APPENDICES

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

December 2009

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APPENDICES

to the

Final Report of the Ocean Energy Task Force

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Appendix 1: Executive Order

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") CO_2 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

Executive Order

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.

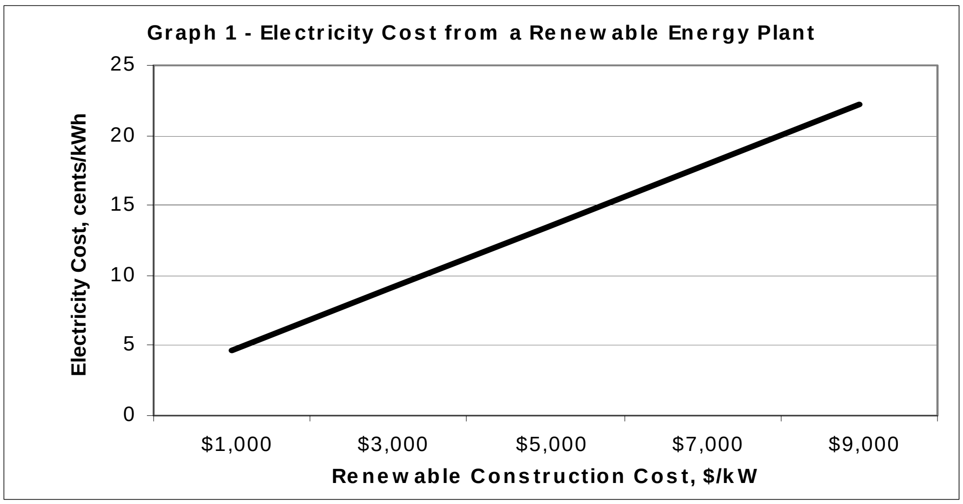
The economics of an electric vehicle program will be largely dependent on the purchase price of electric vehicles. A premium of at least $10,000 would likely be economic for the vehicle owner due to the net lower energy costs of electricity compared to gasoline. An electric vehicle program coupled with 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.

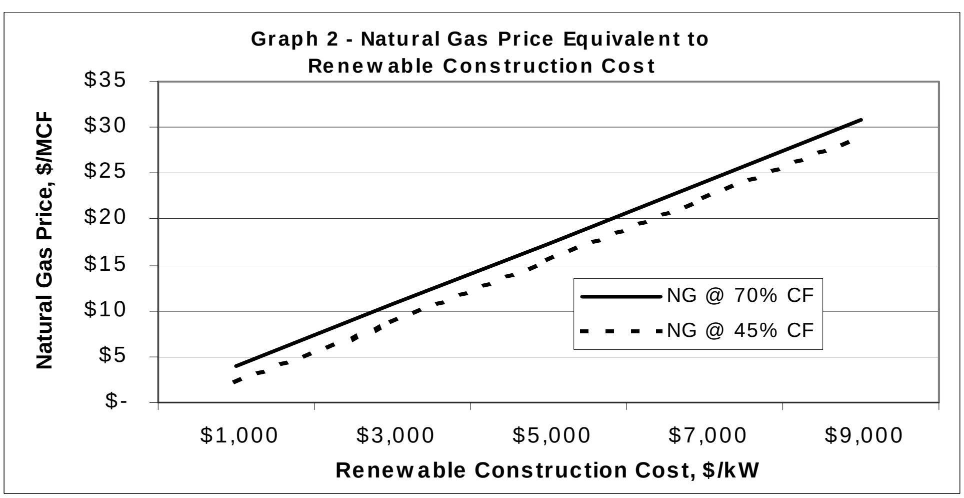
Results of the Analysis

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.



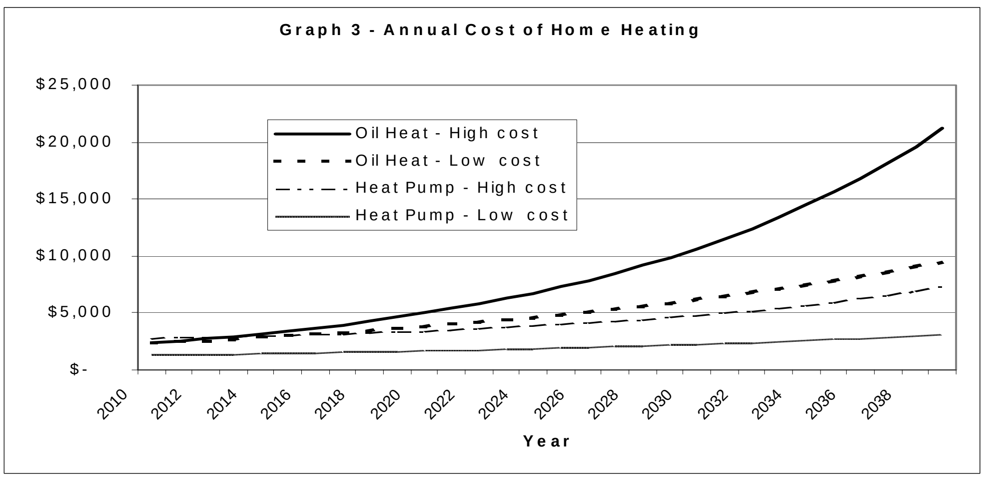
The price for natural gas that would result in equivalent electricity costs from a new combined cycle power plant was then calculated. Graph 2 shows that, for a plant operating at a 70% capacity factor, the equivalent natural gas price would vary from about $4 per thousand cubic feet (MCF) at wind construction 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.



