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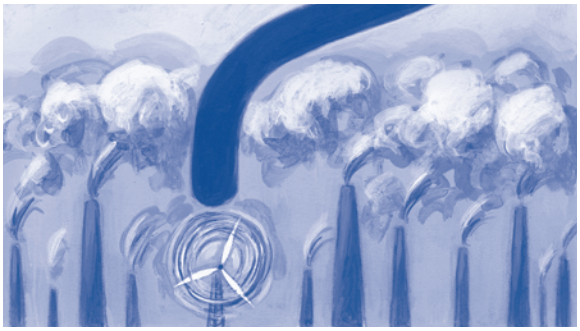

Confronting Global Warming:

Maine's Multi-Sector Initiatives, 2003–2008

by David P. Littell

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In their article David Littell, Gary Westerman and Malcolm Burson describe Maine's pioneering efforts in reducing greenhouse gas emissions, promoting energy efficiency, and developing less carbon-intensive and more sustainable energy sources. They discuss in particular the goals and accomplishments of the state's Climate Action Plan and Maine's participation in several multi-state and regional efforts, including the Regional Greenhouse Gas Initiative (RGGI).

. . .with its reputation as a state of sensible and resourceful people and a history of national leadership in environmental policy, Maine. . . is well positioned to drive national and international action (Union of Concerned Scientists 2007: 5).

The truth of this assessment has been especially apparent in Maine's response over the past five years to global concerns regarding increasing levels of greenhouse gas (GHG) emissions and associated environmental and socioeconomic impacts. Drawing upon the knowledge and commitment of its government agencies, businesses and industries, environmental organizations, and concerned citizens, Maine has developed and implemented a comprehensive mitigation strategy. Maine was among the first states to adopt a GHG action plan, and has designed and enacted first-in-the-nation policies and programs that—collectively with other states and regional initiatives—provide a framework for significant portions of a national GHG reduction strategy.

This article briefly traces the history of Maine's initiatives and involvement in planning for climate change, building upon commitments of the New England governors and the Eastern Canadian premiers. It then presents highlights of the state's mitigation plan and progress toward statutory GHG reduction goals. Finally, the article discusses future directions that hold promise for even greater advancement toward environmental quality as well as improvements in energy efficiency and independence.

MAINE CLIMATE CHANGE ACT

Maine has been both an early and a national leader in developing policies and programs aimed at reducing GHG emissions. At the time that many states were developing GHG reduction policies and action plans, Maine become the first state to adopt mandatory statutory reduction targets with the passage, in 2003, of Public Law 237, commonly know as the Maine Climate Change Act. The act set the following goals (38 MRSA, §576):

- In the short term, reduction to 1990 levels by January 1, 2010.
- In the medium term, reduction to 10 percent below 1990 levels by January 1, 2020.
- In the long term, reduction sufficient to eliminate any dangerous threat to the climate. To accomplish this goal, reduction to 75 percent to 80 percent below 2003 levels may be required.

Maine has been both an early and a national leader in developing policies and programs aimed at reducing GHG emissions.

These statutory goals align with other regional and international agreements, particularly Resolution 25-9 on global warming adopted by the New England Governors and Eastern Canadian Premiers in 2000 (NEG/ECP 2000), and the subsequent Climate Change Action Plan (NEG/ECP 2001).

MAINE CLIMATE ACTION PLAN

To accomplish these reduction targets, the act directed the Maine Department of Environmental Protection (DEP), with input from stakeholders, to develop a comprehensive, statewide action plan. Thus began an extensive effort involving business, industry, and governmental and non-governmental entities. The 15-month stakeholder process included more than 100 people, representing more than 40 groups, associations, agencies, academic institutions, and the legislature, and resulted in "A Climate Action Plan for Maine" (DEP 2004). Its 54 action items, called "options," were presented to the governor and legislature in 2005.

The recommended measures were developed by four stakeholder working groups: energy and solid waste; buildings, facilities, and manufacturing; transportation and land use; and agriculture and forestry. The measures were then ranked from top to bottom in order of expected GHG reductions (Table 1, page 54).[1] If all the options were implemented at the earliest possible time, and carried through as modeled, the 2010 and 2020 targets would be met. The stakeholders understood, however, that real-world conditions would likely

TABLE 1: **Maine's Climate Action Plan Options, Ranked by Projected Carbon Savings (in thousands of metric tons: $KmtCO_2e$)**

