastal resources or coastal uses in Maine's designated coastal area, and subject to the Commission's licensing jurisdiction, Maine and the Commission agree to confer, as early in the process as practical, in order to reach agreement on a schedule for processing the application as expeditiously as practicable while ensuring sufficient time for the necessary state and federal reviews. Such a schedule, to be issued by the Commission, will include milestones for the Commission's review of the application and issuance of an environmental document, and the issuance by Maine of any certifications or concurrences

that may be required from it under federal law. To the extent feasible, Maine agrees to complete any actions required of it within the timeframes established in the schedule and, in any case, agrees to complete such actions in accordance with the decision-making schedules provided for by law. Maine and the Commission further agree that they will use their best efforts to encourage other federal agencies and stakeholders that have an interest in a proposed hydrokinetic tidal energy project in Maine state waters, or in federal waters where the project affects coastal resources or coastal uses in Maine's designated coastal area, to help develop and comply with a coordinated schedule for the review of the project. The Commission agrees to encourage the applicant for a proposed hydrokinetic tidal energy project to work with Maine to facilitate Maine's review of the project under applicable state and federal law.

6. With respect to any application to use the pilot project license process for a hydrokinetic tidal energy project to be located in Maine state waters, or in federal waters where the project affects coastal resources or coastal uses in Maine's designated coastal area, and subject to the Commission's licensing jurisdiction, Maine agrees, pursuant to state legislation (P.L. 2009, ch. 270), to take action on an application for a state permit and a request for water quality certification, for a demonstration hydrokinetic tidal project within 60 days of the State's acceptance of an application for processing. To be accepted for processing, an application must include a copy of an environmental assessment issued by the Commission for the project that includes a finding of "no significant environmental impact" pursuant to the National Environmental Policy Act, 42 U.S.C. §§ 4231 *et seq.* (NEPA). Maine further agrees, pursuant to recently enacted state legislation (P.L. 2009, ch. 270), within 30 days of the approval of a state permit and water quality certification for a demonstration hydrokinetic tidal energy project, to issue a state submerged lands lease for the project, subject to reasonable lease conditions that may not be more stringent than those contained in the state permit and that may not frustrate achievement of the purpose of the project.

7. Maine and the Commission agree that they will work to coordinate their environmental reviews of any proposed hydrokinetic tidal energy project to be located in Maine state waters, or in federal waters where the project affects coastal resources or coastal uses in Maine's designated coastal area, and subject to the Commission's licensing jurisdiction, so that documents prepared by the Commission for review under NEPA may be used by Maine agencies to satisfy the requirements of Section 401 of the Clean Water Act and the Maine Waterway Development and Conservation Act, the Maine Endangered Species Act, Mandatory Shoreland Zoning Act, and other similar requirements that are enforceable policies of Maine's approved Coastal Zone Management Program under the CZMA, or any other required actions to be taken by Maine. The Parties also agree to consult with stakeholders, including the project developers, concerning the design of studies and environmental measures, including adaptive management measures, for hydrokinetic tidal energy projects in Maine state waters, or in federal waters where the projects affect coastal resources or coastal uses in Maine's designated coastal area.

8. The Commission agrees that it will, in issuing any pilot project license or other license for a hydrokinetic tidal energy project to be located in Maine state waters, or in federal waters where the project affects coastal resources or coastal uses in Maine's designated coastal area, consider the extent to which the proposed project is consistent with pertinent state comprehensive river management plans and any subsequent amendments or addendums thereto. In addition, the Commission will consider any terms and conditions that are recommended by Maine under applicable provisions of the FPA to ensure consistency with those plans.

9. Maine and the Commission recognize that any pilot project license or other license issued by the Commission for a tidal energy project using innovative hydrokinetic technology in Maine state waters, or in federal waters where the project affects coastal resources or coastal uses in Maine's designated coastal area, must, in addition to the power and development purposes for which licenses are issued, give equal consideration to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality for beneficial public purposes. [16 U.S.C. § 797(e); 16 U.S.C. § 803(a)(1).]