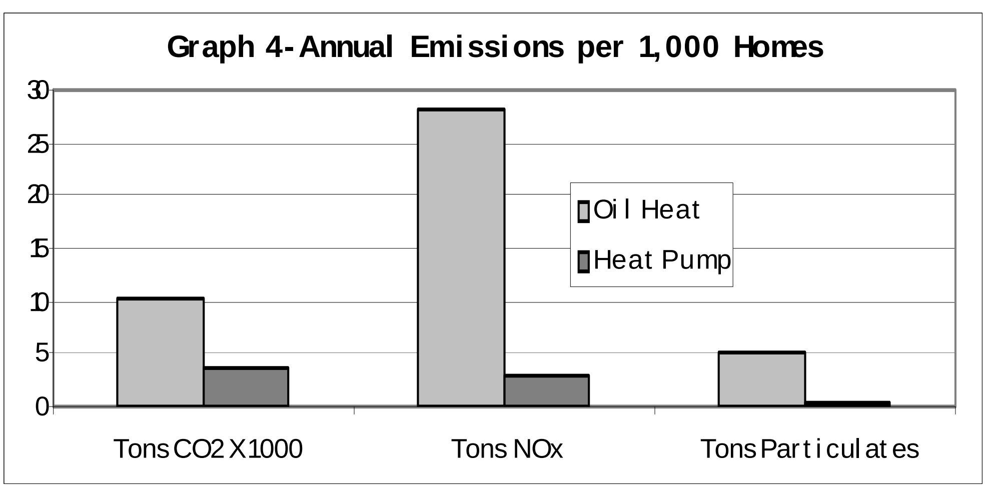
2. Home Heating Comparison – Oil vs. Electric Heat Pumps
One possible use of electricity from offshore wind is the conversion of space heating from oil furnaces to electric heat pumps. The annual heating bill for a representative home was calculated for four scenarios:

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.

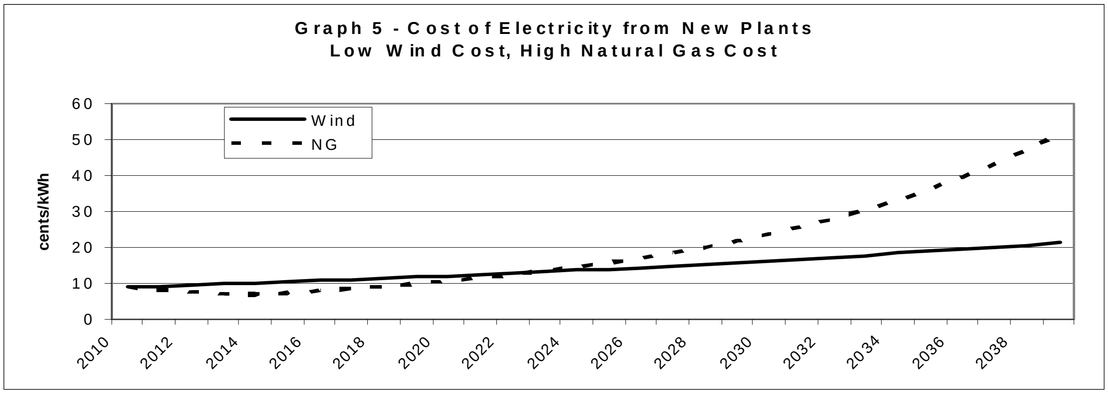


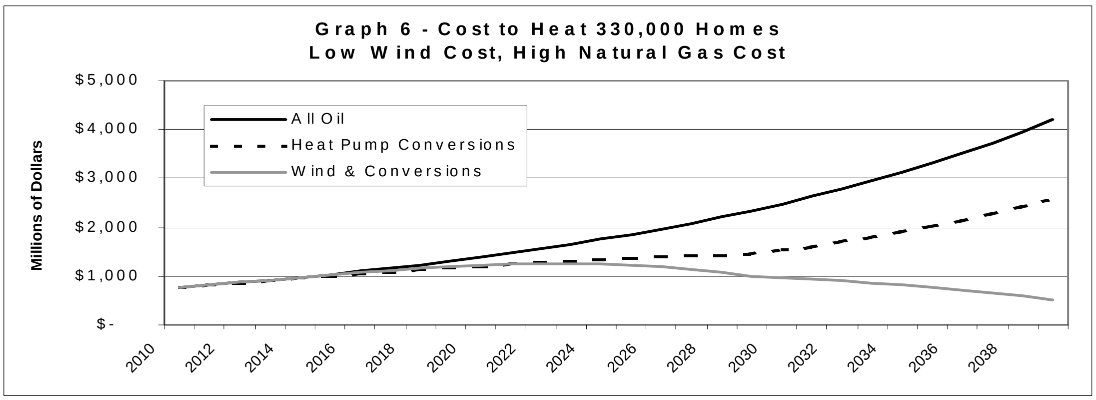
3. Twenty-Year Build Out of Offshore Wind