Option #	Option Name	KmtCO2e saved in 2010	KmtCO2e saved in 2020
1	Offset Requirements	365.0	1022.0
2	Implement Tailpipe GHG Emissions Standards	137.5	933.6
3	Regional Cap-and-Trade	376.0	755.0
4	Clean Diesel/Black Carbon	383.8	740.0
5	Renewable System Benefit Charge	334.0	689.0
6	Set a Low GHG Fuel Standard	63.5	639.5
7	Emission Standards	484.0	609.0
8	Biomass Generation: Existing Units	574.0	574.0
9	Landfill Gas Management: Energy Production	210.0	550.0
10	Increased Stocking with Faster Growing Trees	531.7	531.7
11	Renewable Portfolio Standards	247.0	527.0
13	Pay as You Drive Insurance	6.9	379.0
14	Forestland Protection	376.0	376.0
15	Recycling/Source Reduction	168.0	374.0
16	Early Commercial Thin	331.7	331.7
17	Slowing Vehicle Miles Traveled (VMT) Growth	87.5	286.4
18	Biomass Restart Nonoperating Units	269.0	269.0
19	Improve Electrical Efficiency: Commercial/ Institutional	181.9	250.8
20	Timber Harvest to Capture Anticipated Mortality	239.5	239.5
21	Biomass Electricity Feedstocks	228.4	228.4
22	Electrical Efficiency Measures: Manufacturing	156.5	207.2
23	Fossil Fuel Efficiency Measures	76.6	204.4
24	Low GHG Fuel for State Fleets	19.1	157.5
25	Expanded Use of Wood Products	129.8	129.8
26	Appliance Standards	84.3	128.7
27	Landfill Gas Management: Flaring	109.0	109.0
28	Active Softwood Increase	73.2	73.2
29	Increase Public Expenditures for Electrical Efficiency	25.0	71.1
30	Improve Residential Building Energy Codes	24.7	64.1
31	Voluntary Partnerships and Recognition Programs	34.5	57.5
32	Adopt California Vehicle Emissions Standards	0.0	53.0
33	Local Grown Produce	34.9	52.1
34	State Green Power Purchases	31.0	45.0
35	Efficient Use of Oil and Gas: Home Heating	29.3	39.1
36	Combined Heat and Power Incentive Policy	86.0	38.0
37	Enforce Commercial Building Energy Code	12.0	33.6
38	Solar Hot Water Heater Program	12.0	33.1
39	Soil Carbon Buildup	15.4	31.0
40	Green Campus Initiatives	11.0	29.8
41	Encourage Anti-Idling Measures: Freight	12.0	29.7
42	Voluntary Green Building Design Standards	23.5	28.0
43	Waste-to-Energy	24.0	24.0
44	Agricultural Land Protection	15.9	22.7
45	Energy Savings in State Buildings	7.9	21.0
46	GHG Feebate (Fee & Rebate) System	3.8	18.8
47	Procurement Preference for Concrete Containing Slag	18.0	18.0
48	Promote Energy-Efficiency Buildings	4.3	11.3
49	Specification C150 Portland Cement	9.0	9.0
50	Reduce HFC (hydrofluo-rocarbon) Leaks	1.2	9.0
51	Increase Organic Farming	4.4	8.9
52	Maine Biodiesel	5.5	5.5
53	Low GHG Fuel Infrastructure	0.4	2.0
54	Nutrient Management	1.8	1.8
55	PV (photovoltaic) Buy Down Program	0.1	0.2

Note: Option #12 included in other measures Source: Maine DEP (2004)

mean that some measures might exceed their targets, while others might not perform as expected based on the then-current 2003 modeling or because implementation was delayed.

With this reality in mind, the statute requires the DEP to report biennially on progress, and to adjust the plan as needed to achieve the statutory requirements. Reports have subsequently been submitted in 2006 and 2008, with on-going assessment of the plan and its progress. With the first statutory milestone of 2010 approaching, efforts are now underway to assess Maine's current GHG emissions for comparison with the 1990 baseline.

IMPLEMENTATION OF MAINE'S CLIMATE ACTION PLAN

Unlike some states' plans, which rely extensively on subsequent legislation and/or executive orders, implementation of Maine's plan is balanced among those requiring legislative action, some requiring new rules, voluntary actions, regional cooperation, and the assumption that market forces will promote other emissions reductions. The top 20 percent of actions, in terms of emissions reduction potential, illustrate this principle (Table 2).

