Connecticut Climate Change

Connecticut Climate Change Action Plan

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EXECUTIVE SUMMARY

In accordance with the provisions of Public Act 04-252 (AAC Climate Change), the Governor's Steering Committee on Climate Change (GSC) has successfully completed development of a *Connecticut Climate Change Action Plan 2005.* This plan represents a major milestone in the drive to reduce greenhouse gas (GHG) emissions and achieve the regional goals set by the New England Governors/Eastern Canadian Premiers (NEG/ECP).

In creating this plan, the GSC relied to a large extent on the ideas and input it received from a stakeholder process that consisted of a diverse group of entities representing government, industry, nongovernmental organizations, academia and the public. Together, these dedicated stakeholders participated in a yearlong process of identifying measures to address climate change in Connecticut. During their extensive deliberation process, each proposed measure was discussed, researched, analyzed and debated until participants reached consensus. At the end of this stakeholder process, in January 2004, they delivered a report to the GSC. This report, entitled, *Connecticut Climate Change Stakeholder Dialogue: Recommendations to the Governor's Steering Committee (Stakeholders Report),* became the starting point for this action plan.

The completion of this comprehensive plan is a major accomplishment. Yet GSC members recognize, as they have from the outset, that it does not represent an end in itself. Instead, the plan must be used as a firm foundation for future efforts. Such future efforts, including progress on the implementation of this plan and new initiatives, can be tracked through www.ctclimatechange.com. This web site is updated regularly to provide the most recent information on Connecticut's climate change initiatives.

The GSC's primary objective in developing this action plan was to create a document that could be used to inform policy-makers, implementing agencies, organizations, institutions and the public. This broad and deep approach achieves several complementary objectives:

- It addresses budgetary concerns about new programs and ideas;
- It integrates planning elements for federal and state mandates to assure state commitments are completed; and
- It establishes solid links among state agencies under a working structure that provides for staff flexibility on projects and overall steering by agency heads.

Completing this plan required not only an update on progress achieved, but a strong focus on metrics and accountability by staff and agency heads. The GSC employed advanced technical analysis methods to evaluate proposed policy actions for reducing GHG emissions, including:

- Calculation of the GHG benefits and costs;
- Determination of additional benefits and costs;
- Quantification of any additional benefits and costs using existing and newly developed analytical measures; and
- Assessment of the total GHG reductions to determine if the regional GHG targets agreed upon by the NEG/ECP were being met or exceeded.

Using a new desktop modeling tool developed under the direction of the U.S. Environmental Protection Agency, three of the 55 recommended actions or RA's (RA2: GHG Feebate Program and RA32 and RA33: Creating Heating Oil and Natural Gas Conservation Funds) were analyzed extensively to identify local economic effects and ancillary or co-benefits (e.g., health impacts and economy-wide benefits). As the first state to utilize this new tool, Connecticut was able to identify benefits previously not quantified. For example, the state's energy efficiency program, overseen by the Energy Conservation Management Board, was known to achieve a $3 to $1 direct return on investment based on electricity savings. By using the new EPA tool, an additional $4 to $1 payback in terms of reduced health costs and public health benefits was identified as a result of reductions in criteria air pollutants.

This in-depth analysis enabled the committee to dispel perceptions that the proposed actions would compete with other core priorities and to craft a comprehensive legislative agenda that would meet or exceed the GHG reduction targets. In 2004, the following bills and executive orders were passed:

- P.A. 04-84 An Act Concerning Clean Cars – California emissions standards adopted
- P.A. 04-231 An Act Concerning Clean and Alternative Fuel Vehicles – Promotes hybrids through tax incentives
- P.A. 04-85 An Act Concerning Energy Efficiency – Sets efficiency standards for products and appliances
- P.A. 04-252 An Act Concerning Climate Change – Requires mandatory reporting of GHG emissions, creation of registry, ongoing planning and implementation action plan effort, development of environmentally preferable purchasing for state goods and services
- P.A. 04-222 An Act Concerning Preservation of the Family Farm and Long Island Sound – Promotes the purchase of Connecticut-grown foods by the state and creates "Connecticut Farm Fresh" program
- Governor's Executive Order No. 32 – Requires the state to purchase renewable energy in increasing amounts, leading to 100% clean energy by 2050.

While other states have begun to take similar steps to reduce GHG emissions, Connecticut is the first state to address climate change in such a significant and comprehensive manner. The plan contains 55 recommended actions that focus on five main topic areas: **1) transportation and land use; 2) residential, commercial and**

industrial; 4) agriculture, forestry and waste; 4) electricity generation; and 5) education and outreach. These topic areas were selected in order to broadly address climate change from all sectors and achieve the greatest outcome. Recommendations will require administrative and legislative actions, voluntary and mandatory measures, and state and regional actions.

Thirty-eight recommendations have been designated by the Governor's Steering Committee and the governor for immediate implementation, and are noted as such in this summary. Examples of recommended actions include:

- **Transportation:** Raising emission standards for new cars; reducing black carbon from diesel engines through the use of low sulfur diesel, engine improvements and tailpipe controls; investing in a hydrogen infrastructure and R&D program.

- **Residential, Commercial, Industrial:** Upgrading building codes and using energy efficient materials and design concepts in the construction of new state buildings and schools (LEED standard); promoting the purchase of environmentally preferable products and services by state agencies; testing biodiesel for heating.

- **Agriculture, Forestry, Waste:** Adopting actions to increase recycling and source reductions to 40%; encouraging consumers to buy local produce; supporting landfill-gas-to-energy projects.

- **Electricity:** Increasing the amount of renewable energy supplied to the electricity grid; implementing a program for Connecticut ratepayers to choose to purchase electricity derived from clean energy; state government purchase of clean energy.

- **Education:** Increasing awareness among the general public, policy-makers, community leaders, and others of climate change issues and solutions; integrating into curricula and outreach programming.

These 38 measures result in projected reductions of 3.64 million metric tons carbon dioxide equivalent ($MMTCO_2e$) in 2010 and 6.88 $MMTCO_2e$ in 2020. It is estimated that reductions of 5.74 $MMTCO_2e$ in 2010 and 17.99 $MMTCO_2e$ in 2020 are needed to meet the statutory goals. Thus, only 63.4 percent of the 2010 statutory goal and 38.2 percent of the 2020 statutory goal are achieved in 2020 by just the 38 measures.

Given these results, it is clear that reductions from the remaining 17 measures are crucial for Connecticut to meet its reductions targets. The 17 measures result in additional projected reductions of 5.02 $MMTCO_2e$ in 2010 (87.4 percent of goal) and 12.44 $MMTCO_2e$ in 2020 (69.2 percent of goal).

The remaining 17 items are undergoing further analysis, including the identification of appropriate implementation pathways for follow up in 2005 and beyond. Aggressive implementation of the 38 measures already underway, combined with the start up of new recommended actions in 2005, will ensure Connecticut's success in meeting the reduction goals identified by the NEG/ECP and reflected in state law: to reduce its GHG emissions to 1990 levels by 2010 and to 10 percent below 1990 levels by 2020, eventually reaching the long-term reduction goal of 75 percent.

Implementation of this comprehensive plan represents a significant and on-going challenge. To successfully meet this challenge, the GSC began to reach out during the drafting process to establish working relationships with groups whose active support would be needed to achieve its goals. These key groups included not only environmental and business advocates, but colleges and universities, faith-based groups and municipalities. In addition, working committees at both the agency head and staff level were established to develop, implement and track progress on each recommended action. These working groups have been and will continue to be invaluable as we move toward implementation of additional recommendations.

Through the successful implementation of this plan, Connecticut has an opportunity to provide state residents a healthier environment, a more stable climate and a stronger economy.

Table ES.1
Connecticut Climate Change Action Plan 2005
List of Recommendations

Transportation Sector

1. California LEV II standards*
2. Greenhouse gas (GHG) feebate program **
3. Fleet vehicle incentives and initiatives*
4. Tailpipe GHG standards **
5. Public education initiative*
6. Hydrogen infrastructure research and demonstration program **
7. Transit, smart growth, and vehicle miles traveled (VMT) reduction package*
8. Multistate intermodal freight initiative*
9. Clean diesel and black carbon*

Residential, Commercial, Industrial Sector

10. Appliance standards*
11. Appliance-swapping program*
12. Heat pump water heater replacement program*
13. Bulk purchasing of appliances*
14. Upgrade residential and commercial building energy codes*
15. Promote energy efficient and energy improvement mortgages **
16. Revise Energy Conservation Loan Program **
17. Weatherization Assistance program*
18. Energy Star Homes program*
19. High-performance buildings: schools and other State-funded buildings*
20. High-performance buildings: privately funded projects **
21. Shared savings program for government agencies*
22. Training of building operators*
23. Green campus initiative*
24. Energy benchmarking, measurement, and tracking program for municipal buildings*
25. Pilot fuel-switching projects*
26. Remove barriers to third-party load-management techniques*
27. State procurement of environmentally preferable services and products*
28. Review of New England Regional Demand Response Initiative (NEDRI) recommendations*
29. Promote voluntary programs and actions*
30. Encourage clean combined heat and power **
31. Restore conservation and load management fund **
32. Create Heating oil conservation fund **
33. Create Natural gas conservation fund **
34. Identify measures to reduce high-global warming-potential gases **

Agriculture, Forestry, Waste Sectors

35. Install centralized manure digesters **
36. Reduce nonfarm fertilizer use*
37. Buy local produce*
38. Forest management and forest carbon offsets*
39. Urban tree planting program*
40. Forest and agricultural land preservation*
41. Promote use of durable wood products over other construction materials*
42. Support economically viable landfill gas-to-energy projects*

43. Increase recycling, source reduction to 40 percent*
44. Voluntary carbon offset program **

Electricity Generation Sector

45. Renewable energy strategy (RES) **
46. Renewable portfolio standard (RPS) **
47. Government green power purchase*
48. Production tax credit*
49. Clean Energy Choice (Green power option)*
50. Renewable Energy Certificates (Green tags)*
51. Restore Clean Energy Fund **
52. Energy efficiency and combined heat and power **
53. Regional cap-and-trade program*

Education and Outreach

54. Public Education Initiative*

Greenhouse Gas Reporting

55. Emissions Inventory and Registry*

*** Action item has been designated by the Governor and Governor's Steering Committee for immediate implementation**

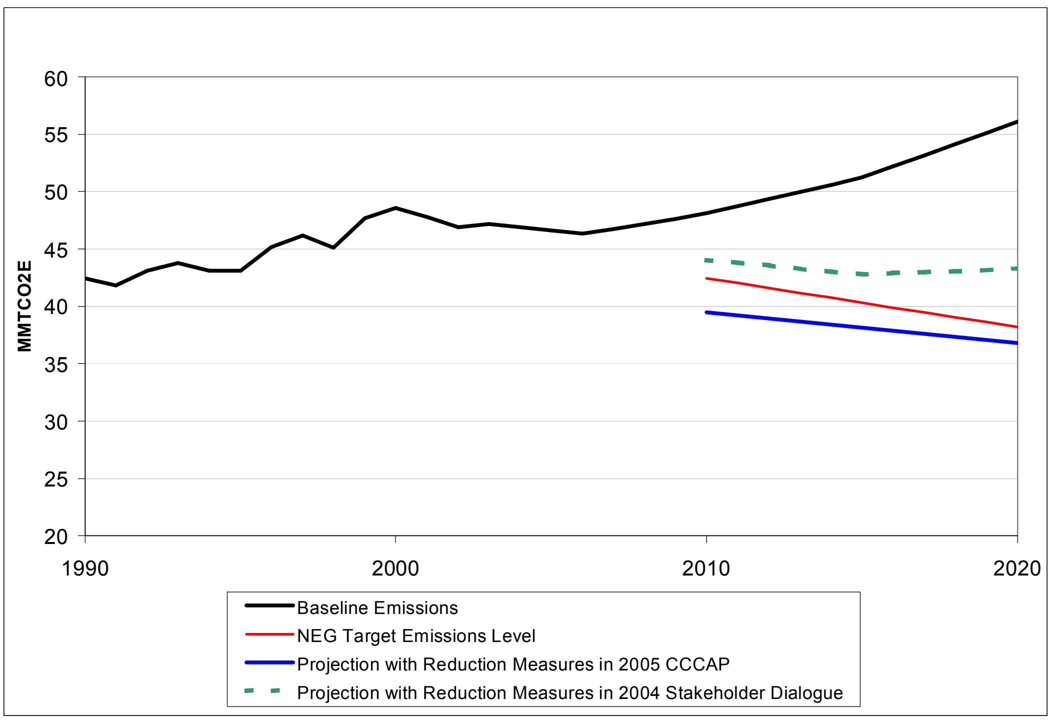
**** Action item has been designated by the Governor and Governor's Steering Committee for further analysis, identification of appropriate implementation pathway, and implementation following 2005**

PROGRESS TOWARD MEETING STATUTORY (NEG/ECP) TARGETS

When the Connecticut Climate Change Stakeholder Dialogue was released in January 2004, the projected GHG emission reductions were not on target to meet the NEG/ECP goals of 1990 emission levels by 2010 and 10% below 1990 levels by 2020. Based on the Recommended Actions quantified for the Stakeholder Dialogue, it appeared that Connecticut was on a path to achieve 70.9% of the necessary reductions in 2010 and 71.3% of the necessary reductions in 2020.

New analyses conducted in 2004 now show that Connecticut can be on a path to meet and exceed the NEG/ECP targets (see graph below). These analyses were based on new information, realistic assumptions and correction of prior analyses and resulted in total net gains of 4.59 MMTCO2e of reductions in 2010 and 6.50 MMTCO2e in 2020.

Figure ES.1
Baseline, Target, and Estimated Progress with Recommendations Graph 1990-2020



A progress table summarizing the new total projected reductions by sector follows. The new and revised analyses completed in 2004 include:

- Cap and Trade: 0.95 MMTCO2e in 2010 and 2.26 MMTCO2e in 2020
- Restore the CCEF: 0.31 MMTCO2e in 2010 and 0.41 MMTCO2e in 2020
- Feebate Program: 0.04 MMTCO2e in 2010 and 0.11 MMTCO2e in 2020
- GHG Tailpipe Standards: 0.05 MMTCO2e in 2010 and 2.63 MMTCO2e in 2020
- Heating Oil Conservation Fund: 1.02 MMTCO2e in 2010 and 1.89 MMTCO2e in 2020

- Natural Gas Conservation Fund: 1.44 MMTCO2e in 2010 and 2.07 MMTCO2e in 2020
- Renewable Portfolio Standards: 1.30 MMTCO2e in 2010 and 3.20 MMTCO2e in 2020

Table ES.2
Summary of Connecticut GHG Reductions with Recommendations
(without black carbon)
MMTCO$_2$e

	2010	2020
Future Baseline (CCAP projections from fuel use)	48.14	56.15
NEG/ECP Targets (1990 in 2010, 10% below in 2020)	42.40	38.16
Reductions Needed to Meet NEG/ECP Targets	5.74	17.99
Projected Reductions By Sector		
Transportation	0.35	3.84
Residential, Commercial, Industrial	4.03	7.29
Agriculture, Forestry, Waste	1.21	1.30
Electricity	3.07	6.89
2005 CCCAP Total Reductions	**8.66**	**19.32**
2003 CT Stakeholder Report Total Reductions	4.07	12.82
Total NEW or REVISED Reductions	**4.59**	**6.50**

Figure ES.2
GHG Reductions Needed to Achieve Targets by 38 Accepted and 17 Remaining Recommended Actions

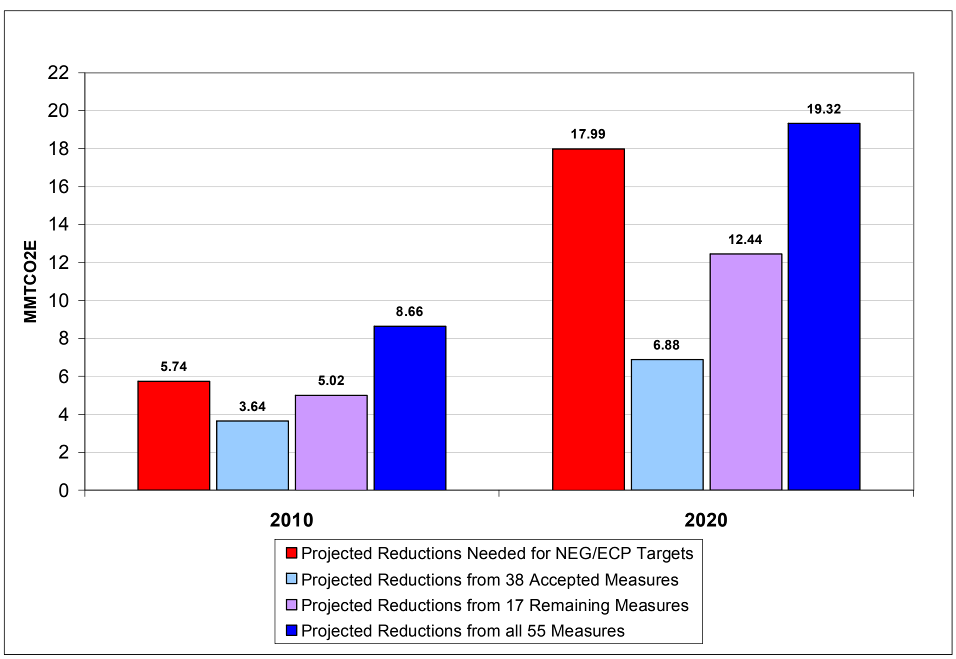


Table ES.3
Summary of Connecticut Climate Change Recommendations

Policy Action	Status
Transportation and Land Use	
1. California LEV II Standards The California Low Emission Vehicle II (LEV II) program establishes strict emission standards for all new cars sold in California as well as for any other state that adopts the program. These standards address non-methane organic gas (NMOG), oxides of nitrogen (NO_x), and carbon monoxide (CO).	**Progress - Implemented** DEP adopted regulations in December 2004 that require compliant vehicles commencing with the 2008 model year. **Expected Greenhouse Gas (GHG) Reduction** • 2010 = 0.04 $MMTCO_2e$ • 2020 = 0.47 $MMTCO_2e$ **Expected Cost per Ton GHG** Baseline LEV II vehicles are currently being sold at the same price as their non-LEV II certified counterparts, and manufacturers' costs for compliance are less than $100 per vehicle. A consumer premium of approximately $3,000 currently exists for hybrid vehicles. California Air Resources Board (CARB) has estimated the following incremental costs for advanced technology partial zero-emission vehicles (AT-PZEVs): • Stage I (2003-2005) $3,300 • Stage II (2006-2008) $1,500 • Stage III (2009-2011) $700. **Estimated Co-Benefits** Adoption of LEV II standards in Connecticut is calculated to reduce toxic pollutants (acetaldehyde, 1,3-butadiene, formaldehyde, and benzene) by 104 tons in 2020.
2. GHG Feebate Program Under a feebate system, purchasers of high CO_2-emitting vehicles would pay a fee, whereas purchasers of low-CO_2-emitting vehicles would receive a rebate. The cutoff threshold can be designed to be revenue neutral so that total fees are equal to total rebates. The levels of fees and rebates for vehicles should be designed to maximize influence on consumer demand for low-emission vehicles. A feebate system could be implemented regionally to strengthen the market signal to vehicle manufacturers and prevent adverse economic impacts in the State.	**Progress - In Process** Further analysis has been done to quantify co-benefits using the REMI regional economic analysis model. Positive economy-wide benefits have been determined. Implementation actions are pending. **Expected GHG Reductions** • 2010 = 0.036 $MMTCO_2e$ • 2020 = 0.109 $MMTCO_2e$ **Expected Cost per Ton GHG** • 2010 = -$166.70 $/ton CO_2e • 2020 = -$171.50 $/ton CO_2e **Estimated Co-Benefits** Positive economy-wide benefits including jobs, output, gross state product, and disposable personal income. (see write-up for summary)

Table ES.3
Summary of Connecticut Climate Change Recommendations

Policy Action	Status
3. Fleet Vehicle Incentives and Initiatives Establish incentives and initiatives to encourage acquisition of low-GHG vehicles in public, private, and State fleets. Partner with other northeastern states, local governments, and private fleets to develop bulk-purchasing proposals for low-GHG vehicles.	**Progress – In Progress** The State presently leases hybrid vehicles as a portion of its daily fleet. DAS has released a new RFP for Alternative fuel and gasoline-hybrid electric light duty vehicles. Legislation passed to give tax exemption for purchase of any hybrid rated at 40 mpg or greater and extends exemption for alternative fuel vehicles and equipment (An Act Concerning Clean and Alternative Fuel Vehicles, PA 04-231) **Expected GHG Reductions** Reflected in GHG tailpipe standards below. **Expected Costs per Ton GHG** Costs have not been estimated. **Estimated Co-Benefits** These actions will result in the reduction of criteria and hazardous pollutants and potential operating cost savings for the State and consumers.
4. Tailpipe GHG Standards Amend LEV II regulations to include GHG standards. Under these standards, new motor vehicles will be required to emit 30 percent fewer GHGs than would have been emitted without the program. The program establishes two fleet average standards for GHG emissions: one for cars, light trucks, and small sport utility vehicles (SUVs) and another for heavier trucks and large SUVs. The standards will be phased in between the years 2009 and 2016.	**Progress - Action Pending** CT DEP plans to adopt regulations in 2005. **Expected GHG Reductions** • 2010 = 0.05 $MMTCO_2e$ • 2020 = 2.63 $MMTCO_2e$ **Expected Cost per Ton GHG** • 2010 = -$136 $/ton CO_2e • 2020 = -$99 $/ton CO_2e **Estimated Co-Benefits** The overall effect of the regulation will be an increase in personal income and, as a result, an increase in employment and sales activity.
5. Public Education Initiative on Transportation Raise public awareness about the benefits of low-GHG vehicles, including the available incentives and potential maintenance options.	**Progress - In Process** Low-GHG vehicles are now available through state contract. The DAS has been making state and municipal purchasers aware of this and of the environmental benefits of low GHG vehicles at the CT $hops event held by DAS in 2004 and through other methods. **Expected GHG Reductions** These are reflected in GHG tailpipe standards above. **Expected Cost per Ton GHG** Costs have not been estimated. **Estimated Co-Benefits** Co-benefits have not been estimated.

Table ES.3
Summary of Connecticut Climate Change Recommendations

Policy Action	Status
6. Hydrogen Infrastructure Research and Development (R&D) Program Support research on low-GHG vehicle technology, such as fuel cells, and assess how best to facilitate the development of alternative fuel infrastructure and refueling networks through measures such as pilot projects, R&D, and incentives.	**Progress – Action Pending** Further macroeconomic studies are to be conducted through REMI regional economic analysis modeling. **Expected GHG Reductions** This effort will not result in any GHG benefits by 2020 (potential long-term benefits of up to 22 $MMTCO_2e$ in Connecticut). Long-term GHG reductions assume the availability of low-emissions hydrogen (i.e., hydrogen produced from gasification of fossil fuels), together with carbon capture and sequestration, achieving roughly 90% improvement in GHG emissions, or renewable energy sources. **Expected Cost per Ton GHG** Costs have not been estimated. **Estimated Co-Benefits** Significant job creation potential.
7. Transit, Smart Growth and Vehicle Miles Traveled (VMT) Reduction Package Increase availability of low-GHG travel choices in Connecticut, such as transit (rail and bus), vanpools, walking, and biking. Provide complementary land-use polices and incentives to improve the attractiveness of low-GHG travel choices. Implement a package of transit improvements and land-use policies and incentives to achieve a 3% reduction in VMT below the 2020 baseline. The package consists of six complementary elements: 1. Double transit ridership by 2020. 2. Consider potential funding mechanisms for new transit investments, such as road pricing and the Connecticut Transportation Strategy Board's fuel tax recommendation. 3. Establish a coordinated interagency program to promote smart growth in Connecticut using regulatory, financial, and planning tools. 4. Redirect at least 25% of new development (forecast population and employment) to growth-appropriate locations, as indicated by the State Plan of Conservation and Development. 5. Study a potential road-pricing pilot project, prepare a feasibility design study by 2006, and implement the pilot project if it is shown to be effective. Study the potential impact on equity and sprawl and consider broader implementation of road pricing in the long term. 6. Consider complementary VMT reduction incentives, such as commuter choices, location-efficient mortgages, and mileage-based insurance.	**Progress - In Process / Action Pending** Work continuing on design and implementation of New Britain – Hartford Bus Rapid Transit (BRT); studies are concluding on Hartford East BRT and New Haven-Hartford-Springfield Rail. About $100 million committed for the project at this time. The total project cost is $338 million. **Expected GHG Reductions** • 2010 = 0.22 $MMTCO_2e$ • 2020 = 0.49 $MMTCO_2e$ **Expected Cost per Ton GHG** Annualized smart growth and transit costs over 17 years yield a marginal cost of $602/$MTCO_2$ in 2020. This assumes a 7% discount rate. When other savings from avoided costs are included (infrastructure cost savings, health costs savings, and consumer fuel cost savings) the marginal cost is calculated to be $280/$MTCO_2$ in 2020. **Estimated Total Costs** Estimated annual transit capital and operating costs are $295 million. Estimated annual savings from avoided infrastructure costs, avoided health care costs, and avoided household expenditures are $158 million. Total costs minus savings are estimated to be $137 million per year. **Estimated Co-Benefits** Benefits of this program include reducing criteria and hazardous pollutants, increasing travel choices, helping to relieve traffic congestion, bolstering economic development and urban revitalization, reducing water pollution from runoff, and minimizing habitat fragmentation.