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
60
50
40
30
20
10
0
Wind
NG
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
$5,000
$4,000
$3,000
$2,000
$1,000
$ -
All Oil
Heat Pump Conversions
Wind & Conversions
2010
2012
2014
2016
2018
2020
2022
2024
2026
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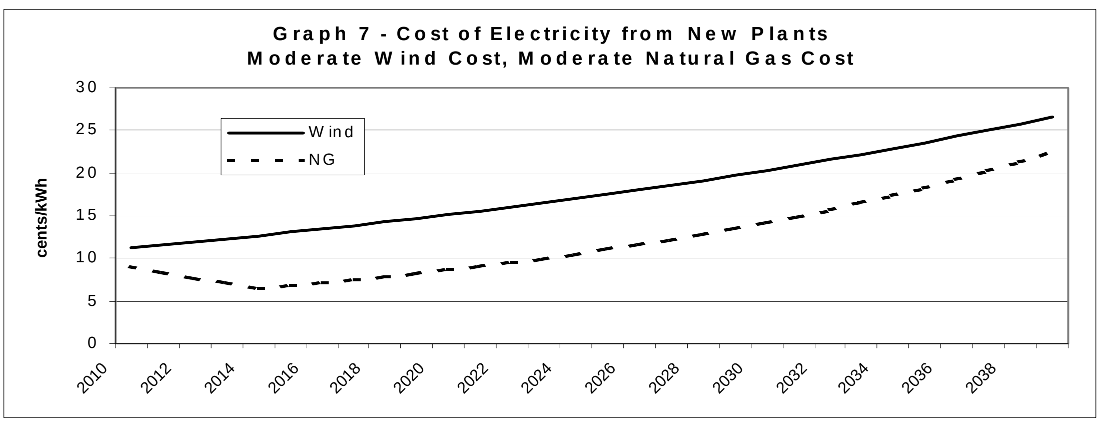
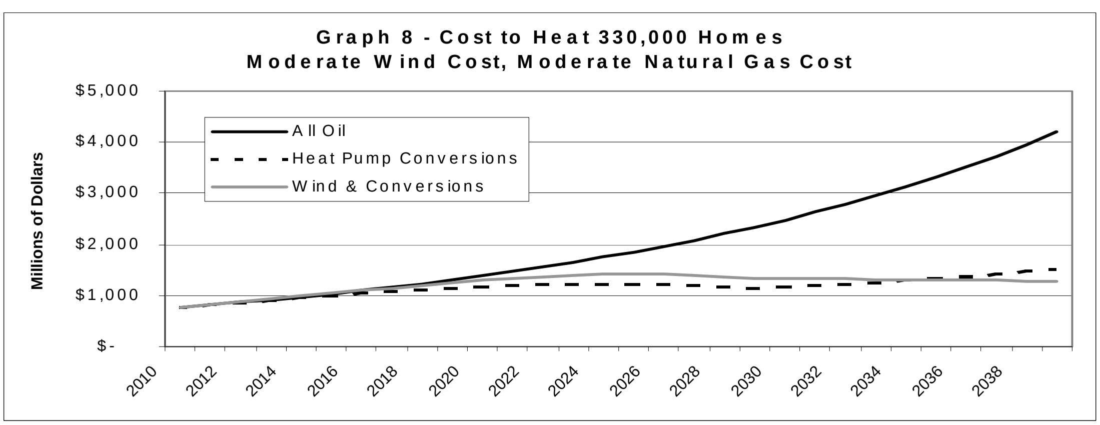
2030
2032
2034
2036
2038

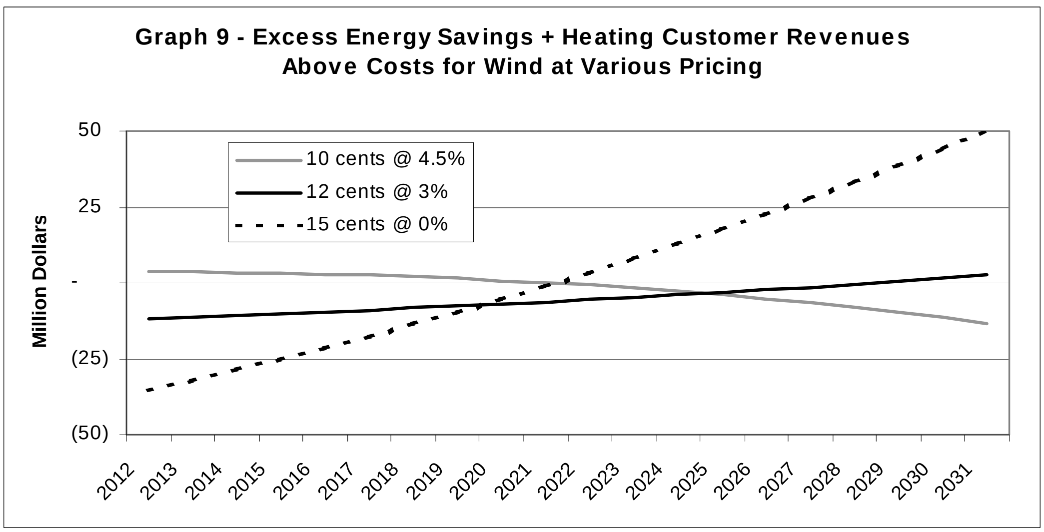

Graph 7 - Cost of Electricity from New Plants
Moderate Wind Cost, Moderate Natural Gas Cost
cents/kWh
30
25
20
15
10
5
0
Wind
NG
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030
2032
2034
2036
2038