10. Maine and the Commission will designate management contacts to work to resolve any procedural issues that arise in the review of a specific tidal energy project in Maine state waters, or in federal waters where the project affects coastal resources or coastal uses in Maine's designated coastal area. However, nothing in this MOU shall compromise or affect the rights of any party to seek relief through any available administrative or judicial process, including rights to intervene in, comment on, and appeal decisions by the Commission.

11. Nothing in this MOU requires any party to take any action that is contrary to applicable federal or state law or regulation.

12. This MOU is neither a fiscal nor a funds obligation document. Any endeavor to transfer anything of value involving reimbursement or contribution of funds between the parties to this MOU will be handled in accordance with applicable laws, regulations, and procedures including those for Government procurement and printing. Any such endeavors will be outlined in separate documents that shall be made in writing by representatives of the Parties and shall be independently authorized by appropriate statutory authority. This MOU does not provide such authority. In addition, this MOU does not establish authority for non-competitive award to the cooperator of any contract or agreement.

13. This MOU is not intended to be a binding contract enforceable in a court of law or in an administrative forum. It is intended only to lay out a process to further cooperation between the governmental entities signing this document.

14. This MOU will take effect when signed by all the parties hereto. This MOU may be modified at any time by the mutual written agreement of the Parties. The Commission or Maine may terminate the MOU upon thirty (30) days written notice to the other. During this period, the Parties shall make good-faith efforts to resolve any disagreement.

JON WELLINGHOFF
Chairman
Federal Energy Regulatory Commission

8/18/09
Date

JOHN E. BALDACCI
Governor
State of Maine

8/4/09
Date

PATRICK K. McGOWAN
Commissioner
Maine Department of Conservation

10/8/09
Date

DAVID P. LITTELL
Commissioner
Maine Department of Environmental Protection

4 Aug 09
Date

ROLAND D. MARTIN
Commissioner
Maine Department of Inland Fisheries and Wildlife

8/6/09
Date

GEORGE D. LAPOINTE
Commissioner
Maine Department of Marine Resources

8/10/09
Date

Page 7 of 7

MARTHA E. FREEMAN
Director
Maine State Planning Office

8/13/09
Date

JOHN KERRY
Director
Governor's Office of Energy Independence and Security

8/10/09
Date

Appendix 13: Best Practices for Stakeholder and Public Engagement in Siting Renewable Ocean Energy Projects

Prepared by Ronald E. Beard, University of Maine Cooperative Extension and Sea Grant

A review of best practices in public engagement reveals a new consensus document[1] endorsed by a number of national organizations, including the National Coalition for Dialogue and Deliberation. The document outlines the following core principles:

1. Careful Planning and Preparation
Through adequate and inclusive planning, ensure that the design, organization, and convening of the process serve both a clearly defined purpose and the needs of the participants.

2. Inclusion and Demographic Diversity
Equitably incorporate diverse people, voices, ideas, and information to lay the groundwork for quality outcomes and democratic legitimacy.

3. Collaboration and Shared Purpose
Support and encourage participants, government and community institutions, and others to work together to advance the common good.

4. Openness and Learning
Help all involved listen to each other, explore new ideas unconstrained by predetermined outcomes, learn and apply information in ways that generate new options, and rigorously evaluate public engagement activities for effectiveness.

5. Transparency and Trust
Be clear and open about the process, and provide a public record of the organizers, sponsors, outcomes, and range of views and ideas expressed.

6. Impact and Action
Ensure each participatory effort has real potential to make a difference, and that participants are aware of that potential.

7. Sustained Engagement and Participatory Culture
Promote a culture of participation with programs and institutions that support ongoing quality public engagement.

[1] http://www.thataway.org/main/wp-content/uploads/2009/05/PEPfinal-expanded.pdf

A Case Study: Ocean Renewable Power Company's Tidal Energy Project in Eastport, Maine

During a meeting of the Tidal Subcommittee of the Ocean Energy Task Force, members heard elements of a case study of how an energy company might engage stakeholders to improve the ability of that company to achieve its goals, while addressing concerns about possible impacts on the local marine and riparian environment, and traditional livelihoods that depend on access to public marine resources (fishing and other harvesting, commercial shipping and recreational users).