Table ES.3
Summary of Connecticut Climate Change Recommendations

Policy Action	Status
8. Multistate Intermodal Freight Initiative Develop infrastructure plan for providing alternatives to freight trucks, including enhanced freight rail infrastructure and intermodal transfer facilities (rail-to-truck and rail-to-barge). Such alternatives use less energy than freight trucks and thus offer a low-GHG alternative for goods delivery.	**Progress - In Process** Continuing work with I-95 Corridor Coalition Freight Initiative. The Transportation Strategy Board demonstration project at Bridgeport Harbor has been implemented. This project received $5 million in funding for improvements to Bridgeport Harbor facilities to enhance the ability of handling barge freight and determine if waterborne freight can garner an increased market share. CT DEP to raise the issue of regional freight coordination at the next NEG-ECP meeting. **Expected GHG Reductions** • 2010 = 0.00 $MMTCO_2e$ • 2020 = 0.14 $MMTCO_2e$ **Expected Cost per Ton GHG** Costs have not been estimated. **Estimated Co-Benefits** This effort would reduce traffic congestion, wear-and-tear on the State's infrastructure, and air pollution as well as provide more efficient delivery of goods and redundancy in freight networks for economic and physical security.
9. Clean Diesel and Black Carbon (BC) Scientists have identified BC, a component of diesel particulate matter (PM), as having a large and fast-acting warming impact on the atmosphere. Diesel engines emit roughly half of the BC in the United States. This program would provide incentives to accelerate the use of ultra-low sulfur diesel and to accelerate adoption of engine improvements and tailpipe control technology to reduce emissions of BC.	**Progress - In Process** DEP pilot programs using ultra-low sulfur diesel school buses (completed in Norwich, being expanded to New Haven, Hartford, Bridgeport). DOT and DEP are collaborating on a program to promote diesel retrofits and the use of clean fuels on off-road construction equipment (Q bridge project). 181 buses in New Haven are being retrofitted with diesel oxidation catalysts and Spiracle crankcase controls. These buses are now being fueled with ultra-low sulfur diesel fuel that is dosed with a fuel-borne catalyst to further reduce emissions. **Expected GHG Reductions** • 2010 = 0.8 $MMTCO_2e$ • 2020 = 2.4 $MMTCO_2e$ **Expected Cost per Ton GHG** A range of cost estimates for vehicle conversion, retrofit and replacement were aggregated and are equivalent to \$6 to \$13/$MTCO_2e$ in 2020. Health care cost savings due to reductions in PM emissions were not quantified. Costs were annualized over 17 years using a 7% discount rate. **Estimated Total Costs**

Table ES.3
Summary of Connecticut Climate Change Recommendations

Policy Action	Status
	Estimated annual capital and operating costs range from \$13 million to \$30 million. Estimated savings from avoided health care costs due to reduced exposure to particulate matter are not included. **Estimated Co-Benefits** Health benefits due to reductions in PM emissions are not included in the cost estimate above.
Residential, Commercial, and Industrial	
10. Appliance Standards For appliances not covered under federal standards, the State can set minimum levels of efficiency for specific appliances. Eight appliances identified: dry-type transformers, commercial refrigerators and freezers, exit signs, traffic signals, torchière lamps, large packaged A/C units greater than 20 tons, unit heaters, and commercial clothes washers.	**Progress - In Process** Legislation enacted to require DPUC, in consultation with OPM, to establish regulations for energy efficiency standards for a variety of heating, cooling and other types of products (Public Act 04-85). The DPUC, in consultation with OPM is currently conducting an administrative proceeding to adopt regulations regarding the certification of designated products, procedures for testing the energy efficiency of products, and the manner in which an annual list of qualified products will be published and maintained (DPUC Docket #04-10-18). **Expected GHG Reductions** • 2010 = 0.104 $MMTCO_2e$ indirect, <0.001 $MMTCO_2e$ direct • 2020 = 0.205 $MMTCO_2e$ indirect, <0.001 $MMTCO_2e$ direct **Expected Cost per Ton GHG** The cost is estimated to be –\$89/$MTCO_2e$. **Estimated Co-Benefits** Reduced hydrofluorocarbon (HFC) and chlorofluorocarbon (CFC) emissions due to leaks from commercial refrigerators, freezers, and A/Cs; and reduced water consumption by commercial clothes washers.
11. Appliance-Swapping Program This program would encourage consumers to discard old appliances and replace them with new, more efficient appliances through a “pay-as-you-save” program. Appliances covered in the program include Energy Star tumble clothes washers, Energy Star refrigerators, Energy Star room A/C (6500 BTU), and Energy Star dishwashers.	**Progress - In Process** The DPUC forwarded this item to the Energy Conservation Management Board (ECMB) for its review and consideration for possible inclusion in its draft 2005 C&LM budget plan (7/04). The ECMB conducted a preliminary review of this item, and has provided initial commentary to the DPUC (10/04). The DPUC is currently conducting an administrative proceeding to approve the 2005 C&LM budget, and it intends to further examine the feasibility of including this item in the 2005 C&LM budget plan (DPUC Docket #04-11-01). **Expected GHG Reductions**

Table ES.3 Summary of Connecticut Climate Change Recommendations	
Policy Action	**Status**
	• 2010 = 0.016 $MMTCO_2e$ indirect (direct not applicable) • 2020 = 0.020 $MMTCO_2e$ indirect (direct not applicable) **Expected Cost per Ton GHG** The cost is estimated to be –$78/$MTCO_2e$. **Estimated Co-Benefits** Co-benefits of this program include small reductions in HFC and CFC emissions leaked into the atmosphere from refrigerators and A/C units.
12. Heat Pump Water Heater (HPWH) Replacement Program Replace inefficient electric water heaters with new HPWH technology through a pay-as-you-save program.	**Progress - In Process** The DPUC forwarded this item to the Energy Conservation Management Board (ECMB) for its review and consideration for possible inclusion in its draft 2005 C&LM budget plan (7/04). The ECMB conducted a preliminary review of this item, and has provided initial commentary to the DPUC (10/04). The DPUC is currently conducting an administrative proceeding to approve the 2005 C&LM budget, and it intends to further examine the feasibility of including this item in the 2005 C&LM budget plan (DPUC Docket #04-11-01). **Expected GHG Reductions** • 2010 = 0.011 $MMTCO_2e$ indirect (direct not applicable) • 2020 = 0.013 $MMTCO_2e$ indirect (direct not applicable) **Expected Cost per Ton GHG** The cost is estimated to be –$121/$MMTCO_2e$**.** **Estimated Co-Benefits** This appliance also can dehumidify the space in which it is located.
13. Bulk Purchasing of Appliances Bulk procurement can reduce the cost of energy efficient appliances or renewable technologies.	**Progress - In Process** The DPUC forwarded this item to the Energy Conservation Management Board (ECMB) for its review and consideration for possible inclusion in its draft 2005 C&LM budget plan (7/04). The ECMB conducted a preliminary review of this item, and has provided initial commentary to the DPUC (10/04). The DPUC is currently conducting an administrative proceeding to approve the 2005 C&LM budget, and it intends to further examine the feasibility of including this item in the 2005 C&LM budget plan (DPUC Docket #04-11-01). **Expected GHG Reductions** • 2010 (residential) = 0.012 $MMTCO_2e$ indirect (direct not applicable) • 2020 (residential) = 0.018 $MMTCO_2e$ indirect

Table ES.3 Summary of Connecticut Climate Change Recommendations	
Policy Action	**Status**
	(direct not applicable) • 2010 (commercial) = 0.011 $MMTCO_2e$ indirect (direct not applicable) • 2020 (commercial) = 0.028 $MMTCO_2e$ indirect (direct not applicable) **Expected Cost per Ton GHG** The cost is estimated to be –\$187/$MTCO_2e$. **Estimated Co-Benefits** Co-benefits have not been estimated.
14. Mandate Upgrades to Residential and Commercial Building Energy Codes Require buildings to meet the most recent energy code efficiency and performance standards established by the International Code Council (ICC), and require the automatic adoption of updated revisions within 18 months from availability for residential and commercial buildings.	**Progress - Implemented** New regulations were passed resulting in updated building energy codes, effective September 2004. **Expected GHG Reductions** • 2010 = 0.009 $MMTCO_2e$ indirect, 0.048 $MMTCO_2e$ direct (residential only) • 2020 = 0.036 $MMTCO_2e$ indirect, 0.176 $MMTCO_2e$ direct (residential only) **Expected Cost per Ton GHG** The cost is estimated to be –\$172/$MTCO_2e$. **Estimated Co-Benefits** Co-benefits have not been estimated.
15. Promote Energy-Efficient and Energy-Improvement Mortgages Energy-efficient mortgages (EEMs) allow purchasers to borrow a larger mortgage when purchasing an Energy Star home. Energy-improvement mortgages (EIMs) allow owners to borrow money for energy efficiency (EE) improvements on their homes, or to upgrade the energy efficiency of a home before purchasing.	**Progress - Action Pending** **Expected GHG Reductions** • 2010 = 0.001 $MMTCO_2e$ indirect, 0.004 $MMTCO_2e$ direct (only EIMs) • 2020 = 0.002 $MMTCO_2e$ indirect, 0.012 $MMTCO_2e$ direct (only EIMs) **Expected Cost per Ton GHG** The cost is estimated to be –\$32/MTCO2e. **Estimated Co-Benefits** Co-benefits include educating residential consumers about energy efficiency.
16. Revise the Energy Conservation Loan Program (ECL) The current ECL provides low-interest loans for EE improvements.	**Progress - Action Pending** **Expected GHG Reductions** GHG emission reductions have not been estimated. **Expected Cost per Ton GHG** Costs have not been estimated. **Estimated Co-Benefits** Co-benefits have not been estimated.
17. Weatherization Assistance Program (WAP) Weatherization programs help homeowners improve	**Progress - Action Pending** Potential funding sources have not been identified.

Table ES.3 Summary of Connecticut Climate Change Recommendations	
Policy Action	**Status**
insulation, air leakage control, heating and cooling efficiency measures.	**Expected GHG Reductions** • 2010 = 0.003 $MMTCO_2e$ indirect, 0.003 $MMTCO_2e$ direct • 2020 = 0.003 $MMTCO_2e$ indirect, 0.003 $MMTCO_2e$ direct **Expected Cost per Ton GHG** The cost is estimated to be \$241/$MTCO_2e$. **Estimated Co-Benefits** Co-benefits have not been estimated.
18. Energy Star Homes Program This program provides rebates for the purchase of newly constructed homes meeting higher efficiency standards established by the U.S. EPA and DOE Energy Star Program.	**Progress - In Process** The DPUC forwarded this item to the Energy Conservation Management Board (ECMB) for its review and consideration for possible inclusion in its draft 2005 C&LM budget plan (7/04). The ECMB conducted a preliminary review of this item, and has provided initial commentary to the DPUC (10/04). The DPUC is currently conducting an administrative proceeding to approve the 2005 C&LM budget, and it intends to further examine the feasibility of including this item in the 2005 C&LM budget plan (DPUC Docket #04-11-01) **Expected GHG Reductions** • 2010 = 0.008 $MMTCO_2e$ indirect, 0.009 $MMTCO_2e$ direct • 2020 = 0.021 $MMTCO_2e$ indirect, 0.023 $MMTCO_2e$ direct **Expected Cost per Ton GHG** The cost is estimated to be –\$3/$MTCO_2e$. **Estimated Co-Benefits** Co-benefits have not been estimated.
19. High-Performance Schools and State-Funded Buildings State-funded construction and renovation should meet higher EE and performance standards. New construction and major renovations of all building projects that receive some State funding (State facilities, local schools, etc.) must meet Leadership in Energy and Environmental Design (LEED) standard and receive U.S. Green Buildings Council (USGBC) certification. Small construction and renovation projects that use State funding should also be required to meet a high-performance building standard.	**Progress - In Process** Various new buildings in the CT State University system have been built to LEED standards (dormitories at ECSU, WCSU, SCSU). New science lab at WCSU being built to LEED Silver standards. OPM held a public education seminar on high performance schools, and is planning another event for 2005, in conjunction with the Rebuild America program of the U.S. Department of Energy. **Expected GHG Reductions** • 2010 = 0.011 $MMTCO_2e$ indirect, 0.006 $MMTCO_2e$ direct • 2020 = 0.038 $MMTCO_2e$ indirect, 0.020 $MMTCO_2e$ direct

Table ES.3 Summary of Connecticut Climate Change Recommendations	
Policy Action	**Status**
	Expected Cost per Ton GHG The cost is estimated to be $419/MTCO_2e$. **Estimated Co-Benefits** Co-benefits include promoting sustainable site planning, safeguarding water and water efficiency, materials and resources conservation, and improving indoor environmental quality. In addition to the environmental benefits, there are economic, health, safety, and community benefits.
20. High-Performance Buildings: Privately Funded Projects Provide incentives for privately financed new construction and renovations to meet higher EE performance standards.	**Progress - In Process** Through a grant from US DOE's Rebuild America program and funding provided by the State's electric utilities through the C&LM fund, privately owned commercial buildings in SW CT are being benchmarked. A subset of these buildings will undergo retro-commissioning, (the process of evaluating the building's systems to ensure that the building is operating as was originally intended when designed and built). The project will also include training facility managers, providing education, and development of case studies and other tools to permit easy replication of the project in other regions of the state. **Expected GHG Reductions** • 2010 = 0.012 $MMTCO_2e$ indirect, 0.007 $MMTCO_2e$ direct • 2020 = 0.034 $MMTCO_2e$ indirect, 0.018 $MMTCO_2e$ direct **Expected Cost per Ton GHG** The cost is estimated to be $308/MTCO_2e$. **Estimated Co-Benefits** Co-benefits include promoting sustainable site planning, safeguarding water and water efficiency, conserving materials and resources, and improving indoor environmental quality. In addition to environmental benefits, there are economic, health, safety, and community benefits.
21. Shared Savings Program for Government Agencies This program allows a State agency to keep a portion of the energy savings realized when it makes EE improvements to a building. The benchmarking program allows an agency to identify buildings performing below the average.	**Progress - In Process** Executive Order 32 was issued revising the existing shared energy savings program to facilitate with its implementation and to require a portion of cost savings to be allocated to renewable/clean power purchasing by state agencies. **Expected GHG Reductions** • 2010 = 0.098 $MMTCO_2e$ indirect, 0.026 $MMTCO_2e$ direct • 2020 = 0.160 $MMTCO_2e$ indirect, 0.039 $MMTCO_2e$ direct

Table ES.3
Summary of Connecticut Climate Change Recommendations

Policy Action	Status
	Expected Cost per Ton GHG Costs have not been estimated. **Estimated Co-Benefits** Co-benefits have not been estimated.
22. Training of Building Operators Training building operators in how to maximize the efficiency of their buildings will decrease energy use if operators successfully implement the information they have been provided.	**Progress - In Process** The DPUC forwarded this item to the Energy Conservation Management Board (ECMB) for its review and consideration for possible inclusion in its draft 2005 C&LM budget plan (7/04). The ECMB conducted a preliminary review of this item, and has provided initial commentary to the DPUC (10/04). The DPUC is currently conducting an administrative proceeding to approve the 2005 C&LM budget, and it intends to further examine the feasibility of including this item in the 2005 C&LM budget plan (DPUC Docket #04-11-01). **Expected GHG Reductions** • 2010 = 0.020 $MMTCO_2e$ indirect, 0.011 $MMTCO_2e$ direct • 2020 = 0.022 $MMTCO_2e$ indirect, 0.011 $MMTCO_2e$ direct **Expected Cost per Ton GHG** The cost is estimated to be –\$140/$MTCO_2e$. It is estimated that the program would cost \$63,000 per year. First year cost savings are estimated to be over \$1.3 million and would accrue for 5 years. **Estimated Co-Benefits** Co-benefits have not been estimated.
23. Green Campus Initiative This program would promote energy efficiency and other environmental measures at all Connecticut institutions of higher education.	**Progress - In Process** During the past year considerable activity has occurred 1) 17 Connecticut universities have signed the New England Board of Higher Education (NEBHE) pledge to support the NEG-ECP 2001 Climate Change Action Plan, 2) 3 Connecticut universities have joined the Clean Air Cool Planet's Campuses for Climate Action program and 3) The first meeting of the CT Green Campus Initiative occurred which included participation by Yale, University of Connecticut, Connecticut College, St. Joseph College, ECSU, ISE, and DEP. **Expected GHG Reductions** • 2010 = 0.099 $MMTCO_2e$ indirect, 0.084 $MMTCO_2e$ direct • 2020 = 0.106 $MMTCO_2e$ indirect, 0.084 $MMTCO_2e$ direct **Expected Cost per Ton GHG** Expected programmatic costs include \$50,000 in the

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Policy Action	Status
	first year for program development; \$50,000 annually for outreach, training, and rollout; \$250,000 for a GHG inventory for all Connecticut colleges and universities; and \$1,000,000 annually for administration, benchmarking, and action plan development. The cost of the energy savings measures was not estimated. **Estimated Co-Benefits** Co-benefits include improving water and waste management, increasing recycling, reducing the need for hazardous waste disposal, and promoting procurement of environmentally friendly products.
24. Energy Benchmarking and Tracking Program for Municipal Buildings This program encourages measurement and tracking of energy consumption, strategic planning, and benchmarking in comparison to other buildings.	**Progress - In Process** Multiple buildings have been benchmarked or are scheduled to be benchmarked including: state buildings, local schools, and 8.5 million square feet of commercial office space in SW CT. The buildings occupied by DEP and DPUC are eligible to receive Energy Star status. The expected date of completion 6/05. **Expected GHG Reductions** • 2010 = 0.046 $MMTCO_2e$ indirect, 0.073 $MMTCO_2e$ direct • 2020 = 0.086 $MMTCO_2e$ indirect, 0.104 $MMTCO_2e$ direct **Expected Cost per Ton GHG** The estimated cost of program administration and outreach to communities is \$250,000 annually. The estimated cost for benchmarking is \$0.005 per square foot. Costs were not estimated for implementing the specific energy saving measures. **Estimated Co-Benefits** Program benefits include energy and environmental education at public schools.
25. Pilot Fuel-Switching Project This pilot project will test the use of B20 biodiesel fuel (diesel blended with 20% low/no GHG biodiesel) at a few State facilities.	**Progress - In Process** Funding has been provided to begin a pilot project at Eastern Connecticut State University utilizing a B20 blend (20% biodiesel blended with 80% #2 fuel oil) for space heating for a period of one year. The pilot, which will commence in 2005, will identify all regulatory steps needed for a facility to use biodiesel (i.e., permit modifications), gather data on fuel efficiency and emissions factors and monitor air emissions associated with using a B20 blend, test fuel quality, impacts on equipment (maintenance and performance satisfaction), and costs. **Expected GHG Reductions** • 2010 = (indirect not applicable), <0.001 $MMTCO_2e$ direct

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Policy Action	**Status**
	• 2020 = (indirect not applicable), <0.001 $MMTCO_2e$ direct **Expected Cost per Ton GHG** The costs are estimated to be –\$22/$MTCO_2e$. **Estimated Co-Benefits** Co-benefits have not been estimated.
26. Remove Current Barriers to Third-Party Load-Management Techniques Remove barriers to allow energy service companies to manage the energy load at commercial or industrial facilities. Recommended changes include: • integrating information and load management solutions into the local distribution company bill • enabling demand resources to participate in the wholesale electric markets, and • including an EE component in the alternative transitional standard offer.	**Progress - In Process** On segments 1 & 2 of this recommendation action is still pending. On segment 3: Energy Efficiency Optional Service under the Transitional Standard Offer, the DPUC intends to conduct an administrative proceeding to develop this program following the implementation of the Clean Energy Option (RA 49) in the first quarter of 2005, with the objective of having the energy efficiency program in place by the end of 2005. **Expected GHG Reductions** • 2010 = 0.018 $MMTCO_2e$ indirect (direct not applicable) • 2020 = 0.033 $MMTCO_2e$ indirect (direct not applicable) **Expected Cost per Ton GHG** The costs are estimated to be –\$34/$MTCO_2e$. **Estimated Co-Benefits** Co-benefits have not been estimated.
27. State Procurement of Environmentally Preferable Services and Products This measure would promote procurement of environmentally preferable products and services by State agencies.	**Progress – Implemented** A variety of EPP contracts and products are currently available to state agencies through DAS. The state's municipalities are also eligible to piggyback on these contracts. A Climate Change Showcase on EPP's at was presented at the 11/8/04 CT Shops Expo put on by DAS. **Expected GHG Reductions in 2010 and 2020** GHG emission reductions have not been estimated. **Expected Cost per Ton GHG** Costs have not been estimated. **Estimated Co-Benefits** Co-benefits have not been estimated.
28. Review New England Regional Demand Response Initiative (NEDRI) Recommendations The State should review the recommendations from the NEDRI report. ISO NE and various state DPUCs, wires companies, and DEPs worked together to develop a series of recommendations over an 18-month period. The NEDRI report provides a good overview and identifies many measures that can be implemented at the federal and	**Progress - Action Pending** **Expected GHG Reductions in 2010 and 2020** GHG emissions reductions have not been estimated. **Expected Cost per Ton GHG** Costs have not been estimated.

Table ES.3
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<table>
<tr><th>Policy Action</th><th>Status</th></tr>
<tr><td>state level. In addition, the Federal Energy Regulatory Commission plans to use NEDRI as a model for other state ISOs.</td><td>Estimated Co-Benefits
Co-benefits have not been estimated.</td></tr>
<tr><td>29. Promote Voluntary Programs and Actions
To promote GHG reductions in particular sectors, state government can encourage participation in voluntary programs that exist on the national level through Federal non-governmental agencies. In addition, the state may enter into direct voluntary or negotiated agreements with industries or industrial sectors. Negotiated agreements, for example, would result in agreed-upon GHG emission reductions or offsets as an alternative to compliance or enforcement actions resulting from violation of air pollution legislation (such as violations of Clean Air Act state implementation plan requirements), or as an alternative for possible regulation of GHG emissions.</td><td>Progress - In Process
Efforts to promote participation in existing programs have resulted in:
• 16 CT towns joining the International Council for Local Environmental Initiatives (ICLEI) Cities for Climate Protection program;
• commitments from CT towns, the state, and faith communities join the 20% by 2010 Clean Energy Campaign of SmartPower and purchase over 100 GWh of electricity from clean energy by 2010;
• the launch of the new CT Clean Energy Communities program by CCEF, SmartPower, and CCM;
• 3 CT universities joining Clean Air-Cool Planet's Campuses for Climate Action program;
• 30 CT towns participating in Rebuild America program;
• EPA holding its Climate Leaders conference in CT in October 2004 (first time outside of Washington, D.C.) with DEP Acting Commissioner as a speaker and several CT companies are members.
• Presentation and promotion of EPA Energy Star program geared to hospitals and medical offices at 2 separate fall workshops for this sector.

Expected GHG Reductions in 2010 and 2020
GHG emission reductions have not been estimated.

Expected Cost per Ton GHG
Costs have not been estimated.

Estimated Co-Benefits
Co-benefits have not been estimated.</td></tr>
<tr><td>30. Encourage Clean Combined Heat and Power (CHP)
CHP is the simultaneous production of electricity and heat using a single fuel. The heat produced from the electricity-generating process is captured and used to produce high- and low-level steam. The steam can be used as a heat source for both industrial and domestic purposes and in steam turbines to generate additional electricity (i.e., combined-cycle power).

The policy consists of two elements:
1. Reducing the current barriers to developing CHP projects (such as permitting and interconnection hurdles and standby power rates)
2. Exploring further mechanisms to promote CHP,</td><td>Progress - Action Pending

Expected GHG Reductions
• 2010 = 0.523 $MMTCO_2e$ indirect, 0.009 $MMTCO_2e$ direct (based on 4% CHP in 2010)
• 2020 = 1.389 $MMTCO_2e$ indirect, 0.025 $MMTCO_2e$ direct (based on 8% CHP in 2020)

Expected Cost per Ton GHG
Costs have not been estimated.