Several of the most important actions focus on lowering emissions in the electricity-generating sector and rely on statutory action to allow regional cooperation. For example, in 2007 and 2008, Maine adopted the necessary rules to enable the state to participate in the Regional Greenhouse Gas Initiative (RGGI), which implements the regional cap-and-trade action (option #3). The extent to which RGGI is implemented over the next few years will determine the volume of GHG savings associated with other plan options that remain to be implemented, namely offset requirements (option #1) and emissions standards for electricity generation (option #7). Maine, which already had the highest renewable portfolio standard (30 percent) in the nation, has enacted legislation to raise that standard by an additional 10 percent progressively by 2017. This will meet the plan goal for that action (option #11) ahead of schedule. Two other "top 20 percent" items, to increase the amount of electricity produced from forest biomass (option #8) and from methane in landfills (option #9), have been accomplished through market forces.

In the transportation sector, Maine has adopted the California tailpipe GHG emission standard (option #2), although implementation has been delayed in 18 states due to the U.S. Environmental Protection Agency's (EPA) denial of California's waiver request. Litigation by the states to overturn EPA's denial to approve California's tailpipe GHG standards is pending in court. Maine has also adopted both the California low-

TABLE 2: **Implementation Mechanisms for Plan Options with the Greatest Emissions Reduction Potential**

Rank	Name of Option	KmtCO2e saved 2020	Cost $/ tCO2e	Mechanism
1	Offset Requirements	1022.0	10	Statutory, in conjunction with #3
2	Implement Tailpipe GHG Emissions Standards	933.6	-48	Rule, with federal participation
3	Regional Cap-and-Trade	755.0	-90	Statutory; regional activity
4	Clean Diesel/ Black Carbon	740.0	14	As proposed, no agreement on method
5	Renewable System Benefit Charge	689.0	30	No specific mechanism in 2004
6	Set a Low GHG Fuel Standard	639.5	34	Regional effort and statutory requirement
7	Emission Standards	609.0	23	Existing DEP authority
8	Biomass Generation: Existing Units	574.0	15	Originally proposed as tax credit
9	Landfill Gas Management: Energy Production	550.0	NE	Originally proposed as regulatory
10	Increased Stocking with Faster-Growing Trees	531.7	1	Variety of means with landowners
11	Renewable Portfolio Standard (RPS)	527.0	10	Statutory increase in existing standard

Source: Maine DEP (2004)

TABLE 3: **Options Ranked by Cost ($) per Ton CO_2 Saved**

	> 200 Kmt Carbon Saved	< 200 Kmt Carbon Saved
Options saving more than $20 per ton	19 Improve electrical efficiency (-139) 3 Regional cap-and-trade (-90) 2 Tailpipe emissions standards (-48) 23 Fossil fuel efficiency (-34) 22 Manufacturing electrical efficiency (-30)	36 CHP (combined heat/power) policy (-185) 26 Appliance standards (-134) 37 Commercial building energy code (-61) 42 Voluntary green building standards (-45) 29 Public expenditure electricity efficiency (-55) 45 State buildings energy savings (-37) 30 Residential building energy codes (-35)
Options saving between $20 and $0 per ton	14 Forestland protection (-6) 21 Biomass electricity stocks (0) 15 Recycling/source reduction (0)	48 Promote energy-efficient buildings (-19) 40 Green campus (-18) 35 Home-heating efficiency (-6) 47 Slag concrete procurement preference (0) 49 Portland cement ASTM specification (0) 54 Agriculture nutrient management (0) 31 Voluntary partnerships (0) 32 ZEV mandate (0) 46 GHG vehicle feebates (0)
Options costing more than $0 and less than $20 per ton	16 Early commercial thinning (1) 10 Increased stocking fast growth (1) 20 Timber harvesting (3.5)	41 Encourage freight anti-idling (>0) 50 Reduce HFC refrigeration leaks (1) 27 Landfill methane flaring (2) 25 Expand wood products use (3) 28 Softwood increase (3) 43 Waste to energy (9) 24 State fleet low GHG fuel (10) 44 Agricultural land protection (13) 38 Solar hot water heater (16)
Options costing more than $20 per ton	7 Emissions standards (23) 5 System benefit charge (30) 6 Low GHG fuel (34)	39 Soil carbon buildup (28) 51 Organic farming (28) 34 State green power purchase (28) 52 Promote Maine biodiesel (40) 53 Low GHG fuel infrastructure (1,482)

Source: Maine DEP (2004)

emission vehicle (LEV) standards and the zero-emission vehicle (ZEV) requirements, which mandate a higher percentage of low-emission gasoline and hybrid automobiles (option #32). Market demand has already accomplished this option with more than 25 percent of the vehicles delivered to Maine as early as 2005 meeting these standards. A third option in the transportation sector, reducing the impacts of black carbon (option #4), is being met through the regional distribution of low-sulfur diesel fuel. (See Rubin, this issue, for discussion of the transportation sector.)