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

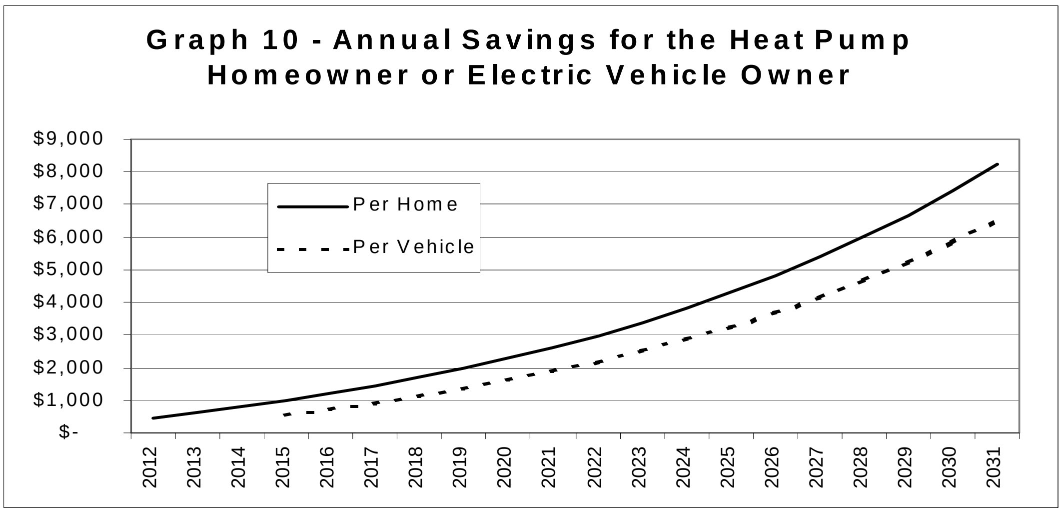
4. Pilot Program with 200 MW of Wind Energy

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.

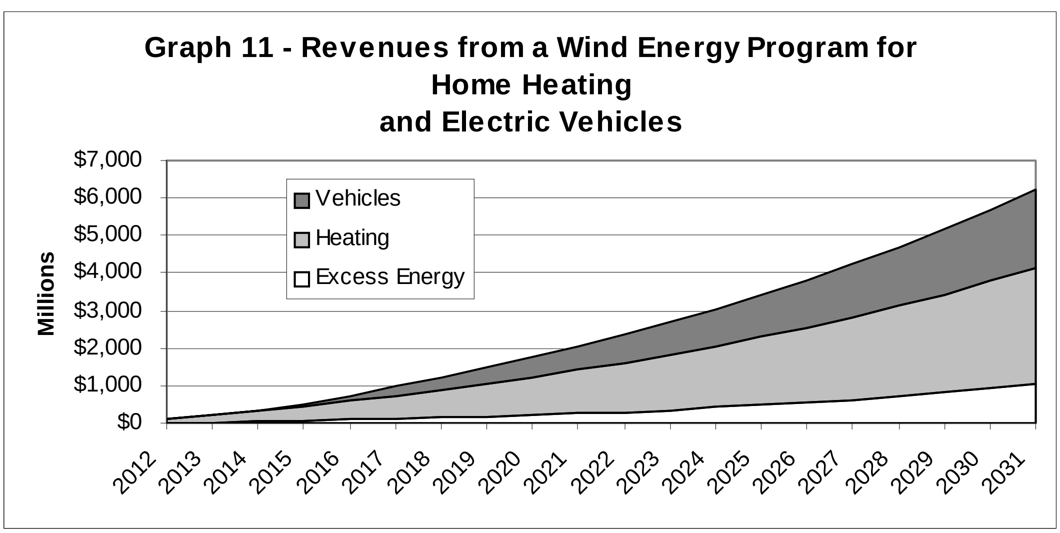
Excess wind energy not used by the heat pumps was assumed to displace standard offer electricity supply. That displaced energy would likely be lower cost than wind energy during the early years of the program, but higher in later years. Graph 9 shows the results at the three different wind pricing scenarios 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.

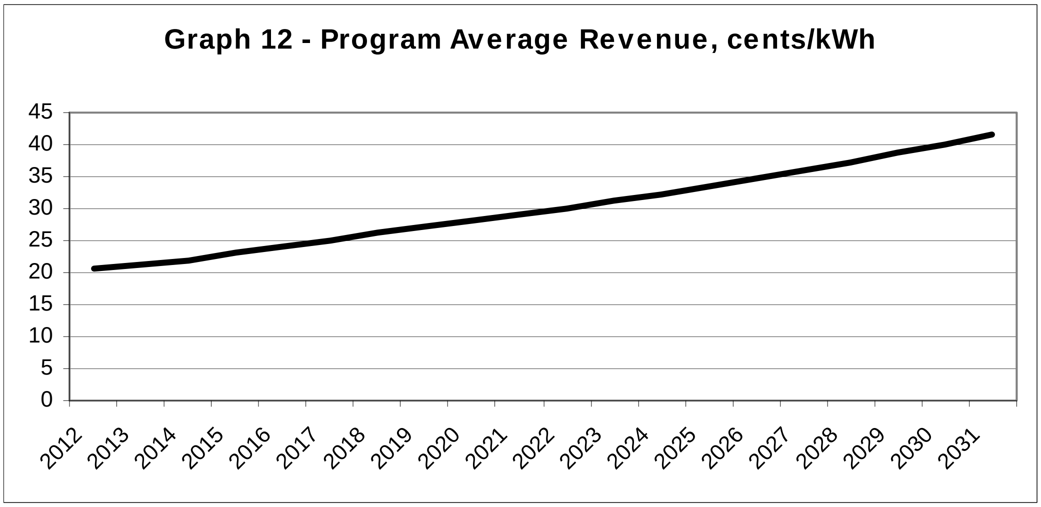


5. Heat Pump Conversion and Electric Vehicle Program Supplied by Wind
An aggressive program of heat pump conversions and electric vehicle sales coupled with the electricity provided from offshore wind was investigated. It was assumed that 35,000 homes per year, or equivalent businesses, would be converted 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.