Estimated Co-Benefits
Co-benefits have not been estimated.</td></tr>
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such as a CHP portfolio standard	
31. Restore the Conservation and Load Management Fund The Conservation and Load Management Fund is directed towards electrical efficiency measures in the residential, commercial, and industrial sectors. It is generated through a ratepayer surcharge on electricity.	**Progress - Action Pending** **Expected GHG Reductions** • 2010 = 0.279 $MMTCO_2e$ indirect, (direct not applicable) • 2020 = 0.606 $MMTCO_2e$ indirect, (direct not applicable) **Expected Cost per Ton GHG** The cost is estimated to be –$56/$MTCO_2e$. This program requires $37 million in 2004 and 2005 and $27 million from 2006-2010. Funding from 2011 to 2020 would be $87 million. These funds are to be generated from a surcharge on electricity. Cost savings would begin to accrue to residential, commercial, and industrial customers immediately and would continue to accrue for the lifetime of the measure or an estimated 15 years (e.g., measures implemented in 2020 would continue to achieve cost savings through 2035). **Estimated Co-Benefits** Co-benefits have not been estimated.
32. Create Heating Oil Conservation Fund Similar to a public benefits funds (eg. Conservation and Load Management Fund and the Connecticut Clean Energy Fund), the revenues for this fund could be collected from oil consumers to support EE or conservation projects in these areas.	**Progress - In Process** Further analysis has been done to quantify co-benefits. Significant Positive economy-wide benefits have been determined. Implementation actions are pending. Legislation will be necessary. **Expected GHG Reductions** • 2010 = 1.02 $MMTCO_2e$ • 2020 = 1.89 $MMTCO_2e$ **Expected Cost per Ton GHG** • 2010 = -$184 $/ton CO_2e • 2020 = -$737 $/ton CO_2e **Estimated Co-Benefits** Significant economy-wide benefits have been estimated including employment, output, gross state product, real disposable personal income, and state revenues. Significant criteria pollutant reductions have been estimated as well that result in improved public health. (see write-up for summary)

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Policy Action	Status
33. Create Natural Gas Conservation Fund Similar to a public benefits funds (eg. Conservation and Load Management Fund and the Connecticut Clean Energy Fund), the revenues for this fund could be collected from oil consumers to support EE or conservation projects in these areas.	**Progress - In Process** Further analysis has been done to quantify co-benefits. Significant Positive economy-wide benefits have been determined. Implementation actions are pending. Legislation will be necessary. **Expected GHG Reductions** • 2010 = 1.44 $MMTCO_2e$ • 2020 = 2.07 $MMTCO_2e$ **Expected Cost per Ton GHG** • 2010 = -$360 $/ton CO_2e • 2020 = -$1,450 $/ton CO_2e **Estimated Co-Benefits** Significant economy-wide benefits have been estimated including employment, output, gross state product, real disposable personal income, and state revenues. Significant criteria pollutant reductions have been estimated as well that result in improved public health. (see write-up for summary)
34. Identify Measures to Reduce High Global Warming Potential (GWP) Gases High-GWP gases, potent GHGs, include HFCs, SF_6, and PFCs. Opportunities to reduce high GWP gases include leak reduction programs, substitution programs, and improved maintenance, among others.	**Progress - Action Pending** **Expected GHG Reductions in 2010 and 2020** GHG emission reductions have not been estimated. **Expected Cost per Ton GHG** Costs have not been estimated. **Estimated Co-Benefits** Co-benefits have not been estimated.
Agriculture, Forestry, and Waste	
35. Install Centralized Manure Digesters Install anaerobic digesters to process agriculture manure into energy (e.g., heat, hot water, or electricity). This process also produces digested manure, which can contain more valuable nitrogen for crop production.	**Progress - Action Pending** **Expected GHG Reductions** • 2010 = 0.0084 $MMTCO_2e$ indirect, 0.0087 direct $MMTCO_2e$ • 2020 = 0.0255 $MMTCO_2e$ indirect, 0.0260 direct $MMTCO_2e$ **Expected Cost per Ton GHG** The expected cost would equal $112 to 126/$MTCO_2e$. It is estimated that the program would cost $2.8 million: 940,800 per digester. The group deliberated on a number of implementation approaches for the manure digester option; however,

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Policy Action	Status
	no specific actions were suggested. Depending on the implementation approach chosen, some or all of the funding could come from the federal government, State government, or private entities. **Estimated Co-Benefits** This project could provide ancillary benefits such as odor control, water quality, and improved farm economics through generating additional income. In addition, this project could support the continuation of farming in the State that can support both smart growth initiatives and the "increase purchase of locally grown food" option mentioned later.
36. Reduce Use of Non-Farm Fertilizer A portion of nitrogen applied to the soil is subsequently emitted as N_2O; therefore, a reduction in the quantity of fertilizer applied can reduce N_2O emissions. The goal is to support education programs to reduce non-farm (i.e., commercial and residential) fertilizer use by 7.5% by 2010 and 15% by 2020.	**Progress - In Process** The towns of Milford and Cheshire have joined Freedom Lawn program. The Organic Landcare Program (administered by Connecticut Northeast Organic Farmers Association) continues to run outreach, training, and accreditation programs for organic landcare professionals in the state. There are currently 56 accredited organic land care professionals in CT. An accreditation course was conducted in CT in 2004; AND another will in February 2005. There have been numerous presentations, articles, and displays on the organic landcare standards to groups such as the CT Chapter of the Association of Landscape Architects, organic farming groups, garden clubs, environmental organizations, and faith based communities. **Expected GHG Reductions** • 2010 = 0.003 $MMTCO_2e$ • 2020 = 0.003 $MMTCO_2e$ **Expected Cost per Ton GHG** Costs have not been estimated. **Estimated Co-Benefits** These efforts can reduce nutrient loading in water bodies; increase the organic content of soil (and thus increase carbon sequestration); reduce GHG emissions and water consumption through natural lawn care methods, such as decreased mowing, and watering; and increase biodiversity.
37. Buy Locally Grown Food Encouraging consumers to buy local produce reduces emissions associated with the transport of agricultural products. The goal is to purchase an additional 10% of CT's farm products from local sources instead of conventional markets.	**Progress - In Process** The CT Grown program of the CT Department of Agriculture continues to work to increase the purchase of locally grown foods in the state. Currently there are 19 schools and 25 farmers participating in the Farm to Schools program that purchase local produce for school cafeterias. There are presently 70 farmers' markets in the state selling locally grown produce. In addition, a number of large institutions are currently purchasing or considering

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Policy Action	Status
	purchasing locally grown produce, including the Department of Corrections and the University of Connecticut. In 2004, the Department of Agriculture was able to hire an additional employee to work on the CT Grown program, using funds it receives from the USDA. In 2004, legislation was enacted to require DAS to give preference to CT grown in contracts for dairy, poultry, eggs, fruits, and vegetables (An Act Concerning Preservation of the Family Farm and Long Island Sound, PA 04-222) and to also require DOA to establish a "Connecticut Farm Fresh" promotional program. **Expected GHG Reductions** • 2010 = 0.003 MMTCO_2e • 2020 = 0.003 MMTCO_2e **Expected Cost per Ton GHG** Costs have not been estimated. **Estimated Co-Benefits** These efforts can provide ancillary benefits such as the reduction of air emissions from reduced food transport, economic development for Connecticut farms, and lower levels of pesticide and water pollution, depending on the type of farming practice supported.
38. Research on Connecticut Forest Management and Carbon Offsets This program will support a research program to examine Connecticut's public and private forests and determine how they could be best managed to maximize carbon sequestration and to develop markets for offsets from terrestrial carbon sinks.	**Progress - Action Pending** **Expected GHG Reductions in 2010 and 2020** The measures have not been quantified. **Expected Cost per Ton GHG** Costs have not been estimated. **Estimated Co-Benefits** Co-benefits have not been estimated.
39. Urban Tree Planting Program Plant trees in urban areas to reduce the consumption of energy for heating and cooling buildings, thereby helping avoid fossil fuel emissions in the energy sector and increasing the carbon stock of non-forest land. The goal is to provide funding and other support to plant an additional 15,000 sufficiently sized tress by 2010, and 20,000 more by 2020.	**Progress - In Process** DEP has had an urban forestry grant program for CT towns in place for about 12 years, using funding from the USDA Forest Service. In 2004, a total of $76,860 was awarded to CT towns for urban forestry programs. Of this, $28,260 was specifically designated for urban tree planting in the towns of East Haddam, Bristol, and Norwalk. **Expected GHG Reductions** • 2010 = 0.0008 MMTCO_2e indirect, 0.00003 MMTCO_2e direct • 2020 = 0.0019 MMTCO_2e indirect, 0.00007 MMTCO_2e direct

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	Expected Cost per Ton GHG The expected cost would equal $9,815/MTCO_2e$. It is estimated that the program would cost $500,000 per year starting in 2004, and have a potential mix of federal and State government funding. **Estimated Co-Benefits** This program could lead to reductions in other air emissions. Planting programs in urban areas should have few barriers to implementation because many communities are actively pursuing tree-planting programs for reasons other than climate change, such as aesthetics.
40. Forest and Agricultural Land Preservation This program would support the protection of forestland and agricultural land preserves and the carbon-absorption capacity of existing forest and agricultural lands, enabling continued carbon sequestration from the atmosphere. The goal is to preserve existing forest and agricultural land in CT.	**Progress - In Process** To date, 23% of the Connecticut Department of Agriculture's 130,000-acre preservation goal has been met through the purchase of land development rights program. As of December 2004, a total of 29,980 acres on 211 Connecticut farms have been preserved through this program. During 2004, $2.2 million was allocated by State Bond Commission to purchase development rights on 1,133 acres of prime farm. **Expected GHG Reductions** • 2010 = 0.283 $MMTCO_2e$ • 2020 = 0.283 $MMTCO_2e$ **Expected Cost per Ton GHG** The expected cost would equal $137/MTCO_2e$. It is estimated that the program would cost $57 million per year: $46.6 million for the forestland preservation and $10.5 million for the agricultural land preservation. A significant portion of the open space land preserved through State funds was conducted under a program in which the DEP provided towns and private conservation groups with matching grants, usually 50% of the land cost. If such a program were to comprise half of the DEP's efforts, the 4,700 acres could be acquired at a cost to the state of approximately $21.4 million per year. The agricultural land preservation is assumed to come from State government funding. **Estimated Co-Benefits** Ancillary benefits include promoting wildlife habitat, protecting and improving water quality, improving the "livability" of the State, supporting smart growth initiatives in the State, supporting economic development (especially in rural parts of the State) by maintaining agricultural capacity, and enabling the continued consumption of locally grown agricultural products.

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Policy Action	**Status**
41. Promote Use of Durable Wood Products Durable wood products, such as furniture or construction lumber, sequester carbon for long periods of time, as long as the timber is produced as a result of certified sustainable harvesting practices. Wood products are also much less energy-intensive to create than materials such as steel, plastic, aluminum, and concrete. The recommendation is to support a voluntary education program to encourage the purchase of durable wood products,	**Progress – In Progress** DAS is using contract language to encourage proposals that include the reuse of durable wood furniture. EPP Program working on promotion of used/refurbished furniture contract. **Expected GHG Reductions in 2010 and 2020** The measures have not been quantified. **Expected Cost per Ton GHG** Costs have not been estimated. **Estimated Co-Benefits** Co-benefits have not been estimated.
42. Support Economically Viable Landfill Gas-to-Energy Projects Landfills naturally create methane gas (a GHG) as a by-product. Rather than being released into the air or burned off (flared), methane can be captured and used as a fuel to produce energy.	**Progress - In Process** The CCEF is currently identifying credible commercial LFGE projects in various sites throughout Connecticut. **Expected GHG Reductions in 2010 and 2020** These are included in waste and electricity sector reference cases. **Expected Cost per Ton GHG** Costs have not been estimated. **Estimated Co-Benefits** Co-benefits have not been estimated.
43. Increase Recycling and Source Reduction This would cover programs to reduce the amount of waste being put in landfills and/or waste-to-energy facilities, thereby reducing the amount of generated methane and CO_2, and emissions associated with producing virgin materials.	**Progress - Action Pending** DEP has issued a Request for Proposals for the development of a statewide solid waste management plan. This plan, which should be completed by early 2006, will further identify and analyze measures to increase recycling and source reduction to 40%. **Expected GHG Reductions** • 2010 = 0.91 $MMTCO_2e$ • 2020 = 0.97 $MMTCO_2e$ **Expected Cost per Ton GHG** The expected cost would equal \$4 to \$5/$MTCO_2e$. It is estimated that the program would cost \$4.1 million per year in State funding (see appendix to Chapter 3.4). **Estimated Co-Benefits** Some of the potential ancillary benefits of this program include decreased raw materials acquisition (fossil fuel energy and other emissions and changes in forest carbon sequestration); decreased manufacturing (fossil fuel energy emissions) and transportation-related emissions; reduced need for new disposal facilities, avoiding land use and siting issues, waste transportation issues, other pollutants

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	from waste combustion, generation of ash residue which requires handling, transportation, and disposal, and reduced toxicity of the waste stream. Consideration was given to the impact of GHG on resource-recovery facilities compared with disposal of waste out-of-state.
44. Voluntary Carbon Offset Program Encourage pilot efforts on carbon offsets (i.e., emissions reductions by sources not covered under specific recommendations from the stakeholders and outside the state or the country).	**Progress - In Process** There is at least one voluntary carbon offset program operating in CT. This program, called Reforest The Tropics, has linked a number of CT carbon dioxide emitters with reforestation projects in Costa Rica. In Connecticut, there are a number of organizations of various sectors participating in this program, including colleges and local schools, municipalities, tribal nations, and individuals. **Expected GHG Reductions in 2010 and 2020** GHG emissions reductions have not been estimated. **Expected Cost per Ton GHG** Costs have not been estimated. **Estimated Co-Benefits** Co-benefits have not been estimated.

Electricity Generation

Policy Action	Status
45. Renewable Energy Strategy (RES) RES is a group of options designed to promote renewable energy. This recommendation includes several combined strategies that were run through the Integrated Planning Model (IPM) to inform the stakeholders in its decision-making role.	**Progress - In Process** **Expected GHG Reductions** • No GHG emissions reductions are reported for this combined policy run. This scenario was run to further inform the judgment of the stakeholders in its decision-making role. **Expected Total Cost** • No costs are reported for this combined policy run. **Expected Cost (In-State) per Ton GHG (Region)** • No costs are reported for this combined policy run. **Estimated Co-Benefits** Co-benefits have not been estimated.
46. Renewable Portfolio Standard (RPS) The RPS mandates that a certain minimum percentage of annual electricity production come from renewable energy sources. Sources of qualifying renewable energy are delineated in the legislation, as are the increasing percentage requirements over time.	**Progress - Action Pending** **Expected GHG Reductions** • 2010 = 1.3 $MMTCO_2e$ • 2020 = 3.2 $MMTCO_2e$ **Expected Cost per Ton GHG** This is calculated in Recommendation 45 based on

Table ES.3
Summary of Connecticut Climate Change Recommendations

Policy Action	Status
	an extension of the current RPS to 8% in 2011 and up to 20% in 2020. **Estimated Co-Benefits** By virtue of reducing conventional power plant production, increased utilization of clean energy resources would yield a number of additional pollutant benefits in terms of reduced SO_2, NOx, and mercury emissions. Other potential co-benefits include greater fuel diversity; fuel cost savings; and increased electric system reliability and security — as well as economic development benefits.
47. Government Clean Energy Purchase State government and universities are required to replace an increasing share of electricity with renewable energy, or to pay a premium on electricity to support investment in renewable energy generation capacity.	**Progress - In Process** Executive Order 32 was issued requiring state government and universities to purchase Class I Renewables - 20% by 2010, 50% in 2020, and 100% in 2050. OPM has retained a consultant to update state building load profiles to assist the state in implementing this measure. Estimated date of completion is Fall of 2005. **Expected GHG Reductions** • 2010 = 0.08 $MMTCO_2e$ • 2020 = 0.21 $MMTCO_2e$ **Expected Cost per Ton GHG** This is calculated under the RES. **Estimated Co-Benefits** "Leading by Example," will establish an important foundation from which other leaders in the business, community, and institutional arenas can commit to significant clean energy purchases.
48. Production Tax Credit (PTC) Create a financial incentive for qualifying renewable energy production with a per-kWh tax credit. Explore a PTC ($0.018/kWh for 10 years) for new Class I renewable projects in Connecticut that are not covered by the federal renewable PTC (i.e., fuel cells, solar, landfill gas, biomass, hydrogen, and small hydro). This would be a potential mechanism to achieve RPS and promote development of in-state renewables in light of future information on the availability of and competition for biomass resources.	**Progress - In Process** Although not directly a Connecticut-based PTC, Public Act 03-135 requires UI and CL&P to sign long-terms power contracts for no less than 100 MW's of clean energy. This act requires that power contracts for no less than a 10-year period (the length of the federal ptc is 10 years) be signed at the wholesale market price plus up to $0.055 per kWh (the federal PTC is inflation-adjusted at a rate of $0.015 per kWh) To date, DPUC has conducted a proceeding that established a procedure and process guidelines to implement the statute. In addition, The CCEF organized a kick-off meeting to prospective developers and financiers to discuss the process and issue a draft RFP for public comment (11/16). The need to develop a Connecticut-based PTC will in part depend upon how this act is successfully implemented.

Table ES.3
Summary of Connecticut Climate Change Recommendations

Policy Action	Status
	Expected GHG Reductions GHG emissions reductions have not been estimated. **Expected Cost per Ton GHG** This is calculated under the RES. **Estimated Co-Benefits** By virtue of reducing conventional power plant production, increased utilization of clean energy resources would yield a number of additional pollutant benefits in terms of reduced SO_2, NOx, and mercury emissions. Other potential co-benefits include greater fuel diversity; fuel cost savings; and increased electric system reliability and security — as well as economic development benefits.
49. Clean Energy Option Allow ratepayers to choose electricity derived from renewable energy sources.	**Progress - In Process** On October 20, 2004 the DPUC issued a decision (docket #03-07-16) establishing the framework for the implementation of state's clean power (renewable energy) program. A bidding process is currently underway, and It is expected that there will be a 50% and 100% clean energy choice option available to to UI and CL&P customers in the first quarter of 2005. The CCEF, in partnership with SmartPower and CCM, have created a program called "CT Clean Energy Communities." This program is designed to compliment the clean power program and support greater market penetration to achieve the recommended targets. **Expected GHG Reductions** • 2010 = 0.43 $MMTCO_2e$ • 2020 = 0.81 $MMTCO_2e$ **Expected Total Cost** (Voluntary Market) • 2010 = $14.49 million • 2020 = $17.76 million **Expected Cost per Ton GHG** • In 2010 = $33.69/$MTCO_2e$ ($123.55/MTCe) • In 2020 = $21.92/$MTCO_2e$ ($80.39/MTCe) **Estimated Co-Benefits** By virtue of reducing conventional power plant production, increased utilization of clean energy resources would yield a number of additional pollutant benefits in terms of reduced SO_2, NOx, and mercury emissions. Other potential co-benefits include greater fuel diversity; fuel cost savings; and increased electric system reliability and security — as well as economic development benefits.

Table ES.3
Summary of Connecticut Climate Change Recommendations

Policy Action	Status
50. Renewable Energy Credits The benefits of renewable energy— zero emissions of GHG and other pollutants—can be purchased via certificates called "green tags," which track the generation and sale of renewable energy, even when produced outside the local utility grid.	**Progress - In Process** The DPUC is conducting an administrative proceeding (Docket 04-01-13) to review the RPS Standards and Trading Programs in New York, Pennsylvania, New Jersey, Maryland, and Delaware. **Expected GHG Reductions in 2010 and 2020** Non-applicable **Expected Cost per Ton GHG** Costs have not been estimated. **Estimated Co-Benefits** It is expected that regional REC trading will reduce compliance costs for the RPS thereby reducing costs to the ratepayers.
51. Restore the Clean Energy Fund This fund provides incentives for new renewable electricity generation capacity and pilot projects.	**Progress - Action Pending** **Expected GHG Reductions in 2010 and 2020** • 2010 = 0.31 $MMTCO_2e$ • 2020 = 0.41 $MMTCO_2e$ **Expected Cost per Ton GHG** • 2010 = \$2.05-\$39.09 $MTCO_2e$ • 2020 = \$0.60-\$29.66 $MTCO_2e$ **Estimated Co-Benefits** By virtue of reducing conventional power plant production, increased utilization of renewable resources and new distributed fuel-cell installations would yield a number of additional pollutant benefits in terms of reduced SO_2, NOx, and mercury emissions. Other potential co-benefits include greater fuel diversity; fuel cost savings; and increased electric system reliability and security — as well as economic development benefits. These benefits are, of course, more likely to be concentrated in Connecticut if CCEF funds are used to promote renewable projects or fuel cell applications within the state.
52. Energy Efficiency and CHP EE/CHP is a group of options designed to promote energy efficiency and CHP. This recommendation includes several combined strategies that were run through the Integrated Planning Model (IPM) to inform the stakeholders in its decision-making role.	**Progress - In Process** Near finalization of REMI modeling. Results show a positive economic benefit to the state. **Expected GHG Reductions** • No GHG emissions reductions are reported for this combined policy run. This scenario was run to further inform the judgment of the stakeholders in its decision-making role. **Expected Total Cost** • No costs are reported for this combined policy run.

Table ES.3
Summary of Connecticut Climate Change Recommendations

Policy Action	Status
	Expected Cost (In-State) per Ton GHG (Region) • No costs are reported for this combined policy run. **Estimated Co-Benefits** Co-benefits have not been estimated.
53. Regional Cap-and-Trade Program Cap-and-trade programs set limits on industry emissions at particular levels over particular time periods within a specified geographic area. They allow flexibility by covered entities in sources and methods of reduction, as well as trading credits between those required to comply with caps or standards and other flexibility mechanisms, such as emissions offsets.	**Progress - In Process** DEP continues its participation in the Regional Greenhouse Gas Initiative (RGGI) and its coordination with other states in the Northeast region. The objective is to have electricity sector modeling results and a model rule completed by April 2005. A RGGI Staff Working Group meeting is held monthly, and numerous subgroup conference calls are held each month. **Expected GHG Reductions** (With Leakage) • 2010 = 0.95 $MMTCO_2e$ • 2020 = 2.26 $MMTCO_2e$ (Without Leakage) • 2010 = 1.98 $MMTCO_2e$ • 2020 = 5.13 $MMTCO_2e$ **Expected Cost per Ton GHG** The costs will be provided as part of the modeling results. **Estimated Co-Benefits** Co-benefits have not been estimated.

Cross-Cutting Recommendations

54. Public Education Initiative Information and education is an important tool for implementing GHG plans and programs, because it alerts the public and key parties to the need for action and the availability of programs and services. The goal is to foster a broad awareness of climate change issues (including co-benefits) and impacts among CT citizens and to engage citizens in actions to reduce GHG emissions. The recommendation details education and outreach initiatives for the following target sectors: policy makers, community leaders, future generations, community-based organizations, and the general public.	**Progress - In Process** The Climate Change Education Committee continues to meet regularly to coordinate education and outreach in CT. Progress during 2004 includes: further development of the state's climate change web site (www.ctclimatechange.com); numerous outreach and technical assistance events for municipalities and universities; establishment of a CT Science Center Collaborative to integrate climate science and research into the programming of the state's science centers and museums; continued research on messaging and public opinion on global warming; and continued networking and collaboration among the many organizations involved in outreach on climate change and related issues in CT.
55. Emissions Inventory and Registry Inventory, reporting, and registry systems are important tools for implementation of GHG plans because they provide a means of measuring and tracking success and	**Progress - In Process** DEP is working with other northeast states and NESCAUM on the Regional Greenhouse Gas Registry (RGGR) project. The goal is to develop a

Table ES.3
Summary of Connecticut Climate Change Recommendations

Policy Action	Status
of cooperating across sectors, programs, and jurisdictions.	GHG registry that can accommodate both mandatory and voluntary reporting programs. This registry is also being designed to handle the emissions and allowance tracking needs of the Regional Greenhouse Gas Initiative (RGGI). Pursuant to Public Act 04-252 (A.A.C. Climate Change), Connecticut sources will need to commence mandatory reporting of annual GHG emissions in April 2006.

Connecticut Climate Change
Action Plan 2005

HISTORY OF CONNECTICUT'S CLIMATE CHANGE LEADERSHIP

Connecticut Climate Change

HISTORY OF CONNECTICUT'S CLIMATE CHANGE LEADERSHIP

New England Governors/Eastern Canadian Premiers Climate Change Action Plan

The New England states and the eastern Canadian provinces have a long history of working together to address and resolve environmental issues. Starting in the 1980s, the New England governors (NEG) and eastern Canadian premiers (ECP) recognized the harmful effects of acid rain on the region's forests and the negative impact on its economy. The NEG/ECP passed a joint resolution calling for the elimination of emissions contributing to those effects. As a result, states and provinces acted to reduce emissions of nitrogen oxides (NO_x) and sulfur oxides (SO_x). Those steps later served as a model for regional and federal action.