In the area of energy conservation and demand management, the coordinated efforts of several state agencies—the Public Utilities Commission (PUC), MaineHousing (formerly, the Maine State Housing Authority, MSHA), and the State Planning Office (SPO)—have had significant impact on reducing emissions by reducing demand, effectively implementing option #30 (improve residential building energy codes) and option #37 (enforce commercial building energy code). The Green Building Standards of MaineHousing, the first of their kind in the

country among housing finance agencies, are projected to result in housing projects that are 30 percent more energy efficient compared to conventionally built projects (MaineHousing 2008). Similarly, the PUC Efficiency Maine program has initiated new programs for both residential and commercial construction (see Vrabel, this issue). These efforts offer financial incentives plus education, training, and certification opportunities to homebuilders as ways to inform and transform both consumers and the construction industry.

In conjunction with these initiatives, and in response to a legislative resolve, the SPO developed recommendations to address building code compliance issues that have long handicapped uniform code enforcement and thus the potential benefits from energy-efficiency efforts. In 2008, the statutory authority necessary to reach and implement these ambitious efficiency code improvements was passed into Maine law as "An Act to Establish a Uniform Building and Energy Code" (LD 2257), which takes effect January 1, 2010.

As originally proposed, the implementation costs of the 54 action items are distributed (on a cost-per-metric-ton-of-GHG-saved basis) across a spectrum from those that save money (generally through avoided costs for electrical efficiency) to those that would require expenditure of public or private funds to accomplish (Table 3).

Based on original modeling, the average cost of implementation is at or slightly above $1 per ton of carbon. More importantly, almost all of the measures that offer the greatest emissions reductions do so at a negative cost, saving both carbon and money. The cumulative impact of implementation of all measures is presented in Figure 1 (page 58), with reference to the 2020 statutory requirement (Maine Regulatory Assistance Project 2005).

According to a recent white paper by the Center for Climate Strategies (CCS 2008), 20 states that cover more than two-thirds of the U.S. economy and population have completed and begun implementation of GHG mitigation plans. The paper indicates that, if similar actions were adopted by all 50 states, cumulative savings of $535 billion would accrue to the U.S. economy between 2009 and 2020. Thus, Maine's actions to date are part of a larger effort that is likely to act as an economic stimulus, clearly an important issue in a time of financial uncertainty.

MAINE'S EFFORTS ARE PART OF A REGIONAL/MULTI-STATE EFFORT

As previously noted, the Maine's 2003 Climate Change Act was based on the NEG/ECP resolution and action plan to address global warming and its impacts, "for which a regional approach to strategic action is required" (NEG/ECP 2001: 1). This agreement among six U.S. states and five Canadian provinces is a non-enforceable commitment in principle by which the jurisdictions agree to plan together to meet GHG reduction targets. Nonetheless, it has been used by a consortium of 17 environmental organizations to assess and rate the region's progress toward emissions reduction targets, with the assessment published annually as a "report card" on climate change actions (NE/EC Partners 2007).