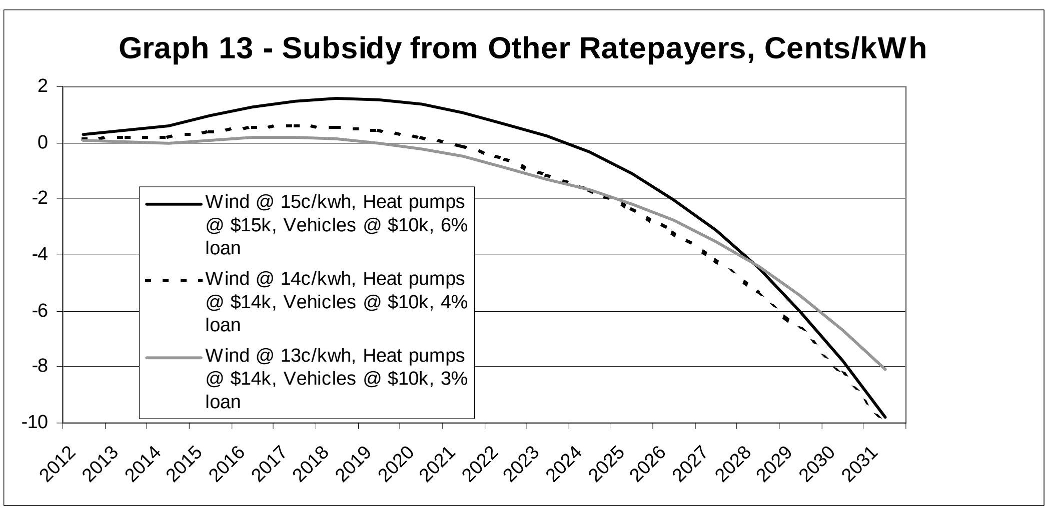


Excess wind energy not consumed by home heating or electric vehicles was assumed sold at market price. The resulting sources of revenue are shown in Graph 11, and the average revenue per kWh of wind energy sold is shown in Graph 12.