In 2000, the NEG/ECP, citing findings in the United Nations Intergovernmental Panel on Climate Change Third Assessment Report, commenced regional discussions on global warming and its environmental impact. A March 2001 NEG/ECP workshop on the science and impacts of climate change provided a framework for a climate change action plan. In August 2001, the NEG/ECP signed the *Climate Change Action Plan 2001*[1] at their annual meeting in Westbrook, Connecticut.

The vision of the Climate Change Action Plan is to reduce greenhouse gas (GHG) emissions to a level that stabilizes the earth's climate and eliminates the negative impact of climate change. The plan outlines important short- and mid-term goals for measuring progress toward the long-term objective based on environmental needs (not feasibility). The plan also specifies nine action items the states and provinces should undertake. Those goals and action items are detailed in Table 1.1. The plan further provides a recalibration mechanism. Starting in 2005, and continuing every five years thereafter, progress in achieving the goals will be evaluated. The goals will be adjusted, if necessary, and future emission goals may be established.

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[1] http://www.negc.org/documents/NEG-ECP%20CCAP.PDF

Table H.1
2001 NEG/ECP Climate Change Action Plan and Related Resolutions

Regional Goals of Climate Change Action Plan

Short-term: Reduce regional GHG emissions to 1990 levels by 2010.
Mid-term: Reduce regional GHG emissions to at least 10% below 1990 levels by 2020.
Long-term: Reduce regional GHG emissions sufficiently to eliminate any dangerous threat to the climate (current science suggests that this level is 75% to 85% below 2001 levels).

Action Item 1 – Establishment of a Regional Standardized GHG Emissions Inventory
Goal: Each jurisdiction should establish a standardized inventory beginning with 1999 GHG emissions levels, reported every three years.

Action Item 2 – Establishment of a Plan for Reducing GHG Emissions and Conserving Energy
Goal: Each jurisdiction should create a plan articulating measures for achieving GHG reductions in view of the regional short and mid-term targets.

Action Item 3 – Promotion of Public Awareness
Goal: By 2005, make the public aware of the problems and impact of climate change and what actions they can take at home and at work to reduce the release of GHGs. The public should also be made cognizant of adaptive measures they can accomplish.

Action Item 4 – Need for State and Provincial Governments to Lead by Example
Goal: Reduce end-use emissions of GHGs through improved energy efficiency and lower carbon fuels within the public sector by 25% by 2012, as measured from an established baseline.

Action Item 5 - Reduction of GHGs From the Electricity Sector
Goal: Reduce the amount of CO_2 emitted per MWh of electricity use within the region by 20% of current emission rate by 2025.

Action Item 6 - Reduction of the Total Energy Demand Through Conservation
Goal: By 2025, increase the amount of energy saved through conservation programs (as measured in tons of GHG emissions) within the region by 20% using programs designed to encourage residential, commercial, and industrial energy conservation.

Action Item 7 - Reduction and/or Adaptation of Negative Social, Economic, and Environmental Impact of Climate Change
Goal: Broaden the understanding of forecast effects on climate and plan the adaptation to these changes, where possible. In addition, seek climate adaptation options that do not increase GHG emissions further.

Action Item 8 - Reduction in the Transportation Sector's Growth in GHG Emissions
Goal: Slow the growth rate of transportation emissions in the near future, better understand the impact of transportation programs and projects on total emissions, and seek ways to reduce these emissions. Work with federal officials to improve the energy efficiency of vehicles for sale to the public.

Action Item 9 - Creation of a Regional Emissions Registry and Exploration of a Trading Mechanism
Goal: To create a uniform, coordinated basis for emissions banking and trading.

Resolution 27-7 (August 2002)

Encourage and promote climate change proposals focused on LED traffic lights; partnerships with regional colleges and universities for emissions-reduction programs; purchase of high-efficiency and low-emission office equipment; and use of clean, energy efficient vehicles in state and provincial fleets.

Resolution 28-7 (September 2003)

Evaluate "smart growth" approaches to land-use and development and seek recommendations for implementation. Continue to develop the administration, tracking, and reporting framework for a voluntary regional GHG registry. Work to develop voluntary partnerships with cities, towns, and businesses to increase the efficacy of NEG/ECP's climate change work.

The goals and results outlined in the plan are for the New England and eastern Canada region in aggregate and may not be achieved in equal measure by each jurisdiction. It is recognized that differences in emissions characteristics and inventories, social and political systems, economic profiles (including transportation, utility, and industrial infrastructures), and resources will lead to different approaches among the jurisdictions in contributing to the regional goals. However, each jurisdiction in the region has committed to participate in achieving the regional goals and will work with the other states and provinces in the region on this important effort.

Connecticut's Greenhouse Gas Emissions Inventory (1990-2000)

Connecticut has quantified its emissions contributing to global climate change by completing GHG emissions inventories for 1990 through 2000. *Connecticut Greenhouse Gas Inventory 1990–2000* (August 2003) was developed by the Northeast States for Coordinated Air Use Management (NESCAUM) using the State GHG Inventory Tool, an Excel-based software package produced by the State and Local Climate Change Program of the U.S. Environmental Protection Agency (EPA).[2] The inventory summarizes Connecticut's emissions of the six major GHGs covered in national inventories: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). The inventory also incorporates information from all major emissions sources in Connecticut: fossil and biomass fuel combustion, industrial production processes, gas and oil activities, landfills and wastewater treatment, agricultural sources, and land-use changes and forestry. To make the inventory comparable to the U.S. national GHG inventory and inventories from other industrialized countries, GHG quantities are expressed in million metric tons of CO_2 equivalent ($MMTCO_2e$), which is derived from the relative global warming potential of each of these gases.

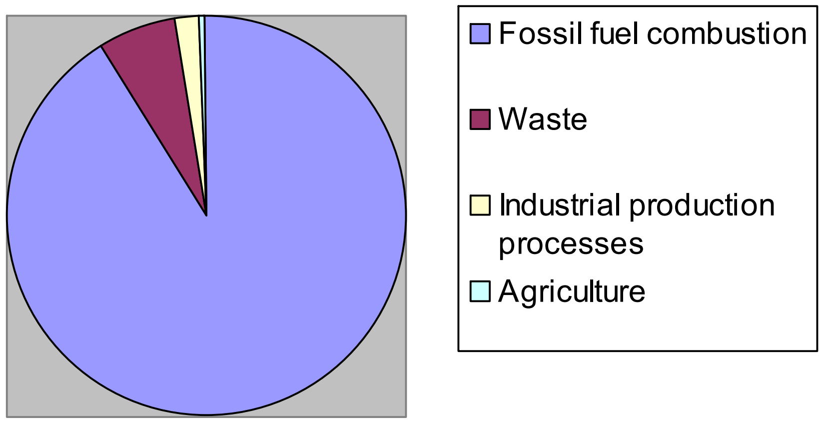
Table 1.2 summarizes Connecticut's GHG emissions from 1990 through 2000 as developed by NESCAUM. In 2000, Connecticut emitted 48.485 $MMTCO_2e$ of GHGs, approximately 9 percent more than in 1990. As shown in Figure 1.1, about 90 percent of the total emissions in 2000 came from the combustion of fossil fuels—oil, gas, and coal—to power the State's cars and factories, heat and cool its homes and buildings, and generate electricity. Municipal solid waste management was responsible for about 6 percent of total emissions. Industrial processes and agriculture contributed less than 2 percent and 1 percent, respectively. Carbon stored in forests and soils offset about 4 percent of Connecticut's annual GHG emissions, resulting in net GHG emissions (total emissions minus carbon sequestered) of 46.45 $MMTCO_2e$ in 2000.

[2] Produced by Northeast States for Coordinated Air Use Management (NESCAUM) and the Connecticut Department of Environmental Protection, with support from the Connecticut Clean Energy Fund. The Inventory Tool incorporates revisions to EPA's guidelines for estimating GHG emissions up through November 2002. The *Connecticut Greenhouse Gas Inventory 1990–2000* (August 2003) uses all revised modules of the Inventory Tool issued through May 30, 2003.

Table H.2 Connecticut GHG Emissions: 1990–2000											
Emissions ($MMTCO_2e$)	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Energy	**40.270**	**39.518**	**39.476**	**38.582**	**37.656**	**37.578**	**41.002**	**44.130**	**43.748**	**44.133**	**44.159**
CO_2 from fossil fuel combustion	38.882	38.081	38.179	37.083	36.166	36.063	39.505	42.679	42.318	42.722	42.853
Stationary combustion	0.201	0.203	0.217	0.215	0.210	0.230	0.236	0.214	0.204	0.199	0.223
Mobile combustion	0.680	0.708	0.719	0.744	0.744	0.752	0.731	0.712	0.703	0.693	0.676
Coal mining	–	–	–	–	–	–	–	–	–	–	–
Natural gas and oil systems	0.508	0.526	0.361	0.540	0.536	0.533	0.530	0.525	0.523	0.520	0.408
Industrial processes	**0.314**	**0.325**	**0.311**	**0.397**	**0.419**	**0.528**	**0.634**	**0.700**	**0.740**	**0.772**	**0.840**
Agriculture	**0.330**	**0.321**	**0.335**	**0.344**	**0.350**	**0.336**	**0.313**	**0.307**	**0.335**	**0.329**	**0.326**
Enteric fermentation	0.124	0.121	0.124	0.121	0.121	0.120	0.110	0.106	0.109	0.107	0.109
Manure management	0.046	0.045	0.044	0.047	0.047	0.046	0.044	0.042	0.045	0.044	0.042
Rice cultivation	–	–	–	–	–	–	–	–	–	–	–
Agricultural soil management	0.160	0.155	0.167	0.176	0.182	0.170	0.159	0.159	0.181	0.178	0.175
Burning of agricultural crop waste	–	–	–	–	–	–	–	–	–	–	–
Forest management and land-use change	**(2.719)**	**(2.650)**	**(2.658)**	**(2.069)**	**(2.039)**	**(2.058)**	**(2.052)**	**(2.015)**	**(2.009)**	**(2.035)**	**(2.035)**
Waste	3.499	3.598	3.598	3.590	3.689	3.662	3.245	3.312	3.230	3.130	3.159
Municipal solid waste	3.239	3.337	3.337	3.329	3.425	3.400	2.983	3.049	2.966	2.863	2.883
Wastewater	0.260	0.262	0.261	0.261	0.264	0.262	0.262	0.263	0.264	0.267	0.277
Gross emissions	**44.414**	**43.762**	**43.720**	**42.914**	**42.115**	**42.103**	**45.194**	**48.450**	**48.053**	**48.364**	**48.485**
Sinks	**(2.719)**	**(2.650)**	**(2.658)**	**(2.069)**	**(2.039)**	**(2.058)**	**(2.052)**	**(2.015)**	**(2.009)**	**(2.035)**	**(2.035)**
Net emissions	**41.695**	**41.112**	**41.063**	**40.844**	**40.076**	**40.045**	**43.142**	**46.435**	**46.044**	**46.329**	**46.450**

Source: *Connecticut GHG Inventory 1990–2000*, August 2003.

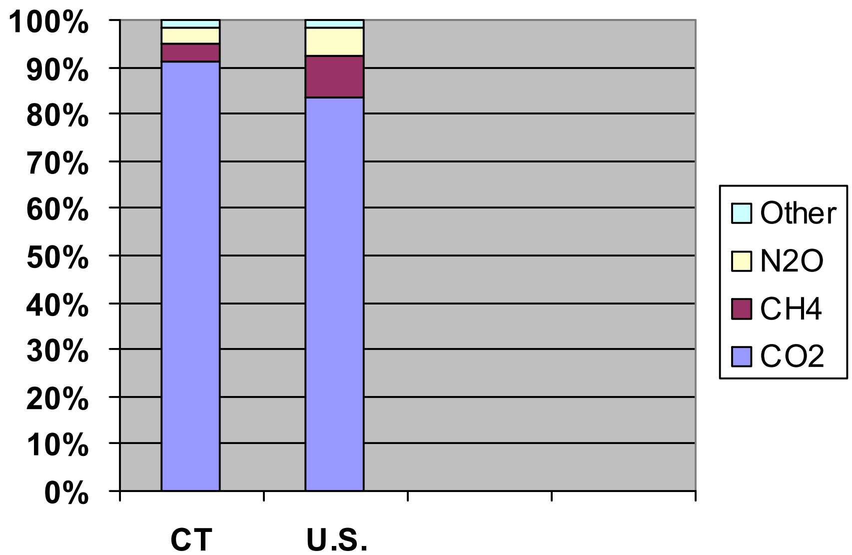
Figure H.1
GHG Emissions by Sector, 2000



Another breakdown of the State's GHG emissions in 2000 is shown in Figure 1.2. CO_2, largely from fossil fuel combustion, accounted for more than 90 percent of the emissions. The contribution of the major GHGs to Connecticut's GHG emissions profile is similar to national figures.

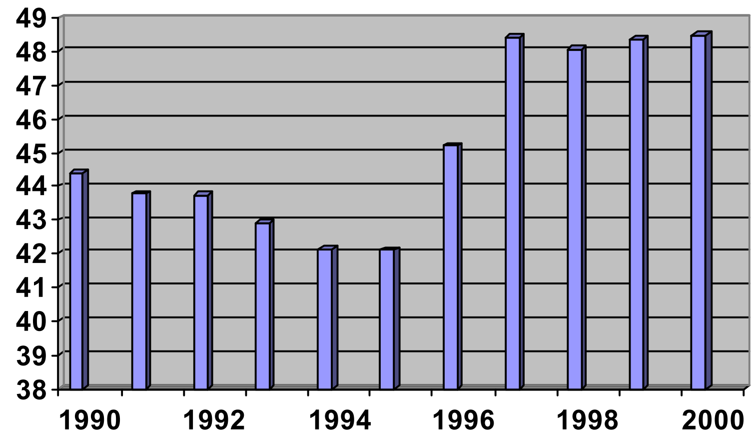
Figures 1.3 and 1.4 show the State's GHG emissions trend between 1990 and 2000. Connecticut GHG emissions declined about 5 percent through the first half of the decade, most likely as a result of a shift in the utility fuel mix used in electric power generation, a shift in waste

Figure H.2
Breakdown of Connecticut and U.S. GHG Emissions
by Type of Gas, 2000



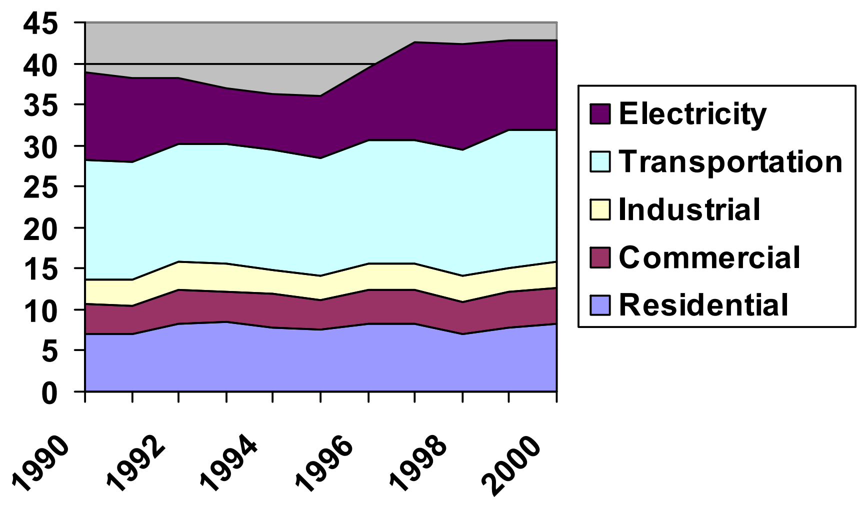
management practices from landfilling to waste-to-energy, a recession in the early part of the decade, and a slight decline in population. Gross GHG emissions, however, increased by more than 15 percent in the second half of the decade, again partly a result of changes in fuel mix, the economy, and the population.

Figure H.3
Total Connecticut GHG Emissions, 1990–2000
(MMTCO_2 equivalent)



CO_2 emissions from fossil fuel combustion result from stationary sources (i.e., power plants, industrial facilities, and home heating systems) and from mobile sources, such as motor vehicles. Transportation accounts for approximately 40 percent of CO_2 emissions annually. Primary energy consumption in the residential and commercial/industrial sectors is approximately 20 percent and 10 percent, respectively. The electric utility sector contributes between 18 and 30

Figure H.4
CO_2 Emissions from Fossil Fuel Combustion, 1990–2000
(MMT)



percent of the CO_2 emissions from fossil fuel combustion. The great fluctuation in electric utility CO_2 emissions stems from the changing fuel mix used to produce electricity in Connecticut.

This inventory provides a basis for establishing baseline emissions. Upon review of the NESCAUM inventory data, some adjustments were made to some of the historical data to establish a baseline for the 2003 Climate Change Stakeholder Dialogue. The most significant adjustment was for the transportation sector.

Connecticut's Climate Change Leaders

The State of Connecticut has a tradition of climate change leadership. From the late 1970s through the 1990s, the State passed more than 20 environmental laws that ranged in scope from allowing towns and cities to exempt solar collectors from property taxes to providing low-cost loans for energy efficiency and renewable energy improvements to the residential, commercial, and industrial sectors. In 1990, the General Assembly passed the Global Warming Act, which required action on state building codes, energy efficient vehicles and appliances, and a comprehensive energy plan for the state.

Reducing GHG emissions in Connecticut to 1990 levels and lower will require aggressive action by all sectors of society, including its businesses and institutions, colleges and universities, nongovernmental organizations, and local governments. All sectors will play a vital role in focusing attention on climate change in Connecticut and implementing the GHG mitigation actions proposed in this plan.

Connecticut businesses have shown leadership in the development of cleaner and renewable energy technologies, such as fuel cells, gas turbines, and the American wind turbine. In addition, many Connecticut businesses and industries have embraced cost-effective measures to reduce GHG emissions voluntarily. Those activities include energy conservation and efficiency, fuel switching and renewable energy purchases, the development of cleaner technologies and the application of cleaner industrial processes, the use of cleaner and more efficient vehicle fleets, carbon sequestration (through improved agriculture and forestry practices as well as participation in voluntary offset projects), and participation in public outreach and awareness. Some companies have joined partnerships or voluntary programs to reduce pollution and emissions and increase corporate stewardship.

Seventeen of the State's colleges and universities have formally committed to making an inventory of GHG emissions on campus and taking actions to reduce emissions. A number of colleges are purchasing renewable energy; many are improving the energy efficiency of lighting, heating, ventilation, and cooling systems and computers and appliances. Connecticut's colleges and universities have also embraced new cleaner technologies, such as solar photovoltaics (i.e., direct conversion of sunlight into electricity), fuel cells, and geothermal heating systems. Some colleges are incorporating green building design standards into new construction and renovations and bio-fuels into their fleets.

Non-governmental organizations have been strong supporters of climate change initiatives in Connecticut. Their support is invaluable in engaging public involvement in understanding the wide spectrum of issues linked to climate change. State and regional nonprofit organizations have acted as catalysts for grassroots action, corporate stewardship, and public policy initiatives. The combined efforts of many non-governmental organizations are helping to educate the public about climate change, assist the State's businesses and institutions, provide resources to municipalities, promote leadership among faith-based communities, build partnerships, and focus the attention of policy makers. Foundations are supporting much of this work through grants.

Sixteen Connecticut municipalities participating in the international Cities for Climate Protection program. These jurisdictions have shown leadership by passing resolutions to inventory and reduce GHG emissions from municipal operations. Many other municipalities have begun to save money through energy efficient measures, such as the installation of light-emitting diode (LED) traffic lights, purchasing Energy Star office equipment, performing energy benchmarking and efficiency upgrades at schools and other public buildings, improving public transit options, and increasing the efficiency of municipal fleets. Several have participated in the utility-sponsored Community-Based Program, which coordinates all conservation and load management programs in selected cities and towns.

State initiatives include the planning and development of statewide GHG mitigation measures as well as the implementation of GHG reduction actions in State operations. Some actions are embodied in State statutes and regulations; others are informal programs or policies. The State has implemented energy performance standards for State buildings and is promoting green building design on major capital projects, purchasing environmentally preferable products ranging from computers to lighting, providing certain tax incentives for clean fuels, and performed energy benchmarking on State buildings to improve efficiencies. In addition, the State is increasing its use of electronic media, resulting in a commensurate reduction in paper consumption.

Designing a Connecticut Process to Develop a Climate Change Action Plan

In 2002, the State of Connecticut, in partnership with the Emily Hall Tremaine Foundation and the Rockefeller Brothers Fund, convened a summit on behalf of a Governor's Steering Committee[3] to establish a State process for developing a climate change action plan. The summit took place in October 2002, at the Pocantico Conference Center of the Rockefeller Brothers Fund. Participants from 13 State agencies[4] assembled to establish a participatory process to develop an innovative and responsible plan to address climate change.

The summit included presentations on the science of climate change and on strategic planning and policy development by the States of Massachusetts and Rhode Island. Participants discussed

[3] Arthur H. Diedrick (Chairman of the Connecticut Clean Energy Fund), Donald W. Downes (Chairman of the Department of Public Utility Control), Arthur J. Rocque, Jr. (Commissioner of the Department of Environmental Protection), Barbara Waters (Commissioner of the Department of Administrative Services), James F. Byrnes (Commissioner of the Department of Transportation), and John A. Mengacci (Undersecretary of the Office of Policy and Management)

[4] Connecticut Clean Energy Fund, Connecticut Department of Administrative Services, Connecticut Department of Agriculture, Connecticut Department of Environmental Protection, Connecticut Department of Public Utility Control, Connecticut Department of Public Works, Connecticut Department of Revenue Services, Connecticut Department of Transportation, Connecticut Innovations, Connecticut Siting Council, Connecticut Global Fuel Cell Center at the University of Connecticut, Institute for Sustainable Energy at Eastern Connecticut State University, and the Office of Policy and Management.

the basic structure of a climate change action plan, including a GHG emissions inventory, baselines, targets, GHG reduction options, and an implementation plan. The summit participants established three Connecticut climate change goals for 2003:

1. Publish and distribute a report summarizing Connecticut's actions on climate change – this goal was realized with the publication of Pocantico Paper Number 6, *Leading By Example: Connecticut Collaborates to Reduce Greenhouse Gas Emissions* (2003).[5]
2. Update a GHG emissions inventory for 1990–2000 – this goal was realized with the publication of *Connecticut Greenhouse Gas Inventory 1990 – 2000* (August 2003).[6]
3. Coordinate a process to identify actions to reduce Connecticut's GHG emissions – this goal was realized through the Connecticut Climate Change Stakeholder Dialogue of 2003 (see details below).

Coordinating a Connecticut Climate Change Stakeholder Dialogue in 2003

In 2003, the Governor's Steering Committee on Climate Change developed the CT Climate Change Stakeholder Dialogue to formulate policy recommendations to help the State meet or exceed greenhouse gas targets established by the New England Governors/Eastern Canada Premiers Climate Change Agreement of 2001. Between April and December 2003, nearly 100 organizations participated in the CT Climate Change Stakeholder Dialogue. Participants included businesses, non-profit organizations, government agencies, and academia. In addition to the 25 stakeholders, there were 5 working groups that performed policy and technical analysis in the following areas: transportation and land use; electricity generation; residential, commercial, and industrial energy use; agriculture, forestry, and waste emissions; and education. The general public provided input through a series of four public information meetings and through written comments. A list of stakeholders is provided in the appendix.

The Center for Clean Air Policy facilitated the dialogue as a non-binding advisory process to the Governor's Steering Committee. Connecticut Innovations, on behalf of the Clean Energy Fund, provided most of the funding, with additional support from the Emily Hall Tremaine Foundation. In addition, the Connecticut Department of Environmental Protection provided funding for advanced modeling for the electricity sector as recommended by stakeholders.

The stakeholders identified 55 separate recommendations that together achieve 72.7 percent of the gap toward the 2010 NEG/ECP target and 70.7 percent of the gap toward the 2020 target. Stakeholders unanimously agreed to 52 of the 55 final recommendations. The remaining three recommendations fell one vote short and were recorded as garnering a supermajority. Descriptions of the recommendations and the associated GHG reductions as well as a full report of the process is provided in the January 2004 report *Connecticut Climate Change Stakeholder Dialogue: Recommendations to the Governor's Steering Committee*. This document can be found at http://www.ctclimatechange.com/ct_action_plan.html.

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[5] For more detailed information on this event and Connecticut's actions on climate change, see the report entitled Leading by Example: Connecticut Collaborates to Reduce Greenhouse Gas Emissions. Pocantico Paper No. 6, by the Governor's Steering Committee. Available at: www.ctclimatechange.com/rbf_rept.html.

[6] *Connecticut Greenhouse Gas Inventory 1990–2000.* (2003). Connecticut**:** Northeast States for Coordinated Air Use Management, Connecticut Clean Energy Fund, and Connecticut Department of Environmental Protection. Available at: www.ctclimatechange.com.