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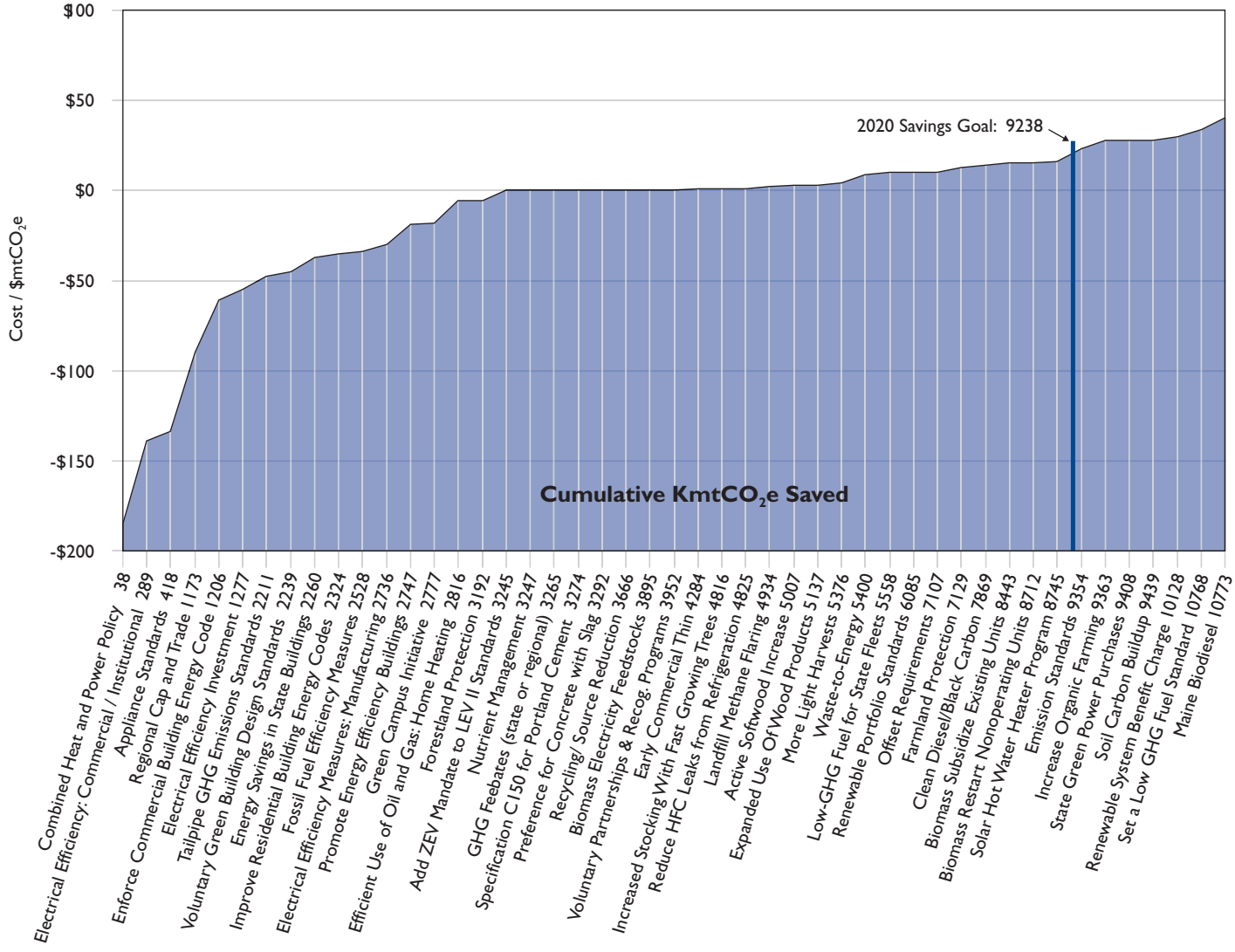
In addition to setting the stage for Maine's reduction goals, the NEG/ECP actions provided a framework for New England states and Canadian provinces to move forward with major statutory and other policy initiatives. This follow-through on the NEG/ECP agreement is reflected in climate action planning in every state and province in the region, encouraging and affirming a regional and international focus and interdependence. For example, in 2001 Massachusetts was the first state to adopt standards regulating GHG emissions from existing power plants, while their 2004 climate plan duplicated the NEG/ECP reduction goals. Similarly, Connecticut's 2005 climate change action plan specifically cited the NEG/ECP reduction goals

FIGURE 1: **Impact of Carbon Reduction Strategies with Greatest Cost-effectiveness for the Year 2020**



as the criteria for selecting and evaluating reduction measures, while implementing a series of actions designed to reduce GHG emissions associated with transportation impacts: adoption of California's automobile emission standards; a sales tax exemption for vehicles rated as high gasoline mileage; and a GHG-labeling program for new vehicles. Both states have also been actively involved in RGGI.

Like other Canadian provinces, Nova Scotia has also adopted the NEG/ECP reduction goals and timeline and has created a new government department to lead the planning in pursuit of those goals. While initial planning responsibility for climate action was coordinated through its Department of Energy, in 2008 the province transferred this responsibility to a newly created Department of Environment. Whereas other states have focused initial efforts on mitigation strategies with adaptation strategies to follow, the Nova Scotia action plan now being developed incorporates both mitigation and adaptation strategies.

As noted, Maine's plan adopted a number of reduction measures that require multi-state and regional efforts to successfully achieve the goals. Among these items are the regional cap-and-trade system (option

3), low GHG fuel standard (option #6), and implementation of electricity offset requirements (option #1), which is closely linked to the extent of implementation of the cap-and-trade system. Adoption of a fuel standard was identified in 2007 as a regional priority by the environmental commissioners of the New England states, and a 2008 biofuels policy report to the legislature stated that regional cooperation "appears to be the most effective State policy for encouraging biofuels production and consumption, followed closely by government leadership" (Maine OEIS 2008: 1). This emphasis on government leadership is also consistent with the recommendation of the Maine Climate Action Plan (option #24).