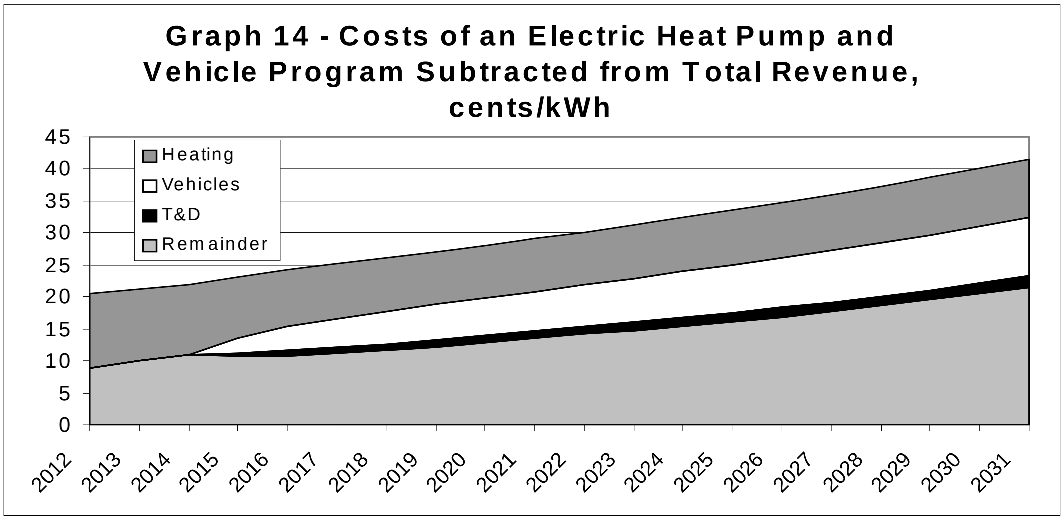


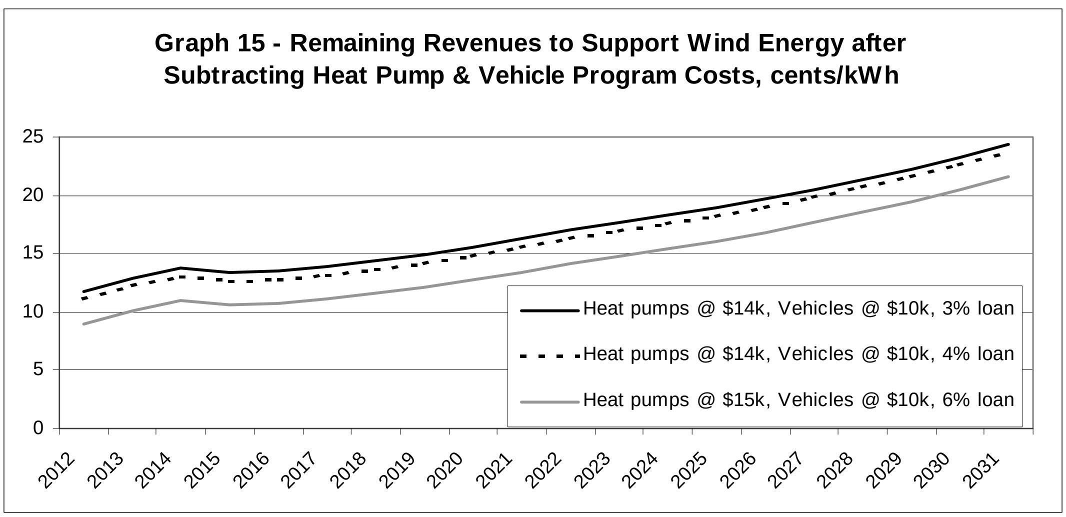


In addition to supporting the wind generators, the revenues from the sale of the wind energy would have to service the loans for the heat pump conversions and the electric vehicle purchase subsidy, and cover the costs of any resulting incremental T&D improvements. Depending on the price of the wind energy, 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

<u>Subcommittee #7: Interim Steps/Coordination</u>

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

<u>Subcommittee #8: Post OETF Entity</u>

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.

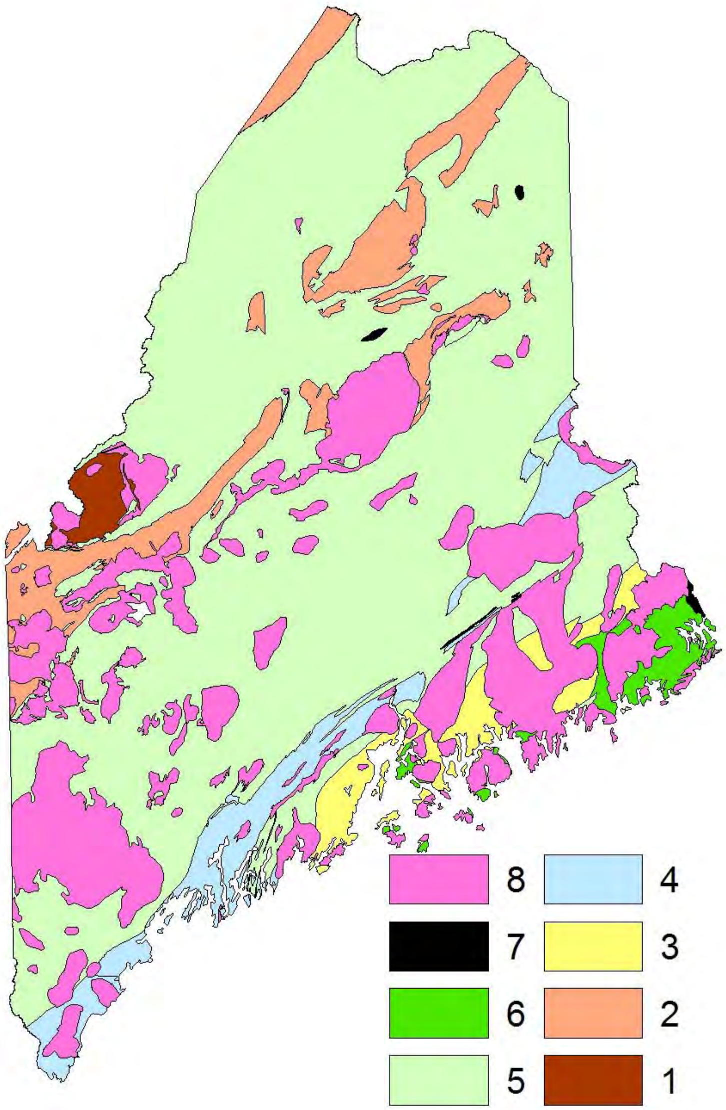


Figure 1.
Generalized geologic map of Maine. Modified from Osberg and others, 1985.

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 600ºC. 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 500ºC. Much of the central and eastern parts of the state experienced greenschist-grade metamorphism with the development of abundant chlorite at between 350ºC and 500ºC. From about the latitude of Mt. Katahdin northward, the rocks are only weakly metamorphosed, having experienced temperatures in about the 200ºC 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 100-200ºC (Figure 3). Above about 225ºC, organic carbon is converted to graphite. In fact, graphite is a common mineral in many of the metamorphosed sedimentary rocks of Maine.