In March 2004, based on the Governor's Steering Committee's recommendation, the Governor accepted thirty-eight of the recommendations for immediate implementation. Staff to the Governor's Steering Committee would perform additional analysis on the remaining 17 recommendations so that they could be considered for implementation in the near future.

Co-Benefits: Energy, Economy, and the Environment Working Together

In 2004, the Connecticut General Assembly passed Public Act 04-252, "An Act Concerning Climate Change" (see appendix for full text of this Public Act). The Act establishes a goal for the state to reduce GHG emissions to contribute to the regional GHG reduction goals of 1990 levels by 2010 and 10% below 1990 levels by 2020. It also requires the GSC to develop an action plan to achieve these goals and to submit such plan to the General Assembly by January 2005. This report is the action plan that fulfills the legislative requirement of Public Act 04-252.

The Northeast States for Coordinated Air Use Management (NESCAUM) was hired in August of 2004 to assist the Connecticut Department of Environmental Protection (DEP) in the implementation of "An Act Concerning Climate Change," Public Act 04-252, and in the development of the draft 2005 climate change action. NESCAUM performed additional analysis on some of the 55 recommendations in the January 2004 report, *Connecticut Climate Change Stakeholder Dialogue: Recommendations to the Governor's Steering Committee*. Specifically, NESCAUM assisted in an in-depth evaluation of seven of the stakeholder recommendations including:

- GHG Feebate Program – GHG emissions reductions and REMI analyses;
- Tailpipe GHG Standards – GHG emissions reductions analysis;
- Create Heating Oil Conservation Fund – GHG emissions reductions, REMI, and COBRA analyses;
- Create Natural Gas Conservation Fund – GHG emissions reductions, REMI, and COBRA analyses;
- Renewable Portfolio Standards – GHG emissions reductions analysis;
- Restore the Clean Energy Fund – GHG emissions reductions analysis; and
- Regional Cap and Trade Program – GHG emissions reductions analysis.

The analysis included assessments, in some cases reassessments, of GHG emissions reductions and co-benefits of these actions to include additional environmental measures – impacts on public health and broader economy-wide benefits. Identifying and quantifying the co-benefits, or hidden positive externalities that result from actions to reduce greenhouse gas emissions, provides for more informed decision-making and establishes precedence for public policy measures to recognize the benefits, along with the costs of a specific action.

The following tools were used in NESCAUM's analysis: Economic Demographic Forecasting and Simulation Model (EDFS), a socio-economic modeling tool created by Regional Economic Modeling, Inc. (REMI), [7] and COBRA (Co-Benefits Risk Assessment), a beta-stage modeling

[7] The REMI Economic-Demographic-Forecasting and Simulation Model (EDFS) is designed with the objective of improving the quality of research-based decision making in the public and private sectors. It is calibrated to many sub-national areas for forecasting and policy analysis by government agencies, consulting firms, nonprofit institutions, universities and public

tool developed by the EPA that monetizes the associated co-benefits that occur with actions to reduce greenhouse gas emissions.[8] In performing this work, NESCAUM worked closely with REMI, EPA, Connecticut Department of Environmental Protection, Connecticut Department of Public Utility Control, Connecticut Department of Revenue Services, Connecticut Clean Energy Fund, and a select group of experts to develop inputs, assumptions, and evaluate the analyses.[9] This dialogue involved a series of regular meetings by phone and in person, all of which took place in the fall of 2004. The State and Local Capacity Building Branch of the Environmental Protection Agency generously offered support for the additional runs.

Upon the completion of the draft results of the in-depth analyses of the seven recommendations, NESCAUM presented the results to the Governor's Steering Committee. Based on the Committee's feedback, revisions were made to finalize the results of the comprehensive analysis of these seven recommendations. The results can be found in the detailed narratives for each recommendation in this report. NESCAUM's analyses were made possible by support from the Connecticut Clean Energy Fund through a grant provided by the Emily Hall Tremaine Foundation.

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utilities throughout the United States. Simulations with the model are used to estimate the economic and demographic effects of innumerable policy initiatives in such areas as: economic development programs, transportation, infrastructure investments, environmental improvement, energy and natural resource conservation programs, and state and local tax changes.

[8] The Co-Benefits Risk Assessment (COBRA) model is a beta-stage draft screening tool that inexpensively and quickly estimates the air quality, human health, and associated economic impacts of various state-level emission reduction scenarios. User enters change in air emissions (e.g. Sulfur dioxide, nitrogen oxides, volatile organic compounds, particles, ammonia). COBRA then: quantifies the associated change in particles using a simple air quality model used by EPA in previous analyses, calculates the change in health effects using concentration response (C-R) functions that link the change in particles with epidemiological studies, estimates monetary value of health effects avoided based on direct medical costs, Value of statistical life, Willingness-to-pay, Cost-of-illness values, then visually maps benefits by county for state, region, U.S.

[9] Special thanks go to Derek Murrow and Environment Northeast for their continued contributions to Connecticut's climate change efforts. Other significant contributions made by United Technologies Corporation, the Institute for Sustainable Energy at Eastern Connecticut State University, Connecticut Fund for the Environment, and Environmental Defense.

Connecticut Climate Change
Action Plan 2005

TRANSPORTATION AND LAND USE SECTOR

1. California LEV II Standards[1]

Recommended Action: Adopt LEV II standards in Connecticut.

The California Low Emission Vehicle II (LEV II) program establishes strict emission standards for all new cars sold in California as well as for any other state that adopts the program. The standards address nonmethane organic gas (NMOG), a precursor of ozone pollution in the lower atmosphere; nitrogen oxides (NO_x); and carbon monoxide (CO).

The LEV II Smart Growth Strawman Proposal, prepared by the Connecticut Fund for the Environment, is the primary source of information on LEV II recommendations, costs, and benefits.

The LEV II program consists of two complementary components: the low-emission vehicle (LEV) requirement and the advanced technology vehicle program. Under the California standards, 90 percent of a manufacturer's vehicle fleet is required to meet strict baseline emissions standards. The emission standards for LEVs are much lower than the corresponding federal standards and can be achieved through the application of conventional pollution-control technology to the internal combustion engine. The remaining 10 percent of the vehicle fleet must be lower emitting than LEV standards, which qualify for credits under the advanced technology component of the program.[2] The advanced technology components of the LEV II standards are summarized in Table 1.1.

Table 1.1
Advanced Technology Requirements of the LEV II Emissions Program, 2005–2008

Category	Vehicle Type	Examples	% of Total Fleet	% of Total Alternative Compliance
Gold	Pure ZEVs	Electric vehicles and fuel cells	2	250 total fuel cell vehicles by 2008
Silver	Advanced	Hybrid Electric and	2	3

[1] The LEV II strawman proposal, prepared by Connecticut Fund for the Environment, is the primary source of information on LEV II recommendations, costs and benefits. Significant portions of this section are excerpted verbatim from the LEVII strawman proposal (see Supporting Document 4).

[2] The LEV II advanced-technology vehicle program consists of three categories of vehicles: gold, silver and bronze. The path likely to be followed by Connecticut would require that 6 percent of the total vehicle fleet satisfy the bronze standard, consisting of ultra-clean partial zero-emission vehicles, or PZEVs. Those PZEVs would consist of conventional internal combustion vehicles that are 90 percent cleaner than normal LEVs (and that produce zero evaporative emissions). Two percent of the vehicle fleet would have to meet the silver standard, consisting of advanced technology (AT) PZEVs (such as the hybrid-electric vehicle). Finally, automakers can satisfy the gold standard, 2 percent, true-zero-emission vehicle by offering either battery-electric or fuel cell vehicles. If they choose the fuel cell path, they would offer 250 hydrogen fuel cell vehicles for sale anywhere in the country by 2008.

	technology PZEVs	Compressed Natural Gas vehicles		
Bronze	PZEVs	Super Ultra Low Emissions Vehicle or SULEV (internal combustion)	6	6

Connecticut may elect to adopt the California standards either legislatively or administratively. Section 22a-174g of the Connecticut General Statutes authorizes the Commissioner of Environmental Protection to adopt regulations implementing California's motor vehicle emissions standards on the Connecticut Department of Environmental Protection's (DEP's) own initiative. Such standards may be adopted either by emulation or by reference to the relevant California regulations. In addition to the authority granted by § 177 of the Clean Air Act, the Connecticut General Assembly retains its inherent power to adopt any legislation that is necessary to protect the health and welfare of the citizens of the State.

Implementation could begin as early as model year 2008 if Connecticut acts during the 2004 session. Under LEV II, auto dealers in Connecticut, beginning with the model year 2008, would be required to sell new vehicles that are certified to California emissions standards.

Result of Assessments for 2010, 2020, and Beyond

Estimated GHG emissions reductions:

0.04 MMTCO$_2$e in 2010
0.47 MMTCO$_2$e in 2020

GHG savings were calculated using the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model Version 1.5a, developed by Argonne National Laboratory.[3] GHG savings are based on "ZEV Scenario Two: Advanced Technology with Minimum Compliance" from the Connecticut Fund for the Environment report *The Drive for Cleaner Air in Connecticut*.[4] This scenario assumes the following penetration rates by 2020:

- ZEV 5 percent (battery electric vehicles through 2009, transitioning to hydrogen fuel cell vehicles between 2010 and 2013, with hydrogen from natural gas)
- AT PZEV 9 percent (hybrid electric vehicles)
- PZEV 2 percent (conventional internal combustion engines with advanced emissions-control technology, SULEV)

Life-cycle GHG savings were reduced by 20 percent to reflect the portion that are direct tailpipe emissions (per GREET).

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[3] Available at: http://greet.anl.gov.
[4] Connecticut Fund for the Environment. September 2003. *The Drive for Cleaner Air in Connecticut.* Available at: www.cfenv.org.

Estimated Costs

Baseline LEV II vehicles are currently being sold at the same price as their non-LEV II-certified counterparts; manufacturers' costs for compliance are less than $100 per vehicle. A consumer premium exists for hybrid vehicles, currently around $3,000. The California Air Resources Board developed consumer cost estimates for advanced technology PZEVs (Table 1.2).

Table 1.2
Advanced Technology PZEVs
(Incremental Consumer Costs)

	Year	Amount
Stage I	**(2003–2005)**	**$3,300**
Stage II	**(2006–2008)**	**$1,500**
Stage III	**(2009–2011)**	**$700**

Source: California Environmental Protection Agency, Air Resources Board, Staff Report: Initial Statement of Reasons: 2003 Proposed Amendments to the California Zero Emission Vehicle Program Regulations, January 10, 2003.

Estimated Co-Benefits

Adoption of LEV II standards in Connecticut is calculated to reduce toxic pollutants (acetaldehyde, 1,3-butadiene, formaldehyde, and benzene) by 104 tons in 2020.[5]

Connecticut's adoption of LEV II will bring a better regional balance and strengthen regional demand for the sale of LEVs, because Massachusetts, New York, and Vermont have already adopted California emissions standards.

Progress – Implemented

In December 2004, the Connecticut Department of Environmental Protection adopted regulations to implement LEV II. The regulations will go into effect and require compliant vehicles commencing with the 2008 model year.

Supplemental Information

- LEV II Strawman Proposal (Connecticut Fund for the Environment) (Document 4)
- *The Drive for Cleaner Air in Connecticut*. pp. 19–31 (Connecticut Fund for the Environment) (Document 5)

Lead Agency

Connecticut Department of Environmental Protection

[5] Connecticut Fund for the Environment, *op cit.*

2. GHG Feebate Program

Recommended Action: Establish a Feebate Program.

A feebate program uses both incentives and disincentives to induce consumer buying practices that reflect the negative externalities associated with the purchase of a motor vehicle. It also provides manufacturers with an incentive to improve technology to reduce emissions. As more states become involved in a feebate, the incentive to manufacturers increases. Consequently, the effectiveness of a feebate would be strongly enhanced if Connecticut's leadership on the issue could be leveraged to spur a regional program.

Under a feebate system, the state would set a "pivot point," based on the amount of CO_2 emitted by the vehicle per mile driven. Vehicles that had emitted less CO_2 would receive a rebate. Those emitting higher levels of CO_2 would pay a fee. The fees and rebates would be assessed based on $/lbs. of CO_2 per 100 miles driven ($/#$CO_2$100M) rate. For example, consumers would have to pay $1,000 for pound of CO_2 per 100 miles consumed ($1,000/$/#$CO_2$100M) that their vehicle goes over the pivot point. Thus, the further the vehicle's CO_2 rating is from the pivot point, the greater the fee or the rebate.

A feebate program can be designed in several different ways, taking into account the classes of vehicle to be covered, the manner in which the fees and rebates are to be calculated, and the way in which those fees or rebates are to be collected. A feebate system can also be designed to either generate revenue or to be revenue neutral (i.e., rebates disbursed equal the amount of fees collected, less administrative costs).[6]

Design Assumptions

- *Establish a single-tier, GHG-based feebate program for all new passenger vehicles sold in Connecticut beginning in 2005.* Although a multi-tiered system (e.g. one with different fees and rebates for cars than for light trucks) might initially garner more political support, such systems may provide inferior incentives and that could distort market signals. Under a multi-tiered feebate system, a car purchaser could pay a fee, but a consumer who purchases a light truck with a higher emissions rate than the car could receive a rebate. To address this, cars and trucks could face the same pivot point, but the fees on trucks would be lower. Though this removes the most egregious example, trucks would still

[6] For additional information on feebates, see "The GHG Feebates Strawman Proposal," prepared by the Connecticut Fund for the Environment, (see Supporting Document 6 in Center for Clean Air Policy Report).

retain a price advantage over cars. For this reason, a single tier applicable to all vehicles was preferred.

- For those who need large vehicles for work-related purposes, the state could provide an exemption. This, however, would present significant administrative difficulties, such as determining the percentage of work-related use of the vehicle (as opposed to discretionary and personal use). If a particular vehicle were truly necessary for work, then it would be eligible for certain favorable tax treatment when the purchaser submits his or her federal income tax.

- *Focusing on consumer demand is particularly important when designing a state feebate policy.* A feebate creates GHG emission reductions by changing consumer and manufacturer behavior. The result is an increase in the average fuel economy of the state's vehicle fleet. Consumers respond to increases/decreases in vehicle prices, favoring vehicles with higher fuel economy. Manufacturers will make technological improvements that increase fuel economy and thus reduce the amount of the fee paid (or increase the amount of the rebate received). A national study on feebates (the "Greene Study") indicates that 95% of the fuel economy improvements achieved by a feebate would be attributable to the manufacturer response and only 5% would be due to changes in consumer demand.[7] As a feebate moves from the national to the state level, the signal to manufacturers is correspondingly lower. This means that, at the state level, consumer demand will play a much larger relative role in creating the incentives that will drive GHG reductions.

- *Outside of covering administrative costs, the program will be revenue neutral.* The current analysis was done under the assumption that the program would generate only enough revenue to cover its administrative costs. The State could decide to design a system that would generate additional revenue. Any generated revenues could support public education on low-GHG vehicles and fund other GHG reduction efforts, such as incentives for the use of low-rolling-resistance replacement tires or retrofits of high emitting vehicles.

- *Design the GHG feebate program to minimize potential leakage*. The feebate system can be administered at several potential collection points. The most likely options include point-of-sale feebate charges or feebates administered at the time of registration. In choosing one of those options, policy makers must be sensitive to possible leakage issues. Leakage would occur if Connecticut residents were to buy high-GHG vehicles in another state to avoid paying the fee, or if out-of-state residents were to buy low-GHG vehicles in Connecticut in order to get the rebate. Administering the program at the time of registration (where vehicle owners would have to show payment of Connecticut sales tax), rather than at the time of sale will eliminate this problem. Because the feebate program would apply only

[7] Greene, Patterson, Singh, and Li, Feebates, *Rebates and Gas-Guzzler Taxes: A Study of Incentives for Increased Fuel Economy* (Oakridge National Laboratory, 2004). The Green study also notes a study done by Davis et. al. indicating a 90% to 10% split.

to new vehicle purchases, the dealer would likely handle registering the vehicle for in-state purchasers, thus reducing the burden on the purchaser. Consumers who purchase their vehicles out-of-state would bear the burden of registering in Connecticut and paying the fee at that time.

- *Engage in multistate and regional discussions on establishing a GHG feebate program for the region.* Regional implementation would be more effective in inducing manufacturers to make technological changes that increase fuel economy. As noted above, technology change can supply significantly greater benefits than changes in consumer demand. Several states in the region, including Maine, Massachusetts, New York, Rhode Island, and Vermont, have considered feebates as a potential GHG reduction strategy. Notwithstanding the desirability of a regional approach, Connecticut should not wait for other states to commit to implementing a feebate program.

Result of Assessments for 2010, 2020, and Beyond

Estimated GHG emissions reductions:

0.036 MMTCO$_2$e in 2010
0.109 MMTCO$_2$e in 2020

These estimates were derived using the Greene Study. The study placed the pivot point of the program at the average fuel economy for each model year. This creates a generally revenue neutral program. The authors then assessed two feebates: one at \$19.25/#CO$_2$100M and another at \$38.50/#CO$_2$100M.[8] The \$19.25 feebate resulted in a 16% increase in fuel economy after approximately 10-15 years. The \$38.50 feebate resulted in a 29% increase in fuel economy. This improvement applies to a single model year in the future, not the entire state fleet. Thus, it takes several years for the benefits to ripple through the state fleet. The workgroup selected the lower feebate of \$19.25 (see table below for examples of how this would affect vehicle prices; provided in the more familiar miles per gallon for ease of comparison).

The Greene paper was widely considered by the workgroup as providing the most definitive analysis. Applying the national to the state level, however, posed considerable difficulties. The biggest challenge was created by the relative impacts of manufacturer change versus consumer demand change. In the national model, 95% of the fuel economy improvement is attributable to changes made by manufacturers. The rest is from the consumer response. In a state program, the signal to the manufacturers is weaker. Dr. Greene and others discouraged eliminating the manufacturers' response entirely.[9] Consequently, the analysis scaled the manufacturer response based on Connecticut's percentage of the national population. This results in Connecticut capturing about 1% of the manufacturer benefit. With the consumer demand effect left in

[8] The authors use a different metric: gallons of gasoline per 100 miles or GP100M. In the study, the feebates were \$500/GP100M and \$1,000/GP100M). Since the focus of this analysis is on greenhouse gases, the metric has been converted to CO_2 form gallons of gasoline.
[9] Email and telephone conversation with Dr. David L.Greene, September 15, 2004.

place, the model assumed that approximately 6% of the national benefit level would be obtainable.

The added benefits of other states joining would dramatically improve the benefits for Connecticut by increasing the manufacturer's response. If the rest of the New England states were to participate, the benefits in Connecticut would increase by approximately 50%.

VMT projections were provided from CT DOT. The state fleet fuel efficiency was provided by CT DEP and then adjusted for changes in the federal CAFE standards for light trucks. Calculations for CO_2 reductions were based on the World Resources Institute GHG Protocol.[10] Gasoline prices (used for the REMI analysis) were based on a combination of the Energy Information Administration's (EIA) long-term and short term energy forecasts.[11]

Table 2.1
CAR/Truck Feebate Examples

Manufacturer	Model (2005 Model Year)	Fuel Economy (MPG)[12]	Feebate amount (fee)/rebate
GMC	K2500 HD SIERRA 4WD	10	$ (5,590.00)
FERRARI	360 MODENA/SPIDER/CHALLENGE	11	$ (4,690.00)
CHEVROLET	K1500 TAHOE 4WD	12	$ (3,930.00)
LAND ROVER	RANGE ROVER	13	$ (3,290.00)
LEXUS	LX 470	14	$ (2,740.00)
DODGE	DURANGO 4WD	15	$ (2,260.00)
CADILLAC	ESCALADE 2WD	16	$ (1,840.00)
CHEVROLET	BLAZER 2WD	17	$ (1,480.00)
DODGE	DAKOTA PICKUP 2WD	18	$ (1,150.00)
JEEP	LIBERTY/CHEROKEE 2WD	19	$ (860.00)
FORD	MUSTANG	20	$ (590.00)
LEXUS	GS 300/GS 430	21	$ (360.00)
SUBARU	OUTBACK WAGON AWD	22	$ (140.00)
SATURN	VUE AWD	23	$ 60.00
TOYOTA	CAMRY	24	$ 240.00
SAAB	SAAB 9-3 SPORT SEDAN	25	$ 410.00

[10] See http://www.ghgprotocol.org/standard/tools.htm#downloadabletools.
[11] Energy Outlook 2004 (January 2004); Short Term Energy Outlook (October 2004).
[12] Based on the United States Environmental Protection Agency 2005 Model Year Combined (city/highway) miles per gallon rating.

TOYOTA	RAV4 2WD	26	$ 560.00
VOLKSWAGEN	JETTA	27	$ 700.00
CHEVROLET	MALIBU	28	$ 830.00
TOYOTA	CELICA	29	$ 960.00
HYUNDAI	ACCENT/BRIO	30	$ 1,070.00
FORD	ESCAPE HEV 4WD	31	$ 1,180.00
DODGE	NEON/SRT-4/SX 2.0	32	$ 1,280.00
TOYOTA	SCION XB	33	$ 1,370.00
HONDA	CIVIC	34	$ 1,460.00
TOYOTA	ECHO	36	$ 1,630.00
HONDA	CIVIC HYBRID	47	$ 2,280.00
TOYOTA	PRIUS	55	$ 2,590.00
HONDA	INSIGHT	56	$ 2,620.00

Reasons Behind Differences From Previous Analysis

The previous analysis was based on scaling the results of studies done for California and for New York. This study was done based on a recent national study that focused on capturing and explaining the difference between consumer and manufacturer responses. The results are a direct result taking the full consumer response estimate of the study and scaling the manufacturer response from the national level to CT.

It should also be noted that the previous analysis went through 2009 under the assumption that Pavley would begin at that time and reduce the need for the feebate program. That analysis still holds. However, this analysis shows a feebate is an excellent way to smooth that transition both before 2009 and beyond.

Estimated Costs

The direct costs of a feebate program are its administration. These costs assumed that the feebate would be assessed at the time of registration. To the extent the rebate would be realized through a deduction in taxes, DRS would also be involved in administration.[13] This would require some retooling of software currently utilized in the registration process and would require additional staff time. The total costs were assumed to be $100,000/year. The REMI model looked at two indirect costs. First, the state would lose gas tax revenue due to the decrease in gasoline purchases. Similarly, filling stations would lose revenue.

Table 2.2
Details of the Feebate Analysis

[13] DRS would then be compensated by the fees paid by other vehicle purchasers. DRS, DMV, and other stakeholders would need to refine the mechanics of the fees and rebates.

	2010	2020
Total Gasoline Demand w/o Feebate (millions of gallons)	1,445	1,567
Reduction in Consumption (millions of gallons)	4.0	12.1
Percentage Consumption Reduction	0.28%	0.78%
GHG reduction ($MMTCO_2e$)	0.036	0.109
Administrative Costs	$100,000	$100,000
Total Savings to Consumers (millions)	$6.1	$18.7
Cost Effectiveness ($/ton CO_2e)	-$166.7	-$171.5

Estimated Co-Benefits

The costs and benefits to consumers, the state, and fuel providers were run through the REMI regional economic analysis model. This model assesses the state economy wide costs and benefits of the policy over time.[14] The following summarizes these REMI results:

Table 2.3
Major Economic Effects of Feebate
(Cumulative 2005-2010)

Employment (Average Increase) *	22
Output (millions of 1996 dollars)	$45
Gross State Product (millions of 1996 dollars)	$13
Real Disposable Personal Income (millions of 1996 dollars)	$10
State Revenues (millions of 1996 dollars) [15]	-$29.5

*Employment is the average annual increase from the baseline. Employment is not cumulative and is based on output growth.

Progress – In Process

Further analyses are being conducted regionally using REMI modeling. MA, RI, ME and CT are expected to release regional results for a feebate program impact on the economy in early 2005. Legislation is necessary to implement this action in Connecticut.

Supplemental Information

See detailed REMI analysis report entitled "Economic Impact of Enacting a Feebate Program in Connecticut."

Lead Agency

Connecticut Department of Revenue Services and the Connecticut Department of Environmental Protection

[14] The full analysis and background of this policy are available at www.ctclimatechange.com.
[15] This is due to a loss in gas tax revenue, which is inevitable in any successful transportation measure.

Connecticut Climate Change

3. Vehicle Fleet Incentives and Initiatives

Recommended Action: Provide vehicle incentives and support state vehicle initiatives

Within every class of vehicles (e.g., compact car, sedan, station wagon, pickup, SUV, van) there is at least a 25 percent difference in the GHG emission rate between the most and least polluting vehicle in a class. A variety of incentives and initiatives can encourage public and private owners of vehicle fleets to purchase low-GHG vehicles. This approach presents an opportunity for government to lead by example and achieve economies of scale to influence vehicle manufacturers' product offerings.

- **The State should establish a procurement policy to reduce GHG emission rates for its fleet of cars and light trucks, whether owned, leased, or contracted.** Currently, the State runs a fleet of 3,000 cars and 1,200 vans and light trucks. It replaces more one-sixth of the fleet each year and achieves complete fleet turnover every six years.