The utility cap-and-trade system is now implemented successfully in RGGI, which officially starts on January 1, 2009, when compliance with the cap on power sector emissions in the participating states takes effect. According to its Web site www.rggi.org/about,

> The Regional Greenhouse Gas Initiative (RGGI) is a cooperative effort by ten Northeast and Mid-Atlantic states to limit greenhouse gas emissions. RGGI is the first mandatory, market-based CO_2 emissions reduction program in the United States. The states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont are signatory states to the RGGI agreement. These ten states will cap CO_2 emissions from the power sector, and then require a 10 percent reduction in these emissions by 2018.

This multi-state effort involved extensive and complex coordination among the member states, requiring most states to develop compatible statutory foundation and to enact new legislation, in addition to executing the necessary multi-state memorandum of understanding. State agency energy and environmental commissioners now make up the board of directors of RGGI, Inc., which is responsible for on-going implementation of the program. In preparation for the first compliance period beginning on January 1, 2009, the RGGI states conducted two pre-compliance period auctions of the carbon emissions allowances that the power sector is required to hold for compliance for their CO_2 emissions. In Maine, the proceeds from these and future auctions are dedicated by statute to energy-conservation measures. By implementing energy-efficiency projects, additional and substantial benefits will be realized from reductions in both GHG emissions and energy demand. (See Bogdonoff, on RGGI, and McCormick and Van Hook, on uses of carbon offset funds for improving home energy efficiency, this issue.)

The interplay between international, regional, state, and multi-state efforts is certainly consistent with recognition that responses to climate change will require substantial cooperation and coordinated action at all levels. The cooperative, statutory, and policy frameworks being developed reflect this recognition. In 2008, the NEG/ECP initiative that had provided impetus for state and provincial climate action plans, leading in turn to regional and multi-state collaborations, came full circle in the form of a two-day workshop on GHG regulation and market-based trading mechanisms. The workshop was sponsored by the Climate Change Steering Committee of the NEG/ECP and the Northeast International Committee on Energy, and brought together more than 50 representatives from federal, state, and provincial governments as well as key environmental advocates.

PROGRESS AND CHALLENGE IN MOVING TOWARD MAINE'S GREENHOUSE GAS MITIGATION GOALS

Maine is making significant progress toward its statutory targets. The "Second Biennial Report to the Natural Resources Committee" (MDEP 2008) details, in a qualitative way, how implementation has proceeded for each of the 54 measures. Quantitative evaluation of progress will be undertaken once real data for 2010 are available. This will require extensive remodeling of the plan's original assumptions because the world, models, and assumptions have already changed significantly from what we knew in 2004. As previously noted, implementation of RGGI is a major step. Preliminary estimate of carbon savings likely to result from RGGI suggests that, while Maine's target for this option may not be reached in 2010

due to increased generation from Maine's lower-GHG gas-fired utilities, they will likely exceed original projections by 2020.

Revenues from the sale of RGGI allowances are likely to produce significant GHG savings in a related sector, buildings, facilities and manufacturing, since these funds are designated by the RGGI Implementation Act of 2007 to improving Maine's energy-efficiency infrastructure. Even so, implementation in this area remains a particular challenge. Among the initiatives that are currently underway, the "Governor's Carbon Challenge" has enlisted more than 70 businesses and institutions in a program of voluntary carbon savings through the establishment of energy-efficiency targets. (For discussion by several of these businesses, see articles by Bennett, Dyer, Rouillard, and Zaitlin, this issue.) The Energy and Carbon Reduction Trust (the "RGGI Trust") put forth program rules for use of RGGI allowance proceeds, to invest in commercial, residential, educational, industrial, and other energy reduction—that is, energy-efficiency projects.

There are clearly areas where more needs to be done...to reach ultimate reduction targets by mid-century.

The agriculture sector, while a relatively small contributor to Maine's climate efforts, is achieving real successes toward its climate-related goals. Positive forces in the market, such as increased demand for locally grown products and opportunities for voluntary carbon market offsets for carbon sequestration in agricultural soils, suggest that the plan's original goals in this area will be met sooner than modeled.

Two action areas with very high GHG reduction potential, biomass power generation and landfill gas management, have already exceeded their 2020 share of the targets due to market forces. (For discussion of landfill gas management, see Zaitlin, this issue.) The plan originally assumed that a tax credit or similar mechanism would be needed to support both, at a cost per unit of carbon in the range of $15 to $17. As markets have developed in the last few years, demand for renewable energy from the private market and state programs have made it possible for the private sector to accomplish these targets at little or no net cost.