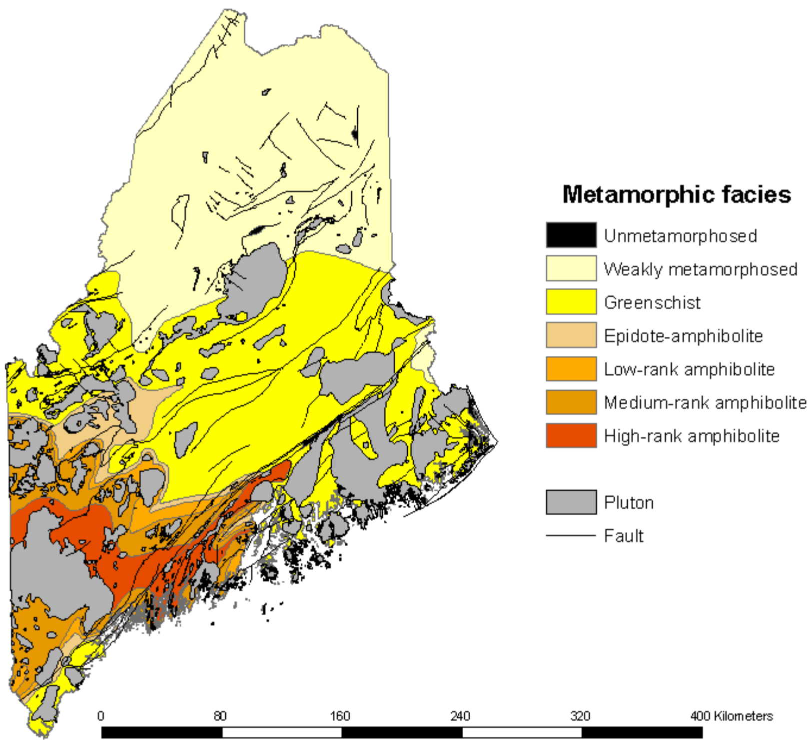


Figure 2. Generalized metamorphic map of Maine. Modified from Guidotti, 1985. Metamorphic grade increases from light yellow to dark red colors. Intrusive igneous rocks (mainly granites) are shown in gray

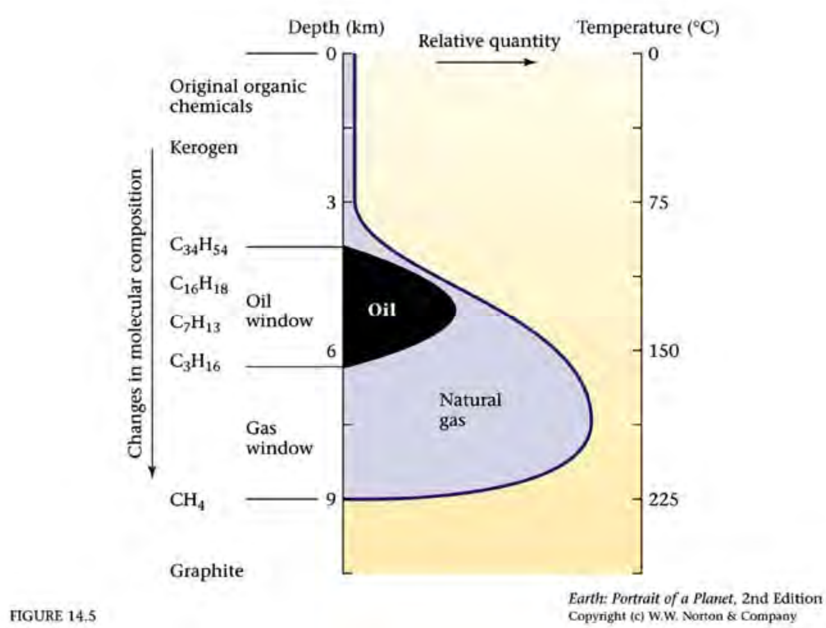


Figure 3. Conditions for oil and gas generation in organically rich sedimentary rocks. Oil is generated between ~80-150°C. Above 225°C, all the organic components in rocks are converted to graphite. Graphite is a common component of Maine's metamorphic rocks.

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.

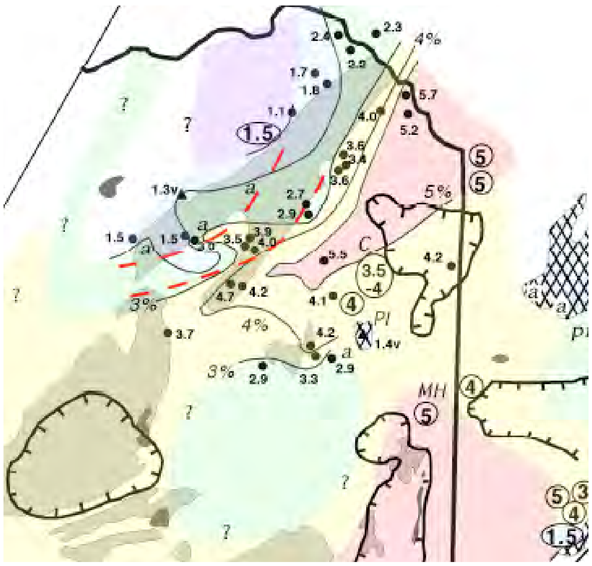


Figure 4.
Map of northern Maine showing thermal maturity of rock units based on graptolite reflectance and other thermal indices. Areas shown in yellow and orange have been heated beyond the temperatures necessary for oil and gas generation. From Malinconico and Roy (1993).

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 300-500ºC 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).