- **The State should establish a program to encourage municipal and private sector fleets to purchase low-GHG vehicles.** The program could include a public awareness campaign and public recognition awards.

- **Partner with other Northeast states, local governments, and private fleets to develop bulk-purchasing proposals for low-GHG vehicles.** In the Northeast states, more than 1 million light-duty vehicles are owned and operated by private sector and government fleets of 10 or more vehicles—more than 10 percent of all vehicles sold into fleets in the United States. These fleets are estimated to generate purchases of about 100,000 new vehicles each year. Industry experts report that manufacturers require a minimum annual market size of about 25,000 vehicles before they will introduce a new model vehicle to the marketplace. A limiting factor is that market studies indicate that an immediate market exists for only about 12,000 vehicles per year in the United States. Thus, an initial campaign target would be to aggregate an annual purchase of 12,000 or more vehicles to "match" current market potential. A purchase of this magnitude might well draw additional low-GHG vehicles (e.g., advanced hybrids) into the market.

- **The State should work with the Federal government to advance policies that will improve the market for low-GHG vehicles.** For example, EPACT alternative fuel vehicle requirements should be redefined to include hybrid electric vehicles. In addition, Congress should extend the Federal tax deduction for hybrid vehicles beyond the current sunset date. Finally, encouraging use of low-GHG vehicles in Federal fleets could have an important market impact.

Result of Assessments for 2010, 2020, and Beyond

GHG emissions reductions included in GHG Tailpipe Standards.

Estimated Costs

Costs have not been estimated.

Estimated Co-Benefits

Co-benefits have not been estimated.

Progress - Implemented

The State presently leases hybrid vehicles as a portion of its daily fleet. DAS has released a new RFP for Alternative fuel and gasoline-hybrid electric light duty vehicles.

Legislation passed to give tax exemption for purchase of any hybrid rated at 40 mpg or greater and extends exemption for alternative fuel vehicles and equipment (An Act Concerning Clean and Alternative Fuel Vehicles, PA 04-231)

Supplemental Information

There is not supplemental information on this recommended action.

Lead Agency

Connecticut Department of Revenue Services and the Connecticut Department of Environmental Protection

4. Tailpipe GHG Standards

Recommended Action: Amend LEV II Regulations to Include GHG Standards

The Low Emission Vehicle II (LEV II) program establishes strict emissions standards for new cars sold in California, as well as for cars sold in any other state that adopts the LEV program. In a recent action, the California Air Resources Board (ARB) approved motor vehicle GHG standards for inclusion in the LEV II program.[16] Once these standards are implemented, the LEV II program will provide substantial greenhouse gas emissions reductions as well as reductions of nonmethane organic gas (NMOG), nitrogen oxides (NOx); and carbon monoxide (CO) relative to the federal motor vehicle emission control program.

Under these standards, new motor vehicles will be required to emit 30 percent fewer GHGs than would have been emitted without the program. The program establishes two fleet average standards for GHG emissions: one for cars, light trucks, and small sport utility vehicles (SUVs) and another for heavier trucks and large SUVs. The standards will be phased in between the years 2009 and 2016. In 2009, the standards will require a small reduction in GHGs and will ramp up to a 30 percent reduction requirement for new vehicles in 2016.

Since Section 177 of the Clean Air Act Amendments (CAA) requires that states opting into the California program must adopt emissions standards that are identical to California's, there are few design issues to be considered for adopting states. However, there are lead time and stability requirements under the CAA that influence the timeline for implementation of the program in states outside of California. These requirements are discussed below.

Design Assumptions and Recommendations:

- *Amend Connecticut's LEV II regulations to include the motor vehicle GHG standards.* In 2004, Connecticut adopted the California LEV II program. At the time the program was adopted, the motor vehicle GHG standards were not yet included in LEV II. In order for Connecticut to benefit from the new standards, the state's LEV II regulation will need to be amended to include the new motor vehicle GHG standards.

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[16] California Air Resources Board Hearing on September 23-24, 2004

- *Complete changes to the Connecticut regulations before January 2, 2006 in order to achieve the benefits of the first model year affected by the GHG regulation.* Section 177 of the CAA requires that states provide automobile manufacturers two years to transition from one set of emissions standards to another. This is called a "lead time and stability" requirement. Since the first model year to be affected by the motor vehicle GHG standards will be 2009, states outside of California will need to amend their LEV II regulations to include the GHG standards by January 2, 2006 to ensure that lower emitting vehicles are available in their states beginning in 2009.[17]

- *LEV II implementation in Connecticut will be on the same schedule as California implementation.* For the purpose of calculating the GHG reductions that will be realized in Connecticut from the adoption of the GHG standards, this analysis assumed that Connecticut will amend their regulations so that lower GHG emitting vehicles are available beginning in 2009.

Assuming the above implementation schedule is followed, the GHG emissions reductions listed in Table 1 will be realized in Connecticut in 2010 and in 2020. Greater reductions will be achieved in later years (2030) when full fleet turnover has occurred.

Result of Assessments for 2010, 2020, and Beyond

Estimated GHG emissions reductions:

0.05 MMTCO$_2$e in 2010
2.63 MMTCO$_2$e in 2020

These estimates were derived from ARB analyses detailing the emission levels, technology options, costs, and benefits associated with the GHG standards.[18,19,20] It is important to note that the California cost and technical feasibility analyses contained in the documents cited below rely heavily on a technical feasibility and cost analysis conducted by the Northeast States Center for a Clean Air Future (NESCCAF), a sister organization of NESCAUM.[21] Given ARB's reliance on the NESCCAF study, NESCAUM is thoroughly familiar with the California analysis and the bases for the assumptions made in this recommendation. To calculate the GHG benefits for Connecticut, the annual fleet average emission levels from the California analyses was applied to vehicles sold in Connecticut. For the purposes of this calculation, the shares of

[17] Although this appears to provide three years of lead time, model year 2009 technically begins in calendar year 2008.
[18] California Environmental Protection Agency Air Resources Board, Staff Report: "Initial Statement of Reasons for Proposed Rulemaking, Public Hearing to Consider Adoption of Regulations to Control Greenhouse Gas Emissions from Motor Vehicles," August 6, 2004
[19] California EPA ARB, "Addendum Presenting and Describing Revisions to: Initial Statement of Reasons for Proposed Rulemaking, Public Hearing to Consider Adoption of Regulations to Control Greenhouse Gas Emissions from Motor Vehicles," September 10, 2004
[20] California EPA ARB "Technical Support Document: Economic Impacts of the Climate Changed Regulations," August 6, 2004.
[21] NESCCAF, "Reducing Greenhouse Gas Emissions from Light Duty Motor Vehicles," draft report of March, 2004 and final report of September 2004.

vehicles sold with the near- and mid-term technology packages were assumed to be the same in Connecticut as in California.[22]

Estimated Costs

The NESCCAF report (and the ARB documents) concluded that all of the technologies needed to achieve the California GHG standards are currently in production. Two-thirds of the technologies examined in the NESCCAF report are in full volume production at this time; the remainder is produced in limited volumes. As a result, the GHG standards are technically feasible. Examples of lower GHG emitting technologies include: electronic power steering, 6-speed automatic transmissions, improved air conditioning systems, cylinder deactivation, and turbo charging.[23] These technologies will need to be introduced in higher volumes than are currently being produced in order for the standards to be met.

Technologies that lower GHGs (with some exceptions) also lower monthly operating costs for consumers. Thus, there is a net benefit associated with operating lower GHG emitting vehicles. The NESCCAF study found that consumers would save money over the life of the vehicle for all technology packages up to the 42 percent GHG reduction level.

The cost calculations provided below rely on the California documents cited previously. This analysis assumes that the costs of implementing the measures necessary to meet these standards are the same in Connecticut as in California. The direct costs of implementing the tailpipe greenhouse gas standards in Connecticut reflect the average incremental increase in vehicle costs required to achieve the specified standards. Table 2 shows the additional retail cost of lower GHG emitting vehicles, based on the ARB analysis.

Table 4.1
Retail Cost to Consumers for the New GHG Standards

	Passenger Cars and Light Trucks / SUV's	Large Trucks / SUV's
Near Term (2012)	$367	$277
Mid Term (2016)	$1,064	$1,029

As can be seen from Table 4.1, there is an added up-front cost for cleaner vehicles. However, as is shown in Table 4.2, this increase is more than offset by lower monthly operating costs. When the cost of lower monthly gasoline costs is compared with higher monthly car payments, the result is a net benefit to operators of cleaner vehicles. As can be seen from the row entitled "monthly net savings to consumers", on average, consumers will save $11 a month from purchasing a lower GHG emitting car in 2012 and $3 a month in 2016.

[22] CARB developed the standard by assuming that the "near-term" package of efficiency measures was fully implemented in 2012 and the "mid-term" package by 2016. The specific fleet average emissions values for these two years are set based on the fleet average achieved by fully implementing these packages on the auto maker with the heaviest fleet of vehicles. Automakers with lighter weight fleets do not need to implement all the measures in order to meet the standard.

[23] The NESCCAF report examined a total of 35 technologies - 33 of which are currently in production at this time.

Table 4.2 Net Savings for Vehicle Purchaser		
	Near Term	Mid Term
Monthly Car Payment Increase	$7	$20
Monthly Operating Cost Savings	$18	$23
Monthly Net Savings to Consumers	$11	$3

The analysis assumed a gasoline price of $1.74 per gallon. At a higher gasoline price, the comparison would be even more favorable to operators of lower GHG emitting cars.

Impact to the Connecticut Economy

To estimate the LEV program's impacts on Connecticut's economy, we scaled the results estimated for California by the ARB. The cost-benefit analysis conducted by California, and upon which the costs cited in this paper are calculated, were based on average vehicle miles traveled (VMT) which can vary state to state. The result of the analysis shows that the regulation will provide substantial GHG reductions at a cost savings to consumers and, as a result, will benefit the Connecticut economy.

The analysis is summarized in Table 4.3.

Table 4.3 Cost Effectiveness ($/ton CO2e of the GHG Regulation)		
	2010	**2020**
Total Incremental Cost	$13.9 million	$243.3 million
Annualized Incremental Cost	$1.8 million	$175 million
Reduction in Fuel Consumption (millions gallons)	5.2	250.2
Reduction in Fuel Costs	$9.0 million	$435.3 million
Annual GHG Reductions (MMTCO2e)	0.1	2.6
Benefit Cost Ratio	4.9	2.5
Cost Effectiveness ($/ton CO_2e)	-$136	-$99

In order to calculate the cost and benefits for Connecticut, some adjustments were made to the California cost savings estimates. California calculates the "annualized" costs and benefits of the LEV II regulation by spreading the costs over the lives of the vehicles assuming a 5 percent discount rate, 16 year life for passenger cars and light-trucks 1, and 19 years for light-trucks 2. Due to road salt and harsh weather, vehicles in Connecticut are not projected to last as long as they do in California. We assumed the passenger cars and light-truck life in Connecticut was 13 years and heavier truck life was 16 years. This increased the annualized costs in Connecticut by 12% for passenger cars and light trucks/SUVs and 15% for heavier trucks/SUVs. As a result, this analysis shows Connecticut consumers would realize a lesser economic benefit from the GHG regulation than would consumers in California.[24] It is important to note that the approach we used is conservative and may underestimate the benefits of the GHG regulation to the Connecticut economy.

Estimated Co-Benefits

A tailpipe greenhouse gas emission standard produces costs and benefits to consumers, the state, and fuel providers. Based on the impacts of this standard on the California economy, we expect the results shown in Table 4.4 for Connecticut.

Table 4.4
Estimated Impact of Standards on Connecticut Economy

	2010	2020
Output (%)	-0.002%	-0.09%
Personal Income (%)	0.01%	0.2%
Employment (%)	0.02%	0.2%

The overall effect of the regulation will be an increase in personal income and, as a result, an increase in employment and sales activity. It is reasonable to assume a similar distribution of impacts and benefits in the Connecticut economy. In ARB's analysis of the economic impacts of this regulation on specific business sectors, they suggest that the only negative impact is on service stations as their fuel sales decline. This decline is expected to be compensated by an overall increase in sales activity in other segments of the economy. The decline in fuel sales is the reason why "output" declines - as can be seen from the summary in Table 4.4.

The benefits of CA LEV II in reducing non-methane organic gas (NMOG), a precursor of ozone pollution in the lower atmosphere; nitrogen oxides (NOx); and carbon monoxide (CO) are unchanged from the original analysis.

Progress Update – Action Pending

Additional analysis and data are available from ARB and from NESCAUM. DEP must adopt regulations in 2005 to maintain program consistency with that of the California program, as required by the Clean Air Act.

Supplemental Information

NESCAUM can provide detailed information on the technical and cost assumptions, as well as modeling method and results if needed.

Lead Agency

[24] Connecticut's vehicle inventory was developed from actual vehicle data for Connecticut in 2002, the vehicle life for PC/LDT1 and LDT2, and the new vehicle sales projections through 2020 from CARB. Using these assumptions, the estimated sales of new PC/LDT1 vehicles range from 146,000 in 2010 to 159,000 in 2020, LDT2 sales in 2010 and 2020 were estimated to be 65,000 and 72,000 respectively. These data suggest that new vehicle sales in Connecticut include a higher share of LDT2/3 vehicles (30% in 2002) compared to California (18% in 2002). We assumed that the LDT2/3 share is expected to grow slightly in Connecticut to 31% by 2020 compared with California – 22% by 2020.

5. Public Education Initiative on Transportation

Recommended Action: Raise the awareness of low GHG emitting vehicles

The State should develop an education program to raise public awareness about the benefits of low-GHG vehicles, including available incentives, such as GHG feebates and fleet procurement initiatives, and potential maintenance options, such as the use of low rolling resistance replacement tires and low friction engine oil.

Result of Assessments for 2010, 2020, and Beyond
GHG emissions reductions included in GHG Tailpipe Standards.

Estimated Costs
Costs have not been estimated.

Estimated Co-Benefits
Co-benefits have not been estimated.

Progress – In Process
Low-GHG vehicles are now available through state contract. The DAS has been making state and municipal purchasers aware of this and of the environmental benefits of low GHG vehicles at the CT $hops event held by DAS in 2004 and through other methods.

Supplemental Information
There is no supplemental information on this recommended action.

Lead Agency
Connecticut Department of Transportation and the Connecticut Department of Environmental Protection

6. Hydrogen Infrastructure Research and Development Program

Recommended Action: Develop a comprehensive hydrogen infrastructure research and demonstration program. [25]

Important technical barriers face the transition both to hydrogen as a primary fuel and to systems that would produce hydrogen in a climate-friendly manner. Nonetheless, the potential benefits to economic development, the climate, and clean air are so large that Connecticut should start now to implement a hydrogen research and development program. The recommendations in this section are based on the detailed strawman proposal on hydrogen prepared by Environment Northeast.

Recommendations

Research

- Review existing relevant safety codes and the status of codes under development; assess potential barriers to development of a hydrogen infrastructure.
- Review the state of the industry and relevant involvement of Connecticut businesses and academic institutions.
- Identify the scenarios for transition to hydrogen economy in the Northeast; identify major developments needed to effectuate the most likely scenarios; and identify the implications for Connecticut transportation infrastructure and businesses.
- Identify potential funding sources for demonstration projects.
- Identify related initiatives in the region through NEG-ECP, academic institutions, business associations, and other interested groups.

Demonstration

Create a strategic plan to guide the involvement of State and local governments, educational institutions, businesses, and nongovernmental organizations (NGOs), including a list of near-term pilot and demonstration projects that the State can facilitate through both public and private initiatives. The plan could also serve as a model for other Northeast states and NEG/ECP. The following early actions should be considered:

- Demonstrate the practicality and safety of key hydrogen mobility-system components (e.g., fuel cell vehicles using hydrogen fuel, vehicle fueling stations, and local hydrogen production at fueling stations).

[25] The Hydrogen Transportation Infrastructure strawman proposal, prepared by Environment Northeast, is the primary source of information for the Hydrogen recommendations. Significant portions of this section are excerpted verbatim from the Hydrogen strawman proposal.

- Demonstrate co-production of hydrogen for local mobility use at an advanced fossil (or biomass) gasification electric-power system in Connecticut, ideally in combination with carbon capture and sequestration.
- Facilitate adoption of the necessary safety codes in appropriate jurisdictions.
- Conduct targeted public education on hydrogen safety.
- Contribute to and participate in national programs to commercialize key technologies (e.g., vehicle-scale fuel cells or improved on-vehicle hydrogen fuel storage systems).
- Identify potential funding sources for priority actions.
- Demonstrate zero-emission production of hydrogen through electrolysis and the use of renewable energy.
- Test hydrogen-fueled vehicle performance in cold-weather environments.

Institutional [26]

In addition to the specific research and development (R&D) actions proposed above, several cross-cutting, institutional measures should be considered to help organize and implement a successful program:

- Establish a strategic R&D advisory council made up of public, private, and nonprofit organizations.
- Encourage State government transportation leaders to be hydrogen and fuel cell champions.
- Support university and industry collaboration through a hydrogen and fuel cell technology incubator. Assess Michigan's NextEnergy Initiative as a potential model.
- Initiate a business development initiative to promote investments in innovation through venture capital, institutional investors, and State economic development authorities.
- Develop a hydrogen education program ranging from introductory information for schoolchildren to higher education scholarships for studies in related energy fields.

Results of Assessments for 2010, 2020, and Beyond

In the time frame of the 2010 and 2020 targets, this report does not provide estimates of the reductions likely to occur from this measure. The potential reductions in the transportation sector that will occur *after* 2020 as a result of hydrogen and fuel cell technologies could be as much 22 $MMTCO_2e$ in Connecticut. This long-term reduction assumes the availability of low-emissions hydrogen (i.e., produced from gasification of fossil fuels together with carbon capture and sequestration, achieving roughly 90 percent improvement in GHG emissions, or renewable energy sources).

Estimated Costs

The transportation working group proposes the establishment of a Connecticut "Clean Energy Transportation Fund" that, among other things, would invest in demonstration projects that advance the state of hydrogen production, storage, distribution, and utilization for transportation applications. Although it is premature to estimate costs of a Clean Energy Transportation Fund

[26] Institutional recommendations outlined by the Connecticut Clean Energy Fund.

or other elements of R&D, the hydrogen program should be designed to prove the value of hydrogen technologies through a diverse portfolio of end-user applications.

Estimated Co-Benefits

An important ancillary benefit from a hydrogen and fuel program for Connecticut's transportation sector is economic development. Connecticut currently has 35 percent, or 1,300, of the estimated jobs in fuel cell manufacturing, and over $300 million in fuel cell products have been manufactured and shipped from Connecticut.[27] The Connecticut Clean Energy Fund estimates that the State's hydrogen and fuel cell industry in Connecticut could create 33,000 direct and indirect jobs.[28]

Progress – Action Pending

The State anticipates that it will investigate the macro-economic impacts instituting a hydrogen infrastructure and R&D program for Connecticut's hydrogen and fuel cell industries.

Supplemental Information

- Hydrogen Transportation Infrastructure Strawman Proposal
- Summary of Hydrogen Fuel Cell Workshop (and list of participants)

Lead Agency

Office of Policy and Management and the Connecticut Clean Energy Fund

[27] Connecticut Clean Energy Fund (CCEF), PricewaterhouseCoopers (PWC), as cited by the CCEF, via personal communication with Bryan Garcia of CCEF, November 2003.

[28] Based on the current employment makeup with the forecast job market in 10 years from Price Waterhouse Coopers.

7. Transit, Smart Growth, and VMT Reduction Package

Recommended Action: Implement a package of transit improvements and land-use policies and incentives to achieve a 3 percent reduction in VMT below the 2020 baseline.

Passenger VMT in Connecticut is projected to increase by 22.2 percent from 2000 to 2020, according to the ConnDOT's Master Transportation Plan.[29] Implementation of the measures recommended here are estimated to reduce that growth to 19.2 percent.

This package of recommendations is aimed at increasing accessibility and low-GHG travel choices in Connecticut, such as transit (rail and bus), vanpools, walking, and biking. It draws on more detailed, strawman analyses and proposals, which are listed at the end of this section. Notably, the Smart Growth Strawman proposal, prepared by the City of New Haven, is the primary source of information on smart growth recommendations, costs, and benefits.[30]

The recommendations consist of six complementary elements:

1. Double transit ridership by 2020.
2. Consider potential funding mechanisms for new transit investments, such as road pricing and the Transportation Strategy Board fuel tax recommendation.
3. Establish a coordinated, interagency program to promote smart growth in Connecticut:

    a. Establish priority funding areas to target State spending in areas considered appropriate for growth, as established by the State Plan of Conservation and Development (PCD).

    b. Establish additional planning capacity at the State level to coordinate activity between agencies and provide technical support for planning for growth.

    c. Establish an outreach program to regional planning organizations (RPOs) and local planning and zoning commissions to enact smart growth locally through measures such as transportation and infrastructure planning, regulatory reform, transit-oriented development, and housing diversity.

    d. Expand bicycle and pedestrian infrastructure.

[29] www.ct.gov/dot/cwp/view.asp?a=1383&q=259760
[30] Significant portions of this section are excerpted verbatim from the Smart Growth strawman proposal, prepared for the City of New Haven.

4. Redirect at least 25 percent of new development (based on forecast population and employment) to growth-appropriate locations, as indicated by the PCD.
5. Study a potential road-pricing pilot project, prepare a feasibility design study by 2006, and implement the pilot project if it is shown to be effective. Study road pricings potential impact on equity and sprawl, and consider broad implementation of road pricing in the long term.
6. Consider complementary VMT reduction incentives, such as commuter choice, location-efficient mortgages, and mileage-based insurance.

Below are the details of the core elements of the recommendation.

Transit

Public transportation is an efficient, low-GHG alternative that is used by some 85,000 Connecticut commuters every day. The working group set a goal to double transit ridership as a means of reducing VMT. ConnDOT performed model runs assuming doubling ridership for rail and bus transit from the 2020 baseline. The agency also analyzed two stand-alone projects: the New Haven-Hartford-Springfield rail service and the Manchester/Vernon-Hartford bus rapid transit service. ConnDOT conducted a bottom-up analysis to cost out the transit investments necessary to achieve a VMT reduction equivalent to doubling transit ridership. A summary of key elements is included below (for details, see "Transit Growth Scenario Assumptions").

Rail Options

- New Haven-Hartford-Springfield rail service
- Direct service to New York City (Penn Station) via enhanced Amtrak
- Enhanced New Haven Line (NHL) service to New York City (Grand Central Terminal)
- Enhanced intrastate service on NHL Mainline; NHL Branch Lines; Shore Line East (SLE); and extended SLE, all via enhanced passenger train service (i.e., Amtrak)

Bus Options

- Manchester/Vernon-Hartford bus rapid transit service
- Statewide extended span of service and service area
- Enhanced express service in Hartford and other markets

Other

- Vanpool enhancements

Potential Funding Sources

The State should consider potential funding mechanisms for new transit investments such as road pricing and the Transportation Strategy Board fuel tax recommendation.

Smart Growth

Residential and commercial development in suburban and exurban areas increases VMT as distances between homes and jobs increase. Low-density development cannot support public transportation, so single-occupancy-vehicles are often the only practical travel option. Since 1970, Connecticut's population has increased by a modest 12 percent, but VMT have increased by 78 percent. The National Governors Association reports that nationwide, the increase in VMT is attributable to more miles driven by existing drivers, rather than to new drivers.

Since 1999, eight major reports have documented the impact of sprawl on Connecticut's economy, transportation systems, urban infrastructure, environmental resources, and social equity.[31] These studies have put forth recommendations for reducing sprawl by redirecting growth patterns through appropriate constraints, incentives, and long-term planning. As the eight reports demonstrate, the State has much to gain by planning for growth in appropriate areas rather than permitting continued unfettered development. Efficient reuse of existing infrastructure, reinforced funding for existing schools, improved air and water quality, reduced road and sewer extension costs, congestion mitigation, increased access to jobs, and affordable housing are recognized benefits of growth management. Connecticut's commitment to reducing GHG emissions underscores the needs identified by the eight reports and introduces an additional benefit to the already long list. This proposal borrows from the excellent work contained in these eight reports, with emphasis on recommendations that directly address the sprawl–climate change nexus.

The proposal is a measured response. It acknowledges that most new growth will continue to follow current trends. The working group therefore recommends a modest 25 percent penetration of smart growth principles by 2020 manifested by a 25 percent redirection in projected growth (population and employment) from inappropriate to appropriate locations, as defined by the PCD.

Smart Growth Recommendations

Planning, Coordination and Outreach

- Direct the Office of Policy and Management to address climate change and transportation-related GHG emissions in the State PCD.
- Establish additional planning capacity at the State level to coordinate activity between agencies and provide technical support for growth planning in accordance with the PCD.
- Establish an outreach program to RPOs and local planning and zoning commissions to enact smart growth locally through measures such as transportation and infrastructure planning, regulatory reform, transit-oriented development, and housing diversity.