Given Maine's overwhelmingly forested landscape, the carbon sequestration potential of our forests is a key component of the plan. There is still a need to provide incentives for Maine's forest landowners to adopt the management practices that have been shown to increase carbon storage while also protecting the viability of the forest industry. In one current initiative, the Maine Forest Service, in collaboration with the DEP, Environment Northeast, and the Manomet Center for Conservation, has proposed additional categories for offsets to be made available to RGGI emission sources beyond the current single category of aforestation. If adopted, recommendations in the areas of sustainable forest management and avoided deforestation through smarter development could provide economic incentives to maintain and increase forest carbon storage while increasing biomass available for wood products and energy production.

WHERE WE NEED TO DO MORE: LESSONS FROM BEYOND MAINE'S BORDERS

There are clearly areas where more needs to be done to meet the Maine statutory and NEG/ECP goals, and more significantly, to reach ultimate reduction targets by mid-century. Three areas stand out: (1) enhanced energy efficiency to achieve the most cost-effective reductions in energy use and to avoid construction of new fossil fuel facilities; (2) development of sustainable renewable sources of energy including wind, hydroelectric, solar; and (3) reduced emissions from the transportation sector through reductions in vehicle miles traveled, alternative forms of transportation, and development of low-carbon fuels.

According to the results of a 2005 market survey conducted for Northeast Energy Efficiency Partnerships (NEEP), energy-efficiency (EE) strategies offer a wide range of potential benefits for energy

conservation, meeting peak demand growth, and realizing climate change goals. Specifically, the NEEP survey concluded that:

- Current Northeastern states and regional policies significantly under-target EE potential over the next 10 years.
- Cost-effective investments in EE could defer the need for more than 8,000 megawatts (MW) of combined-cycle power by 2013.
- By 2010 EE investments could meet 21 percent to 68 percent of the targeted reductions in GHG emissions from the stationary combustion sector (Optimal Energy, Inc. 2005).

In the years since the survey, the PUC, through its Efficiency Maine program, has implemented several energy-efficiency strategies resulting in significant lifetime savings: residential lighting ($118 million saved since 2006); businesses ($53 million saved in 2007); high-performance schools ($3.7 million saved in 2007). Measured in terms of megawatt hours per year (MWh/yr), the combined programs have consistently outperformed the expectations of the 2005 survey, with a current peak in annual savings in 2007 of 87,400 MWh/yr. Table 4 presents a sampling of savings information in various units: millions of dollars, MWh, and tons of CO_2 (MPUC 2008).

In terms of renewable sources of energy, Maine has the highest potential for terrestrial wind power development in New England. In 2007, Governor Baldacci established by executive order a 16-member Wind Power Task Force to undertake a comprehensive review of the regulatory process and to recommend policy changes necessary to enable the development of Maine's potential. The wind power task force concluded "that Maine should seek to host at least 2,000 megawatts (MW) of installed wind power capacity by 2015, and at least 3,000 MW by 2020.…[and that] at least 300 MW of the 2020 goal could be achieved with projects built offshore" (Governor's Task Force 2008: 5). More than 10 percent of the 2015 goal is already in operation (Mars Hill with 42 MW), under construction (Stetson Ridge with 57 MW), or approved for construction (Kibby Mountain with 132 MW) (see Parker, this issue). In 2008, legislation proposed by the task force was enacted in the Wind Energy Act. In addition, the four state agencies charged with implementation have adopted and/or are adopting the rules, guidelines, and protocols needed to streamline wind power terrestrial development and to ensure proper project siting through appropriate environmental review.

In other states as far away as California and Texas, installation of wind power is moving ahead rapidly. New Jersey and Delaware have announced intent to built substantial offshore wind power similar to the Danish installations at Horns Rev and Nysted, which each produce approximately 160 MW. Perhaps most ambitious of all, according to a news story on the SustainableBusiness.com Web site in September 2008 Rhode Island announced selection of the construction firm to build offshore capacity of 1.3 million MW (SustainableBusiness.com). Even if individual projects do not go forward, the shift toward renewable sources of electrical generation and energy from fossil fuel is marked and will continue with strong support from state environmental and energy officials and policymakers.

TABLE 4: **Savings from Energy-efficiency Strategies in 2007**

Energy-Efficiency Strategy	Savings		
	LEB[1]	MWh[2]	Tons[3]
Residential Lighting Program	$36.3	44.72	16.5 tons*
Business Program	$53.6		
High Performance Schools	$3.7	1,372	507.0 tons*
Solar Energy Rebate Projects			
All Projects combined			211.7 tons
Solar Photovoltaic (PV)		51.80	
Solar Hot Water		71.65	
Low Income Appliance Replacement	$2.6	3,560	1,315.4 tons*

[1]LEB = Lifetime economic benefits in millions

[2]MWh = Megawatt hours annually

[3]tons = CO_2 annually

tons* = calculated: 739 lbs CO_2/MWh (USEIA 2006)

Source: except where noted, MPUC (2008)

The development of significant wind power and other renewable sources of generation will provide the basis for a shift to domestic, renewable, and sustainable forms of electrical, transportation and heating energy. Large-scale wind power development would make development of electrical-charge hybrids—chargeable during off-peak hours to maximize use of renewable capacity—a realistic and economical alternative.