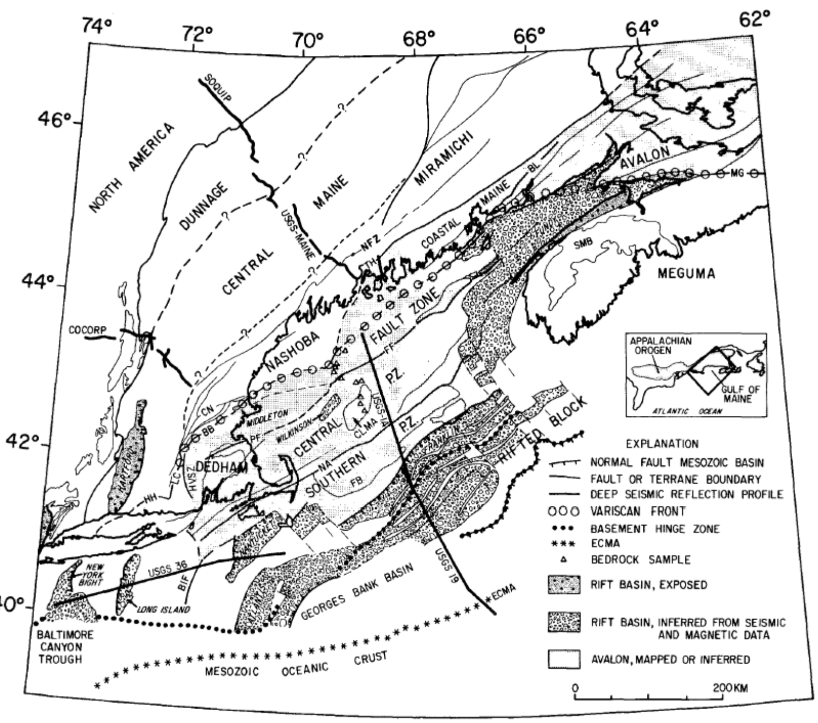


Figure 6. Generalized tectonic map of the Gulf of Maine from Hutchinson and others (1988). Dark gray areas are Triassic rift basins. Areas labeled "P.Z." are dominated by intrusive igneous rocks (plutons).

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.

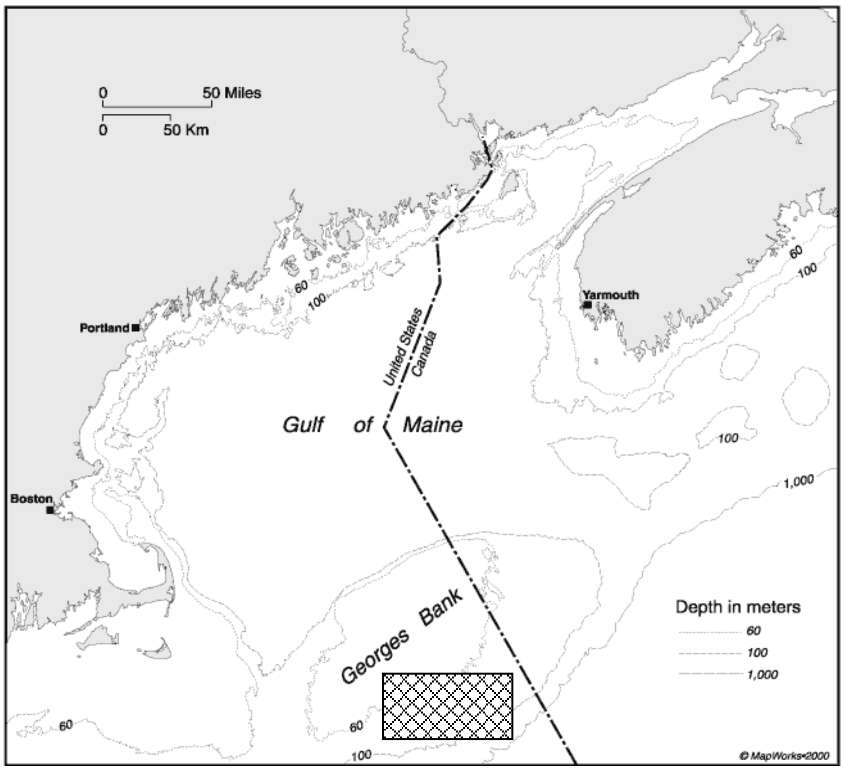


Figure 7. Outline map of the Gulf of Maine and Georges Bank. Cross-hatched box shows the approximate location of leases and exploration wells of the 1970s and 1980s. Modified from Gulf of Maine Times (2000).

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.

<u>Potential risks oil and gas development</u>

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.

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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: Organized Areas	Maine's Coastal Waters: Unorganized Areas	Federal Waters[1]
State	Site Location of Development Act - DEP - Permit[2]	X		
State	Natural Resources Protection Act - DEP - Permit	X		
State	Stormwater/Erosion and Sedimentation Control Laws - DEP - Permit/ Requirement[3]	X	X	
State	Maine Endangered Species Act - DIFW and/or DMR - Review; Requirement[4]	X	X	
State	Submerged Lands Lease - Bureau of Public Lands - Lease	X	X	
State	Maine Historic Preservation - Maine Historic Preservation Commission - Review[5]	X	X	
State	Coastal Zone Management Act - SPO - Federal Consistency Review[6]	X	X	X
State	Wind Energy Act - DEP - Certification[7]	X		
State	Rezoning - LURC - Rezoning Approval[8]		X	
State	Land Use Standards - LURC - Permit		X	
State	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
Federal	Outer Continental Shelf Lands Act - Minerals Management Service (MMS) - Lease or ROW			X
Federal	Executive Order 10485; Federal Power Act - Department of Energy/Federal Energy Regulatory Commission - Permit/Interconnection Approval[11]	X	X	X
Federal	FAA Circular l-864 - Federal Aviation Administration - Guidance Conformity	X	X	X
Federal	Federal Navigation Laws - U.S. Coast Guard - Permit	X	X	X
Federal	National Environmental Policy Act - ACOE or MMS - Review[12]	X	X	X
Federal	**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.

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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

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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.

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[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.