Financial and Regulatory Mechanisms

- Adopt smart growth legislation that requires State agencies to target State economic development, transportation, infrastructure, and school construction spending in areas considered appropriate for growth, as established by the State PCD.
- Restructure Section 8.23 of the Connecticut General Statutes to promote integration of State, regional and municipal PCDs; the new laws should provide for enforcement "teeth" and a reporting mechanism for inconsistencies.
- Align statewide policies to support smart growth by pursuing reform in areas identified to affect the shape of growth in Connecticut, including open space acquisition (see AFW

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[31] State of Connecticut Blue Ribbon Commission on Property Tax Burdens and Smart Growth Incentives. 2003 *Report*; Myron Orfield et al. 2003. *Connecticut Metropatterns: A Regional Agenda for Community and Prosperity in Connecticut*; Connecticut Regional Institute for the 21st Century. 2003. *Connecticut: Economic Vitality and Land Use*; Regional Plan Association. 2002. *Is Connecticut Sprawling?*; Harvard Design School. 2002. *Promoting Smart Growth in Connecticut*; Connecticut Conference of Municipalities. 2001. *10 Principles of Smart Growth in Connecticut*; Gallis & Associates. 1999. *Connecticut Strategic Economic Framework*; Connecticut Transportation Strategy Board. 2003.*Transportation: A Strategic Investment*.

recommendations), bicycle and pedestrian travel, property tax reform, and building energy codes (see RCI recommendations).

- Establish an oversight group comprising senior staff from all State agencies and NGOs as well as public participants to ensure that the policies and activities of each agency are supportive of smart growth.

Road Pricing

A recent Connecticut report completed an analysis of travel demand mode shifts that would result from a value-pricing toll of $0.20 per mile in the southwest Connecticut corridor.[32] ConnDOT's travel-demand model predicted that this pricing measure alone would create a 6 percent reduction in drive-alone trips, an increase in new rail trips of 72 percent, and an increase in bus use of 25 percent. The results are consistent with the results of the 1994 COMSIS Transportation Control Measure study, which indicated that a highway value toll of $0.10 per mile was expected to reduce VMT by 3.5 percent.

Road Pricing Recommendations

- The State should pursue Federal Highway Administration funds available for studying and implementing a road-pricing pilot project. Existing underutilized HOV lanes in the Hartford area may provide an opportunity for initial study.
- The State should study the impact that road pricing could have on equity and sprawl.
- The State should consider broad implementation of road pricing in the long term.

Complementary VMT Reduction Incentives

The State should consider complementary VMT-reduction incentives, such as commuter choice, location-efficient mortgages, and mileage-based (pay-as-you-drive) insurance.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.22 MMTCO$_2$e in 2010
0.49 MMTCO$_2$e in 2020

GHG reductions were calculated on the basis of a 3 percent reduction of passenger VMT below the 2020 baseline, assuming a 1.5 percent reduction in 2010. The working group considered several different data sources and calculations in developing the 3 percent estimate:

- First, the working group considered the range of VMT savings from metropolitan planning organization smart growth studies from around the country, which ranged from 1 to 14 percent below baseline projections, with most studies falling in the range of about 3 to 10 percent.[33]
- Next, ConnDOT calculated that VMT reduction from doubling transit ridership would result in a VMT reduction of about 1.6 percent in 2020 (425.5 million divided by 26.4 billion).

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[32] Southwestern Regional Planning Association (SWERPA). 2002. *Vision 2020; Congestion Mitigation Systems Plan*.

[33] Summarized in Center for Clean Air Policy. 2003. *State and Local Leadership on Transportation and Climate Change.*

- Concurrently, ConnDOT calculated that the VMT reduction from redirecting 25 percent of new growth to urban areas would yield a VMT reduction of 0.5 percent. This modeling did not capture VMT reductions from walking, biking, or reduced trip lengths (due to closer origins and destinations).
- Discussions with a national expert on transit and smart growth yielded a rough rule of thumb that VMT reductions from walking and biking are approximately equal to VMT reductions from transit under smart growth scenarios.

Combining all of this information, the working group agreed on 3 percent as a reasonable estimate of VMT reductions from a package including transit, smart growth, and complementary incentives. The working group noted that even greater VMT reductions may be available with the introduction of road pricing on a large scale throughout the State.

Estimated Costs

Transit

ConnDOT calculated that the required transit investments would require approximately $1.8 billion in capital expenses and $110 million in annual operating expenses.

Smart Growth

The Transportation Strategy Board estimated a one-time capital cost of $10 million for State assistance in GIS mapping and technical analyses and annual operating costs of $380,000 for State assistance with municipal and regional plan development.

Estimated Co-Benefits

Avoided Infrastructure Costs

To the extent that future growth can be targeted to developed areas, costly infrastructure investments can be avoided. Scarce resources can be used to repair and maintain existing systems rather than extend them into sparsely populated, exurban areas. The Research Institute for Housing America estimated the potential cost savings of smart growth measures nationally could be as much as $250 billion over a 25-year period.[34] If this nationwide estimate is apportioned to Connecticut by population, the savings could approach $2.7 billion by 2025. About 20 percent of the savings are road and land-use savings to State and local governments, and about 80 percent of the savings are housing, development cost, and utility savings to developers, home buyers, and commercial tenants.

Avoided Health Care Costs

An additional $3.1 million to $40.1 million in annual savings is expected from avoided health care costs due to air pollution reductions (see below).[35] The working group assumes a midpoint of $21.6 million.

Consumer Savings

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[34] Research Institute for Housing America. 2001. *Linking Vision with Capital –Challenges and Opportunities in Financing Smart Growth.* Institute Report No. 01-01. Available at: www.housingamerica.org/docs/RIHA01-01.pdf.

[35] Based on McCubbin D, Delucchi M. 1999. *The Health Costs of Motor-Vehicle-Related Air Pollution*. Journal of Transport Economics and Policy. Publication No. UCD-ITS-RP-99-16.

A 2000 analysis of household transportation expenditures in 28 metropolitan areas found that transportation expenses are greater in low-density areas with few alternatives to the automobile. The study found that families living in low-density areas pay roughly $1,300 more per year in transportation expenses than families in compact, mixed-use areas do.[36] If this savings is assigned to the population shift associated with 25 percent penetration of smart growth measures in Connecticut, it results in decreased transportation expenditures amounting to more than $28 million in 2020. Table 7.1 summarizes the costs and benefits annualized over 17 years using a 7 percent discount rate.

This set of smart growth, transit and VMT reduction measures results in an estimated incremental cost of $602 per metric ton of CO_2 direct cost to government (including capital and operating costs) and $280 per metric ton of CO_2 when cost savings are included: infrastructure (pubic and private spending), health care, and household transportation expenditures.

Table 7.1
Annualized Costs and Benefits in 2020
(Annualized Over 17 Years With a 7% Discount Rate)

	Present Value	Levelized Annual	Operating	Total Annual
New Haven-Hartford-Springfield rail	$481,000,000	$49,266,518	$48,000,000	$97,266,518
Manchester/Vernon-Hartford BRT	$100,000,000	$10,242,519	$5,000,000	$15,242,519
Rail	$980,920,000	$100,470,920	$19,200,000	$119,670,920
Bus	$225,100,000	$23,055,911	$38,400,000	$61,455,911
Smart growth costs	$10,000,000	$1,024,252	$380,000	$1,404,252
Subtotal: Direct Government Costs				***$295,040,120***
Smart growth benefits (govt.)	($221,429,897)	($22,680,000)		($22,680,000)
Health cost savings (avg.)				($21,600,000)
Household expenditures (2020)				($28,000,000)
Subtotal: Cost Savings				***($157,600,000)***
Total Costs (direct costs minus cost savings)				**$137,440,120**

Air Pollution Reductions

In Connecticut, mobile sources are responsible for the lion's share of criteria and hazardous air pollutant emissions. Health effects of these emissions include respiratory diseases, such as asthma and bronchitis; cardiovascular disease; and premature death. Although difficult to quantify, these emissions have real financial and social costs: treatment and hospitalizations for pollution-induced illness, missed work and school days, restricted activity, coping with symptoms of illness, and premature deaths.

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[36] Surface Transportation Policy Project. 2000. *Driven to Spend: The Impact of Sprawl on Household Transportation Expenses.* Available at: www.transact.org/report.asp?id=36.

A 3 percent reduction in VMT is expected to yield the following reductions in criteria pollutant emissions (Table 7.2):

Table 7.2
Criteria Pollutant Savings in 2020 From 3% VMT Reduction (tons)

CO	NOx	PM10	SO_2	VOC
18,935	1,226	35	82	1,767

Note: Calculated with ICLEI Clean Air and Climate Protection Software, Torrie Smith Associates, Inc. Based on 2020 fleet-wide passenger vehicle emission factors.

Other Benefits

- *Increased transportation choices to the traveling public.* In addition to fostering quality-of-life improvements, increased travel choices can help relieve traffic congestion, bolster economic development, and aid urban revitalization.
- *Health benefits from increased mobility.* Auto-centric development patterns have decreased mobility among adults and children, reducing opportunities for walking and bike riding. The Surface Transportation Policy Project released a report this year demonstrating a statistically significant correlation between sprawl, obesity, and hypertension. Research suggests that people in compact, mixed-use areas reap benefits from increased opportunities to integrate walking and biking into their everyday routines.[37] Smart growth seeks to encourage centralized, mixed-use communities with well-developed pedestrian and bicycle infrastructure. Given the myriad health costs associated with inactivity, creating opportunities for increased mobility through smart growth has a clear (although unquantified in this analysis) economic value.
- *Additional environmental benefits.* Smart growth measures reduce the environmental impact of development in other ways. Reduced impervious surfaces and improved water detention safeguard water quality. A study of New Jersey's Development and Redevelopment Plan found that compact development would produce 40 percent less water pollution than would more dispersed development patterns.[38] Urban sprawl is associated with habitat loss and habitat fragmentation, processes that can disrupt the stability of Connecticut's natural ecosystems. Clean up and reuse of brownfield sites is an additional environmental benefit to smart growth.
- *Avoided costs of sprawl* that can be minimized through smart growth policies include: economic loss due to congestion, declining urban centers, disconnect between affordable housing and job location, quality of life impacts.

Progress – In Process / Actions Pending

7A on Transit (In Process) – Work continuing on the design and implementation of New Britain to Hartford Bus Rapid Transit (BRT). Studies concluding on Hartford East BRT and New Haven to Hartford to Springfield Rail.

[37] Barbara A. McCann and Reid Ewing. 2003. *Measuring the Health Effects of Sprawl: A National Analysis*. Washington, DC: Surface Transportation Policy Project.

[38] Center for Urban Policy Research. 2001. *Impact Assessment of the New Jersey State Development and Redevelopment Plan*.

7B on Smart Growth and 7C on VMT Management (Actions Pending) – Road Pricing Feasibility Study, and other VMT management strategies such as expansion of tax-free commute benefits, and pay-as-you-drive insurance are being investigated.

Supplemental Information

- Smart Growth Strawman Proposal. This document provides more detail on the smart growth recommendations considered by the working group.
- Transit Growth Scenario Assumptions.
- Modeling results from 25 percent reallocation of new growth.

Lead Agency

Connecticut Department of Transportation and the Office of Policy and Management

Connecticut Climate Change

8. Multistate Intermodal Freight Initiative

Recommended Action: Embark upon a multistate intermodal freight initiative.

The Transportation and Land Use working group concluded that Connecticut can do little on its own to foster intermodal freight transportation in the State (see the ConnDOT memo on intermodal freight). Therefore, the stakeholders recommend that Connecticut engage in multistate and regional discussions on opportunities to divert a portion of the projected 70 percent growth in regional truck traffic to rail and barge modes in order to reduce significantly the GHG impact of freight transportation. Because of the structure of today's freight networks, the geographic scope would likely need to go beyond the Northeast (as far south as Virginia and as far north as Halifax, Nova Scotia).

Results of Assessments for 2010, 2020, and Beyond

Estimated GHG emissions reductions:

0.00 MMTCO_2e in 2010
0.14 MMTCO_2e in 2020

Key Assumptions

- The modeling assumes that 5 percent of truck traffic shifts to rail or barge by 2020.
- Beyond 2020, the potential exists for considerable GHG emissions reductions in Connecticut and regionally, due to the creation of a more efficient, integrated, and diverse freight network that has reduced reliance on trucks as the sole means of goods movement.

Estimated Costs

Cost estimates will depend on the selection, adoption, and level of implementation for low-GHG freight policies.

Estimated Co-Benefits

- Reduced traffic congestion and wear-and-tear on infrastructure
- Air pollution reductions
- More efficient delivery of goods
- Redundancy in freight networks for economic and physical security

Progress – In Process

Continuing work with I-95 Corridor Coalition Freight Initiative. Transportation Strategy Board Demonstration Project being implemented. Connecticut Department of Environmental Protection will raise the issue of regional freight at the next NEG/ECP meeting.

Supplemental Information

- ConnDOT Memo on Intermodal Movement of Freight (August 2003).

Lead Agency

Connecticut Department of Transportation and the Connecticut Department of Environmental Protection

9. Clean Diesel and Black Carbon

Recommended Action: Reduce black carbon by establishing a Connecticut clean diesel program.[39]

Scientists have identified black carbon, a component of particulate matter (PM, or soot), as having a large and fast-acting warming impact on the atmosphere.[40] Diesel engines emit roughly half of the black carbon in the United States; the proportion may be lower in Connecticut, depending on black carbon emissions from other sources.[41] Thanks largely to tightening federal standards for new engines, emission-control technology is now available to retrofit or rebuild existing ("in-use") engines for any kind of diesel engine (on-road, off-road, locomotive, and marine).

The science of black carbon's global warming potential is still evolving, and as it becomes more precise, the calculations herein may need to be adjusted. Every effort was made to use conservative assumptions about the level of black carbon emissions and reductions.

The recommendations herein summarize the strawman proposal on diesel black carbon prepared by Environment Northeast. Refer to the transportation baseline section of this report and Environment Northeast's memo on diesel black carbon calculations for more information on how the CO_2 equivalency of black carbon was calculated.

The following stakeholder recommendations are based on a conservative set of assumptions, regarding technology integration and black carbon reduction:

- Include black carbon in the Connecticut GHG baseline. See baseline discussion.
- Connecticut should recommend to the NEG/ECP that black carbon emissions be included in GHG inventories and baselines.
- Establish a Connecticut clean diesel program with the following characteristics:
  - Multi-agency program charged with maximizing diesel emission reductions
  - Design and implement programs and supporting regulations
  - Oversee revenue and expenditures earmarked for clean diesel program.

[39] The Diesel Black Carbon Strawman Proposal, prepared by Environment Northeast, is the primary source of information for recommendations, costs and benefits in this section. Significant portions of this section are excerpted verbatim from the Diesel Black Carbon strawman proposal.

[40] Jacobson M. 2002. Control of fossil-fuel particulate black carbon and organic matter, possibly the most effective method of slowing global warming. *Journal of Geophysical Research* 107(D19): ACH 16, 1-22.

[41] See the introductory section to the report. The stakeholders have recommended that black carbon emissions from other sources, such as residential boilers, be evaluated.

State Procurement

- **Construction contracts** funded by the State should require best available control technology (BACT) and other emissions-mitigation measures for all diesel engines.[42]
- **Connecticut Transit and ConnDOT:** In the next three years, retrofit with BACT or retire early all buses in the Connecticut transit fleets (500 or more buses); all 632 DOT dump trucks and snow removal equipment; and all 131 diesel ground vehicles at Bradley airport.

Incentives

Fuel

Consider the following measures:

- Cut State sales tax on ultra-low-sulfur diesel fuel in order to reduce (or eliminate) the incremental cost of this fuel until its use is federally required in June 2006.
- Raise sales tax for on-road and off-road diesel fuel earmarked through the State Transportation Fund to the clean diesel program for retrofits and early retirements.

Retrofit Emission Controls and Early Retirement/Replacement

Consider the following measures:

- tax incentives for private sector purchase and installation of qualifying diesel emission control technology
- funding from Connecticut Clean Diesel Program to help defray costs of compliance
- federal grants, earmarked fuel tax revenues, enforcement penalties, appropriations, user fees, etc.
- Interstate trucks
- Establishment of a northeast regional program with NEG/ECP and/or Northeastern States for Coordinated Air Use Management (NESCAUM) to create a new incentive system to promote BACT for in-use engines on long-haul, interstate trucks.
- Anti-idling measures
- Support capital expenditures to reduce truck, locomotive, and marine engine idling through electrification and use of clean auxiliary engines.

Regulatory Support

- Propose legislation directing DEP to establish phased-in emission standards requiring BACT for particulates, black carbon, and NO_x (as verified by EPA or CARB). The legislation would target in-state trucks (garbage, snow removal, dump, and tanker), school buses, transit and intercity buses, and construction equipment and would extend anti-idling rules to locomotive and marine engines.

Results of Assessments for 2010, 2020, and Beyond

Black Carbon Baseline

Developing an estimate of black carbon reductions requires development of a baseline emissions forecast. In projected black carbon emissions, it is crucial to take into account federal regulations

[42] See the key assumptions for discussion of BACT.

that will reduce black carbon emissions. Specifically, current EPA rules set standards for all new on-road engines that will achieve 90 percent reductions in PM beginning in 2007. Pending EPA rules are expected to require similar reductions for all new off-road engines that would be phased in between 2008 and 2014. The working group developed the baseline to reflect the EPA rules for new diesel vehicles, so that the black carbon policy recommendations would focus on existing on-road and off-road vehicles.

Baseline levels of black carbon are projected to be 3.0 $MMTCO_2e$ in 1990 and 3.7 $MMTCO_2e$ in 2010 and 2020. Refer to the transportation baseline section of this report and Environment Northeast's memo on diesel black carbon calculations for more information on how the black carbon was determined.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.80 $MMTCO_2e$ in 2010
2.40 $MMTCO_2e$ in 2020

Key Assumptions

- The working group assumed that by 2020, the technical potential will exist to achieve 100 percent penetration of emission-control technology in pre-EPA-rule on-road and off-road vehicles, which on average would achieve 90 percent lower PM emissions than in 2000.
- As a conservative estimate, penetration rates of 25 percent in 2010 and 75 percent in 2020 were assumed.
- The working group did not "take credit" in its reduction calculations for any purchases of "new" engines that comply with the federal on-road or proposed off-road rules unless those purchases were made before the end of the engine's useful life as a result of State policies.
- For purposes of this discussion, BACT refers to equipment that is commercially available and achieves the highest amount of emission reductions at practical costs for a given engine type and use. For high-operating-temperature engines beginning with model year 1994, BACT represents the diesel particulate filters (DPFs) that achieve at least 90 percent black carbon reductions. DPFs capture diesel particulates before they are discharged from the tailpipe into the ambient air. For pre-1994 engines and low-operating-temperature engines (in which DPFs may not be practical), the working group assumed the use of alternative controls, including high-performance diesel-oxidation catalysts (DOCs), which oxidize diesel particles to prevent harmful emissions components and achieve better than 50 percent reductions in particulate matter and 25 percent reductions in black carbon. Although standard DOCs remove about 25 percent of particulate matter, they do not remove black carbon or NO_x and thus do not have climate benefits.
- For engines too old to warrant the expense of retrofits or those that cannot be retrofitted, the options are to accelerate early retirement and replacement with new, low-emission engines (which in the case of a new on-road truck would deliver greater than 99 percent

reductions in PM and black carbon) or to minimize operation of those engines through a combination of anti-idling programs, electrification, and clean auxiliary power units. The combination of those measures will give Connecticut the technical potential of achieving 90 percent reductions from present-level black carbon emissions by 2020.

Estimated Costs

The working group did not have comprehensive cost data or complete data on the inventory of diesel vehicles operating in Connecticut. However, it was able to develop the following cost estimates. The working group also noted that as technology evolves, emissions-control technology costs are likely to drop. For more details, see the strawman proposal.

- Ultra-low-sulfur diesel fuel (ULSD), which contains less than 30 ppm sulfur, costs anywhere from $0.05 to $0.15 per gallon more than regular diesel. It is a prerequisite for proper operation of most DPF systems. Existing facilities can be used, but use of ULSD requires dedicated shipping and storage facilities so that it is not contaminated by higher sulfur fuels.
- DPF retrofit packages currently cost between $4,500 and $9,000 per unit for an average truck or bus. Transit buses would be on the lower end of this scale. For large construction engines such as front-end loaders, the filters can cost as much as $12,000. The cost varies with the size of the engine and the volume of the purchase.
- Alternative retrofittable controls, such as the recently commercialized Particulate Reactor, cut PM by 50 to 60 percent and cut black carbon by around 25 percent, on average. Costs vary by size of the engine; for a standard transit bus, they would be between $3,000 and $3,500. The units do not require the use of low-sulfur fuel.
- Maintenance for retrofit emission controls is very low. DPFs (in the muffler) should be removed, cleaned, and reinstalled annually.

The following cost estimates were developed for several categories of vehicles.

- Transit Buses (ConnDOT): $1.6 million to $7.0 million
  - 183 “young” Connecticut Transit buses @ $5,000 = $915,000
  - 213 “middle-aged” Connecticut Transit buses @ $3,500 = $745,500
  - Retiring or replacing 107 “old” Connecticut Transit buses after 2007 at $10,000 to $50,000 (partial cost) = $1.07 million to $5.35 million
- Bradley Airport: $0.26 million (131 pieces of equipment @ $2,000 each)
- Construction sector: $3.15 million
  - 225 units @ $4,000 = $900,000
  - 225 units @ $10,000 = $2,225,000
- School Buses: $40 million to $130 million
  - 2,210 units @ $5,000 = $11 million
  - 2,210 units @ $3,500 = $ 7.7 million
  - 2,210 units @ $10,000 to $50,000 (partial cost) = $22 million to $111 million
- Trucks: $98 million to $172 million
  - 6,550 units @ $5,000 = $32.75 million
  - 8,400 units @ $3,500 = $29.4 million
  - 632 ConnDOT plows and dumps @ average $4,250 = $17.5 million

- 1,850 units @ $10,000 to $50,000 (partial cost) = $18.5 million to $92.5 million
- Locomotives and Marine Engines = N/A
  - Anti-idling measures = free
  - Electrification or clean auxiliary power units = N/A

Perhaps the most uncertain cost component is that of replacement costs for buses and trucks. It is assumed that vehicle replacement would not require the full vehicle purchase price but a partial cost of $10,000 to $50,000 per vehicle.

Accepting the cost assumptions, along with the other projections regarding the cooling impact of black carbon and the penetration rates of retrofits, then the cost of carbon reductions from this measure would be in the range of $6 to $13 per $MTCO_2e$. Using these assumptions, levelized annual costs would range from $13 million to $30 million.[43] Note that the cost assumptions do not include reduced health care costs resulting from lowered PM emissions.

Estimated Co-Benefits

Health and climate objectives are advanced with immediate effect, including avoidance of: premature death, asthma and asthma attacks, emergency room visits, heart disease, and cancer associated with risk of exposure to diesel toxic emissions. Note that the cost assumptions above do not include reduced health care costs resulting from lowered PM emissions.

Progress – In Process

181 school buses in New Haven are being retrofitted with diesel oxidation catalysts and Spiracle crankcase controls. These buses are now being fueled with ultra-low sulfur diesel fuel that is dosed with a fuel borne catalyst to further reduce emissions.

The Connecticut Department of Environmental Protection is in the process of updating fleet information for the Hartford and Bridgeport school bus fleets to determine engine types and operating temperatures as these parameters effect the control technology determinations.

About two years ago the Connecticut Department of Environmental Protection established a voluntary partnership with the Department of Transportation and CCIA to explore the feasibility of including construction retrofits as part of the I-95 Quinnipiac Bridge reconstruction project. To date, 72 pieces of equipment have been retrofitted with diesel oxidation catalysts for both Contract C1 and Contract D. Through this partnership, a contract specification was developed which requires "all diesel powered construction equipment with engine horsepower (HP) rating of 60 HP and above, that are on the project in excess of 30 days to be retrofitted with Emission Control Devices and/or use clean fuels in order to reduce diesel emissions."

Supplemental Information

- Diesel Black Carbon Strawman Proposal (Environment Northeast)
- Environment Northeast's memo on Diesel Black Carbon Calculations (10-22-03)

Lead Agency

Connecticut Department of Environmental Protection

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[43] Annualized using a 7% discount rate over 17 years.

Connecticut Climate Change

Action Plan 2005

RESIDENTIAL, COMMERCIAL, AND INDUSTRIAL SECTOR

10. Appliance Standards

Recommended Action: Establish efficiency standards for appliances.