In the area of development of low-carbon fuel, Maine has encouraged cellulosic ethanol research that reflects our natural resource forestry base. In 2008, the U.S. Department of Energy (DOE) made the competitive selection of a pilot project to produce cellulosic ethanol at a pulp mill located in Old Town with a DOE cost share of up to $30 million (U.S. DOE 2008). The business consortium that will guide this project consists of 22 U.S. and Canadian companies along with the University of Maine. While the full benefits of cellulosic ethanol in terms of GHG reduction are still the subject of research and evaluation, research results have led some experts to estimate reductions of more than 90 percent compared to petroleum gasoline (Schmer et al. 2007).

An energy transformation is already in progress as we are moving towards less carbon-intensive and more sustainable energy sources.

In 2007, the NEG/ECP formed a new standing committee, the Transportation and Air Quality Committee (TAQ), and charged it with developing a comprehensive Transportation and Air Quality Action Plan (TAQAP). The following year, the NEG/ECP approved the TAQAP which is comprised of 34 action recommendations organized around seven major areas, including low/no-carbon fuels, clean car programs, and transportation and land use planning (NEG/ECP 2008).

This energy transformation will be economy wide—that is the only way to reduce GHG emissions to levels most scientists believe are necessary to reverse the current atmospheric trends. The state's policy goals are to move toward greater efficiency in residential, commercial, and industrial use of electricity and traditional fossil fuels combined with a significant move toward renewable sources of electrical energy exploration of sustainable alternatives to transportation and heating fossil fuels.

THE PATH FORWARD TO CONTINUE REDUCING MAINE'S CARBON FOOTPRINT

An energy transformation is already in progress as we are moving towards less carbon-intensive and more sustainable energy sources. This is being driven by recognition at all levels of government that movement toward sustainable and renewable energy sources is imperative. For example, wind power generation in the U.S. grew in 2007 at a 45 percent rate, and according to an article by Craig Rubens on the earth-2tech Web site, has been estimated by the DOE to potentially account for 20 percent of U.S. electricity by 2030 (earth2tech.com/2008/05/13/doe-wind-could-power-20-of-us-needs/). Internationally, installed capacity of wind-produced electricity has increased twelve-fold in the past 10 years, from 7,600 MW to more than 94,000 MW at the end of 2007, and shows no signs of slowing, according to an article by Jonathan Dorn's on the Earth Policy Institute's Web site (www.earth-policy.org/Indicators/Wind/2008.htm). For example, the United Kingdom is well underway with a national program to build 6600 MW installed offshore wind capacity by 2015 (BWEA 2007).

Maine's governor has charged a 21-person Ocean Energy Task Force with going beyond the wind power task force and wind power legislation to make specific policy, legislative, and economic development recommendations to encourage offshore wind power, tidal, and other ocean-based energy projects. This initiative is consistent with the status of the Gulf of Maine as a world-class wind power resource: the Ocean Energy Institute estimates around 100,000 MW of theoretical Gulf of Maine electric capacity, an amount three times larger than New England's current installed capacity (Maine Office of the Governor 2008). (For discussion of tidal energy, see Ferland, this issue.)

Fundamentally, we are seeing what was called the "green movement" absorbed into mainstream American culture. Lifestyles that are not sustainable are losing their appeal, from 5,000-square-foot new "McMansions" to Hummers. Spending more for less to reduce energy footprints is now in vogue—hybrids have been backordered for sale at full sticker price while sport utility vehicle production lines have been closed as models sit unsold on dealer lots. Locally grown produce is selling at a premium.

In New England in particular, this mainstreaming of the green movement dovetails well with traditional Yankee frugality. This frugality is manifest in habits of turning down thermostats at night—now transformed to installing programmable thermostats—because New Englanders have always known that the least expensive source of energy is the energy we don't use. We now know the energy we do not use has the smallest environmental and GHG footprint (see Voorhees, this issue). Many essays in this issue explore how Maine will get there.

ENDNOTE

1. Greenhouse gas reductions are, by convention, expressed in metric tons (tonnes) of carbon dioxide equivalent ($mtCO_2e$) to account for the fact that some greenhouse gases have a much larger effect than others. Each metric ton of methane, for example, as emitted from landfills, has the effect of 22 tonnes of CO_2.

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