Intentions and commitment

The Ocean Renewable Power Company, LLC (ORPC), through its subsidiary ORPC Maine, is one of three companies exploring tidal energy resources near Eastport, in Western Passage and Cobscook Bay, Maine. After initial meetings with town officials, representatives of local business, marine pilot organizations and commercial fishing, ORPC made a commitment to engage stakeholders and take advice on how and where to deploy test equipment in its surveys of tidal resources and in the development of a permit application for commercial tidal power. Based on its belief that "…agencies give permits, communities give permission," ORPC chose a public engagement strategy that was transparent to stakeholders and based on lots of listening, and intention to build on the capacities of Eastport (its maritime and manufacturing history, its current economic base in shipping, aquaculture and tourism, its interest in energy development, its abundant human resources and a prevailing "can do" spirit).

Role of Neutral Broker

In addition to regular contact with town officials and other key community stakeholders, telling them of their plans, marking progress and listening to and responding to their concerns, ORPC sought out the Cobscook Bay Resource Center in its role as an established convener and neutral broker on issues of concern to both fishing and community interests. The Resource Center pulled together three community conferences in three years, helping local residents learn about tidal energy in general and communicate the plans of ORPC as they developed.

Will Hopkins, Executive Director of the Resource Center, facilitated individual meetings between ORPC representatives and fishing interests, resulting in changes to test locations and other details. Will helped set up a series of informal meetings, so that area residents could meet with ORPC representatives and take the measure of the people and the information they were providing about their plans. Because of past work with Passamaquoddy Tribal Government, the Resource Center also facilitated contact between ORPC and tribal representatives. The Resource Center posted relevant information about tidal energy and ORPC proposals on its website, promoting their website as a place to go for background and specifics, helping maintain the "community memory" of what was said at the beginning and at each step in the process.

Collaboration with local government

In 2006, the Electric Power Research Institute (EPRI), the research and development arm of the national electric utility industry, released a North American study that identified the Western Passage and Cobscook Bay areas as the two best tidal energy sites on the East Coast of the United States.

Bud Finch, Eastport City Manager, said that after early inquiries following release of the EPRI study, the community was afraid of losing an ability to partner with energy companies in what he categorized as the "gold rush" phase to put a stake in local waters. As part of its introduction to Eastport, ORPC gained an early sense that ocean energy and perhaps the manufacturing and shipping of tidal and other technologies and equipment fit well with the economic development strategy of Eastport city officials. Mr. Finch became impressed with ORPC's willingness to partner with local government and local industry. ORPC networked with Eastport stakeholders to draw on local talent at an early stage of problem-solving in the company's development of test sites and equipment in Eastport, and eventually hired a local resident as general manager for the project. Mr. Finch cited the openness and honesty of ORPC's leadership as key factors in the City's willingness to partner. "They told us when they didn't know something, they didn't dance around," Finch said. Finch also noted the importance of the Cobscook Bay Resource Center as a neutral, trusted facilitator of potentially "difficult" community conversations, and for their role in providing information about the process ORPC was using to engage stakeholders and how people could participate.

Promise to the public

Both Mr. Hopkins and Mr. Finch cited the importance of ORPC's initial outreach strategy, which included a promise to the public for both involvement and collaboration. It was as if ORPC was borrowing from the "spectrum" formulated by the International Association of Public Participation and said to the people of Eastport, *"…not only will we keep you informed and work with you to ensure that your concerns are represented in what we come up with, but further, we will look to you for advice and innovation in formulating solutions and we will incorporate your advice and recommendations into our decisions to the maximum extent possible."* Further, ORPC, the City of Eastport, and the Cobscook Bay Resource Center have worked in partnership to validate the principles of public engagement outlined above.

Recommendation

Ocean energy developers will gain trust, understanding, and possible support, from a variety of local stakeholders by adopting the best practices in public engagement as outlined above and demonstrated by the ORPC-Eastport example.