The State should set efficiency standards for eight appliances that are commercially available and do not require a federal waiver for state regulation. Those appliances include dry-type transformers, commercial refrigerators and freezers, exit signs, traffic signals, torchière lamps, packaged large A/C units greater than 20 tons, unit heaters, and commercial clothes washers (Table 10.1). Appliances at the proposed efficiency level are commercially available.

Table 10.1
Summary of Proposed Appliance Standards

Product	Unit Sales in CT	Annual per Unit savings (kWh)	Year Effective	Lifetime
Dry type transformers	254,820	16.6	2005	30.0
Commercial refrigerators and freezers	500	1,542	2005	9.0
Exit signs	4,450	223	2005	2.5
Traffic signals	5,080	431	2005	15.0
Torchiere lamps	107,700	288	2005	10.0
Packaged large AC > 20 tons	150	6,141	2005	15.0
Unit heaters (therm savings)	1,470	268	2006	18.0
Commercial clothes washers	2,880	197	2008	8.0

Source: NEEP, 2003

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reduction:

0.104 MMTCO_2e in 2010
0.205 MMTCO_2e in 2020

The savings estimates are based on a study by the Northeast Energy Efficiency Partnership (NEEP). NEEP disaggregated a national study by the American Council for an Energy Efficient Economy (ACEEE) and allocated fractions of the estimated energy and peak-demand savings from efficiency standards to individual states by applying state allocation factors. The analysis is static and assumes that equipment sales remain at 2000 levels for all products. In the absence of standards, efficiency levels remain at present levels. In actuality, product sales and efficiency are gradually increasing, even in the absence of standards. Thus, NEEP's study implicitly assumed that those factors counterbalance each other (NEEP, 2003).

The appliance standards will reduce primarily indirect emissions; minor direct emissions savings will come from unit heaters. Estimates are shown in Table 10.2.

Table 10.2 Estimated Emission Reductions From Improved Appliance Standards	2010	2020
Direct emissions reductions ($MMTCO_2e$)	<0.001	<0.001
Indirect emissions reductions* ($MMTCO_2e$)	0.104	0.205
Total emission reductions ($MMTCO_2e$)	**0.104**	**0.205**

* Estimates of indirect emission reductions (due to decreased electricity consumption from the electricity grid) are based on the marginal grid emission factor for NEPOOL region. See EE Model Run for the interactive effects of all electricity demand-side measures.

Estimated Costs

Levelized annual costs, based on the NEEP study, were estimated as –$106/tCO_2$. This estimate accounts for the incremental cost of higher efficiency appliances and the cost savings associated with reduced energy consumption.

Estimated Co-Benefits

Co-benefits were not quantified, but they include (1) reduced hydrofluorocarbon (HFC) and chlorofluorocarbon (CFC) emissions due to leaks from commercial refrigerators and freezers and AC and (2) reduced water consumption from commercial clothes washers.

Progress – In Process

Legislation enacted to require DPUC, in consultation with OPM, to establish regulations for energy efficiency standards for a variety of heating, cooling and other types of products (Public Act 04-85). The DPUC, in consultation with OPM is currently conducting an administrative proceeding to adopt regulations regarding the certification of designated products, procedures for testing the energy efficiency of products, and the manner in which an annual list of qualified products will be published and maintained (DPUC Docket #04-10-18).

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency

Connecticut Department of Public Utility Control

11. Appliance-Swapping Program

Recommended Action: Create an appliance-swapping program.

Develop a "pay-as-you-save" program under the Conservation and Load Management Fund to replace old appliances in the residential sector with new Energy Star appliances. Appliances to be covered include Energy Star Tumble Clothes Washer, Energy Star Refrigerator, Energy Star Room A/C (6500 BTU), and Energy Star Dishwasher.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.016 MMTCO$_2$e in 2010
0.020 MMTCO$_2$e in 2020

The GHG savings were estimated by multiplying the incremental electricity savings of new Energy Star units compared with old units by the number of units replaced each year by the marginal CO_2 emission factor for regional electricity grid. Assumptions and the estimated savings and costs are shown in Table 11.1.

Table 11.1
Assumptions for GHG Savings From Appliance-Swapping Program

	Savings Compared With Older Unit (kWh/yr/unit)	Number of Units Replaced Annually	Lifetime*
Energy Star tumble clothes washer	281	3,000	14
Energy Star refrigerator	1,200	3,000	15
Energy Star room AC (6500 BTU)	100	3,000	10
Energy Star dishwasher	186	3,000	10

Source: Savings estimates from DPUC; number of units replaced estimated
*The analysis assumes that savings would only be generated during the first seven years of the equipment life.

The appliance-swapping program will reduce indirect emissions from electricity consumption (Table 11.2).

Table 11.2
Estimated Emissions Reductions From Appliance-Swapping Program

	2010	2020
Direct emissions reductions (MMTCO$_2$e)	NA	NA
Indirect emissions reductions* (MMTCO$_2$e)	0.016	0.020
Total emission reductions (MMTCO$_2$e)	**0.016**	**0.020**

*Estimates of indirect emission reductions (due to decreased electricity consumption from the electricity grid) are

based on the marginal grid emission factor for NEPOOL region. See EE Model Run for the interactive effects of all electricity demand-side measures.
NA: not applicable

Estimated Costs

Levelized annual costs were estimated to be –\$94/tCO_2. This estimate is based on the incremental cost of the equipment and the cost savings associated with reduced electricity consumption.

Estimated Co-Benefits

Although not quantified this measure will also reduce the emissions for hydrofluorocarbons (HFCs) and chlorofluorocarbons (CFCs) leaked into the atmosphere from refrigerators and A/C units.

Progress – In Process

The DPUC forwarded this item to the Energy Conservation Management Board (ECMB) for its review and consideration for possible inclusion in its draft 2005 C&LM budget plan (7/04). The ECMB conducted a preliminary review of this item, and has provided initial commentary to the DPUC (10/04). The DPUC is currently conducting an administrative proceeding to approve the 2005 C&LM budget, and it intends to further examine the feasibility of including this item in the 2005 C&LM budget plan (DPUC Docket #04-11-01).

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency

Connecticut Department of Public Utility Control

12. Heat Pump Water Heater Replacement Program

Recommended Action: Create a heat pump water heater (HPWH) replacement program.

Develop a pay-as-you-save program under the Conservation and Load Management Fund (C&LM) to promote the WatterSaver, the next generation of heat pump water heater (HPWH) technology. By utilizing the ambient air, the WatterSaver attains an efficiency rating nearly three times that of the most efficient electric water heaters. This technology is projected to be commercially available in 2004.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.011 MMTCO$_2$e in 2010
0.013 MMTCO$_2$e in 2020

The GHG emissions were estimated by multiplying the annual electric savings associated with the WatterSaver by the number of units replaced each year by the marginal CO_2 emission factor for the regional electricity grid. The annual electric energy savings for the WatterSaver HPWH is estimated to be 2400kWh/yr/unit, compared with the current state-of-the-art electric hot water heaters. It was estimated that this technology will achieve a 0.5 percent annual market penetration during the first five years following commercialization in 2004, or approximately 1,350 units per year in Connecticut.

The GHG emission reductions from this measure are indirect emissions from decreased electricity consumption (Table 12.1).

Table 12.1
Estimated Emissions Reductions From Heat Pump Water Heater Replacement Program

	2010	2020
Direct emissions reductions (MMTCO$_2$e)	NA	NA
Indirect emissions reductions* (MMTCO$_2$e)	0.011	0.013
Total emission reductions (MMTCO$_2$e)	**0.011**	**0.013**

*Estimates of indirect emission reductions (due to decreased electricity consumption from the electricity grid) are based on the marginal grid emission factor for NEPOOL region. See EE Model Run for the interactive effects of all electricity demand-side measures.
NA: not applicable.

Estimated Costs

Levelized annual costs were estimated to be –\$145/tCO_2. This estimate is based on an approximate incremental installed cost of \$500 per unit and the cost savings associated with reduced electricity consumption.

Estimated Co-Benefits
In addition to improving the efficiency of water heating, this appliance has also demonstrated the co-benefit of dehumidifying the space where it is located.

Progress – In Process
The DPUC forwarded this item to the Energy Conservation Management Board (ECMB) for its review and consideration for possible inclusion in its draft 2005 C&LM budget plan (7/04). The ECMB conducted a preliminary review of this item, and has provided initial commentary to the DPUC (10/04). The DPUC is currently conducting an administrative proceeding to approve the 2005 C&LM budget, and it intends to further examine the feasibility of including this item in the 2005 C&LM budget plan (DPUC Docket #04-11-01).

Supplemental Information
There is no supplemental information on this recommended action.

Lead Agency
Connecticut Department of Public Utility Control

13. Bulk Purchasing of Appliances

Recommended Action: Create a program for bulk purchasing of appliances.

This program consists of two components:

1. Promote the Consortium for Energy Efficiency's (CEE's) residential-sector bulk-purchasing program in Connecticut along with other states in the region. The program covers apartment-sized refrigerators, large refrigerators, subcompact fluorescents, reflector compact fluorescent lights, dedicated compact fluorescent recessed light fixtures, and heat pump water heaters.
2. Promote Pacific Northwest National Laboratory's (PNNL's) commercial-sector bulk-purchasing program in Connecticut and in other states in the region. This program covers unitary rooftop air conditioning products in the 65,000 to 135,000 Btu/h cooling capacity range.

Technology Bulk Procurement is a method for pulling new highly efficient and affordable products into the marketplace through competitive procurements that are backed by large volume buyers.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.023 MMTCO$_2$e in 2010
0.046 MMTCO$_2$e in 2020

The GHG savings were estimated by multiplying the annual unit savings (kWh) for the appliance by the number of appliances sold annually under the program by the marginal CO_2 emission factor for the regional electricity grid. Data were not available to estimate savings for all appliances under the program. The appliances for which data were available are listed in Table 13.1.

Table 13.1
Summary of Appliance Data for Bulk-Purchasing Program

Appliance	Unit Savings (kWh)	Appliances Sold Under Program Annually
Apartment-sized refrigerators (14.5 cu ft)	575.0	1,991
Large refrigerators (18.5 cu ft)	435.0	1,991
Subcompact fluorescents	43.8	36,000
Unitary AC	849.0	4,000

Sources: CEE, 2003; PNNL, 2003.

The GHG emission reductions from this measure are indirect emissions from decreased electricity consumption as shown in Table 13.2.

Table 13.2
Estimated Emissions Reductions From Bulk Purchasing of Appliances

	2010	2020
Direct emissions reductions ($MMTCO_2e$)	NA	NA
Indirect emissions reductions* ($MMTCO_2e$)	0.023	0.046
Total emission reductions ($MMTCO_2e$)	**0.023**	**0.046**

*Estimates of indirect emission reductions (due to decreased electricity consumption from the electricity grid) are based on the marginal grid emission factor for NEPOOL region. See EE Model Run for the interactive effects of all electricity demand-side measures.
NA: not applicable

Estimated Costs
Levelized annual costs for the residential program were estimated to be –$222/tCO_2$ and for the commercial program –$187/tCO_2$. The estimates are based on the incremental cost of the appliance and the savings associated with reduced electricity consumption.

Estimated Co-Benefits
Co-benefits have not been estimated.

Progress – In Process
The DPUC forwarded this item to the Energy Conservation Management Board (ECMB) for its review and consideration for possible inclusion in its draft 2005 C&LM budget plan (7/04). The ECMB conducted a preliminary review of this item, and has provided initial commentary to the DPUC (10/04). The DPUC is currently conducting an administrative proceeding to approve the 2005 C&LM budget, and it intends to further examine the feasibility of including this item in the 2005 C&LM budget plan (DPUC Docket #04-11-01).

Supplemental Information
There is no supplemental information on this recommended action.

Lead Agency
Connecticut Department of Public Utility Control

14. Mandate Upgrades to Residential and Commercial Building Energy Codes

Recommended Action: Upgrade residential and commercial building energy codes.[1]

The State should adopt the latest Energy Code from the International Code Council (ICC) by July 2004 and require the automatic adoption of updated revisions within 18 months as they become available for both residential and commercial buildings. Current State law requires the State Building Code (Code) to be updated to incorporate any “necessary” revisions adopted by the ICC. The stated purposes of the Code include conserving energy and facilitating the use of renewable resources.

Conn. Gen. Stat. § 29-252 incorporates energy conservation provisions and is based on the 1996 building code developed by a predecessor of the ICC. The adoption of subsequent revisions in Connecticut has been delayed, in part, by a dispute over whether the International Fire Code should be adopted for certain provisions (mostly unrelated to energy) in place of the existing National Fire Protection Association Code. The State Codes and Standards Committee and the Department of Public Safety are in the process of reviewing and considering updated commercial and residential codes that could be adopted by July 2004.

The most up-to-date revision of the ICC codes, including the International Building Code and the International Energy Conservation Code, occurred in 2003. Many other states, including New Hampshire, New York, Pennsylvania, and Rhode Island, use the ICC codes. Adoption of the updated ICC Building, Energy and Fire codes has been endorsed by key officials of the Department of Public Safety, including the State Building Inspector; the Codes and Standards Committee; and the Coalition for the Adoption of a Unified Code, which includes organizations representing architects and construction trades.

Connecticut can ensure that efficiency standards keep pace with evolving technology by requiring that revisions to the International Energy Conservation Code be adopted (without additional legislative action) within 18 months after they become available. This would not require changing the existing flexibility for adopting more complex building and fire codes.

The State of Connecticut should work with the insurance industry to encourage and enforce

[1] The upgrade residential and commercial building energy code strawman proposal, prepared by Environment Northeast, is the primary source of information on the upgraded residential and commercial building code recommendations. Significant portions of this section are excerpted verbatim from the upgrade residential and commercial building codes strawman proposal and the full strawman proposal is available in the RCI Assumptions Document (October 30, 2003).

increased energy efficiency and mitigation of GHG emissions in commercial, institutional, and residential buildings, through improvements and changes to the State's building codes. The State should encourage the insurance industry to identify changes needed in the building code that will result in reduced fire and safety losses while addressing energy efficiency and conservation (i.e., similar to what was done with torchiere lamps).

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.057 MMTCO_2e in 2010
0.212 MMTCO_2e in 2020

These GHG savings only represent savings associated with upgrading the residential building code. Savings associated with upgrading commercial buildings were not estimated because data were not available. GHG savings for the residential building code upgrade were estimated by multiplying the electricity, gas, and oil savings per household by the number of new homes built that comply with the ICC standard by the appropriate GHG emission factor. Based on a study that looked at upgrading residential building codes in Massachusetts (XENERGY, 2001), it was assumed that upgrading the codes would result in the average home achieving a 1.1 percent savings in electricity and a 13.7 percent or 18.4 percent savings in oil or natural gas, respectively, depending on the home heating fuel. It was assumed that 70 percent of new homes comply with the new standard. It was also assumed that new codes would be developed every three years and adopted by the State within two years.

It is estimated that both direct and indirect emission reductions will be achieved through this measure, as detailed in Table 14.1.

Table 14.1
Estimated Emissions Reductions from Updated Building Energy Codes

	2010	2020
Direct emissions reductions (MMTCO_2e)	0.048	0.176
Indirect emissions reductions* (MMTCO_2e)	0.009	0.036
Total emission reductions (MMTCO_2e)	**0.057**	**0.212**

*Estimates of indirect emission reductions (due to decreased electricity consumption from the electricity grid) are based on the marginal grid emission factor for NEPOOL region. See EE Model Run for the interactive effects of all electricity demand-side measures.

Estimated Costs
Costs have not been estimated.

Estimated Co-Benefits
Co-benefits have not been estimated.

Progress - Implemented
Connecticut's updated building code went into effect in September of 2004.

Supplemental Information
This measure needs to be implemented every three years.

Lead Agency
Department of Public Safety/(Office of Policy and Management)

15. Promote Energy Efficient and Energy Improvement Mortgages

Recommended Action: Promote energy efficient and energy improvement mortgages.

This measure is targeted at increasing the awareness of financial products that can encourage people to purchase energy efficient homes and includes the following activities:

- Actively promote EE mortgages (EEMs) in Connecticut. The current EEM allows homebuyers to purchase Energy Star homes that might have cost more than they would have qualified to borrow. In its initial form, the EEM was a straight 2 percent stretch that allowed the buyers of EE homes to qualify for up to 2 percent more debt because of their lowered monthly utility costs.
- Work with the Connecticut Housing and Finance Authority (CHFA), Fannie Mae, and others to develop an energy improvement mortgage (EIM), and then actively promote this product in Connecticut.[2] EIMs target homeowners who purchase existing homes or are making upgrades to their current home. This program would help finance EE improvements on existing homes, such as upgrading to efficient furnaces and adding insulation. Because most of the housing stock in Connecticut was built before 1960, this measure is likely to have a large impact if homeowners take advantage of it. This program has worked best when a home energy rating system (HERS) is available to document the relative efficiency of a home.
- Work with CHFA, Fannie Mae, and others to develop a "smart-commute mortgage," and then actively promote it in Connecticut.
- The State of Connecticut should work with the insurance and banking industries, as well as with home inspectors, to identify safety and EE measures that may mitigate GHG emissions. These measures can be addressed during real estate sales and affect insurance and bank products and services.
- The State should work with the Connecticut home inspectors trade association to provide information on energy efficiency and energy audits. It could develop or collect existing materials that deal with efficient appliances, heating and cooling systems, water heaters, and other home energy savings ideas that inspectors can distribute during home inspections.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

[2] Fannie Mae and Freddie Mac are piloting similar efforts in Alaska, Arkansas, Colorado, Iowa, Louisiana, Mississippi, Vermont, and Wisconsin.

0.005 $MMTCO_2e$ in 2010
0.014 $MMTCO_2e$ in 2020

GHG savings are only estimated for EIMs. GHG savings associated with the EEMs were not estimated because it was assumed that those savings would be accounted for under the Energy Star Homes Program. In other words, promotion of EEMs would lead to an increased participation in the Energy Star Homes Program. Data on smart-commute mortgages were not available for this exercise; therefore, the estimates below do not include savings associated with that type of product.

GHG savings were estimated by multiplying the electricity, gas, and oil savings per home by the number of new homes participating in the EIM program by the appropriate GHG emission factor (Table 15.1). Electricity savings were estimated to be 3 percent whereas fossil fuel savings were estimated to be up to 39 percent, which is based on data from an EIM program administered in Vermont. Participation in the program was estimated to be 0.5 percent of residential resale in Connecticut in the first five years and 1 percent in the subsequent years.

Table 15.1
Estimated Emissions Reductions Through Energy Efficiency and Energy Improvement Mortgages

	2010	2020
Direct emissions reductions ($MMTCO_2e$)	0.004	0.012
Indirect emissions reductions* ($MMTCO_2e$)	0.001	0.002
Total emission reductions ($MMTCO_2e$)	**0.005**	**0.014**

* Estimates of indirect emission reductions (due to decreased electricity consumption from the electricity grid) are based on the marginal grid emission factor for NEPOOL region. See EE Model Run for the interactive effects of all electricity demand-side measures.

Estimated Costs

Levelized annual costs for this measure were estimated to be –\$33/t CO_2. This estimate is based on the costs associated with the Vermont program and the cost savings associated with the reduced energy consumption.

Estimated Co-Benefits

EIMs represents an untapped tool that could potentially reduce energy consumption and GHG emissions while creating more affordable homes. They could also facilitate community revitalization by helping U.S. consumers access capital; improving the energy efficiency of existing housing stock; and helping communities retain conserved energy dollars in the local economy.

Progress – Action Pending

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency

Office of Policy and Management

16. Revise the Energy Conservation Loan Program

Recommended Action: Revise the current Energy Conservation Loan Program (ECL).

The State should improve the current ECL program, which provides low-interest loans (with the interest rate based on income) for EE improvements and is run by the Department of Economic and Community Development. The total annual savings from the existing ECL program is approximately 790,533,000 BTUs; the average cost of $875,000/year is based on the past two years. Approximately 70 percent of the money went for "energy saving" measures, 30 percent of the dollars went to energy-related but "non-energy saving" measures.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable):
GHG emissions reductions have not estimated.

Estimated Costs
Costs have not been estimated.

Estimated Co-Benefits
Co-benefits have not been estimated.

Progress – Action Pending

Supplemental Information
There is no supplemental information on this recommended action.

Lead Agency
Connecticut Department of Economic and Community Development / (Office of Policy and Management)

17. Weatherization Assistance Program

Recommended Action: Expand weatherization program.

The State should provide funding to double the amount of households served under the Federal Weatherization Assistance Program (WAP), which targets low-income households for comprehensive weatherization. The current WAP program covers between 700 and 1000 housing units per year at a cost of $2,400 to $3,000 per unit.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.006 MMTCO$_2$e in 2010
0.006 MMTCO$_2$e in 2020

The GHG savings were estimated by multiplying the electricity and fossil fuel savings per home times the number of homes participating in the program by the appropriate GHG emission factor. The savings were based on an Oak Ridge National Laboratory study (ORNL, 1994) that estimated weatherization savings to be, on average, 13.5 percent, including both electricity and fossil fuel. It was estimated that savings would persist for five years and that an additional 840 homes could be served, compared with the existing program. Estimates for direct and indirect emissions are shown in Table 17.1.

Table 17.1
Estimated Emissions Reductions Through Weatherization Program

	2010	2020
Direct emissions reductions (MMTCO$_2$e)	0.003	0.003
Indirect emissions reductions* (MMTCO$_2$e)	0.003	0.003
Total emission reductions (MMTCO$_2$e)	**0.006**	**0.006**

*Estimates of indirect emission reductions (due to decreased electricity consumption from the electricity grid) are based on the marginal grid emission factor for NEPOOL region. See EE Model Run for the interactive effects of all electricity demand-side measures.

Estimated Costs

The costs were based on the low-income WAP at a cost of approximately $2,500 per home for an annual average of 700 to 1,000 homes completed over the 2001–2003 period (DSS, 2003). The annual levelized annual costs are estimated to be $265/tCO$_2$. This estimate also accounts for the cost savings associated with reduced energy consumption.

$3 Million annually

Estimated Co-Benefits

Co-benefits include improved living conditions for low-income residents of the state.

Progress – Action Pending

Action Pending; funding sources have not been identified.

Suggested Next Steps for Implementation:

- Identify potential funding sources.

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency

Department of Social Services/(Office of Policy and Management)

Connecticut Climate Change

18. Energy Star Homes Program

Recommended Action: Double participation in the Energy Star Homes Program

This program would expand rebates under the Conservation and Load Management Fund to double participation in the Energy Star Homes program (for new construction only). The current Energy Star homes program targets approximately 15 percent of new homes at an estimated cost of $1,800 to $4,700, depending on the measures implemented. In addition, Connecticut should stay abreast of developments of the United States Green Building Council (USGBC), which is in the early stages of developing a LEED (Leadership in Energy and Environmental Design) standard for residential homes. Although the standard will not be finalized for three to five years, when it is available, Connecticut should review and determine if it should be actively promoted.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.018 MMTCO$_2$e in 2010
0.044 MMTCO$_2$e in 2020

The GHG savings were estimated by multiplying the average savings of electricity and fossil fuel use for an Energy Star home compared with an average home by the number of new Energy Star homes built by the appropriate GHG emission factor (Table 18.1). Energy Star-qualified homes incorporate savings in design and construction and, in Connecticut, use approximately 15 percent less energy for heating, cooling, water heating, lighting, and appliances than a standard home. The number of new homes in Connecticut is expected to be between 8,300 and 8,900 over the next five years.

Table 18.1
Estimated Emissions Reductions Through the Energy Star Homes Program

	2010	2020
Direct emissions reductions (MMTCO$_2$e)	0.009	0.023
Indirect emissions reductions* (MMTCO$_2$e)	0.008	0.021
Total emission reductions (MMTCO$_2$e)	**0.018**	**0.044**

*Estimates of indirect emission reductions (due to decreased electricity consumption from the electricity grid) are based on the marginal grid emission factor for NEPOOL region. See EE Model Run for the interactive effects of all electricity demand-side measures.

Estimated Costs

The incremental cost to build Energy Star homes varies greatly; it depends on the house size, the region, and the prevailing construction practices in the region. The average incremental cost is $2,150. A few homes cost more; occasionally, an Energy Star-labeled home can actually be less expensive to build than its non-Energy Star counterpart (i.e., good insulation, high-performance windows, tight infiltration, and elimination of duct leakage can lower the heating and cooling load so much that smaller and less expensive HVAC equipment and more compact duct runs are able to be installed, saving significant first costs) (EPA, 2003). Based on the incremental cost and the cost savings associated with reduced energy consumption, levelized annual costs were estimated to be –\$3/tCO_2.

Estimated Co-Benefits

Co-benefits have not been estimated.

Progress – In Process

The DPUC forwarded this item to the Energy Conservation Management Board (ECMB) for its review and consideration for possible inclusion in its draft 2005 C&LM budget plan (7/04). The ECMB conducted a preliminary review of this item, and has provided initial commentary to the DPUC (10/04). The DPUC is currently conducting an administrative proceeding to approve the 2005 C&LM budget, and it intends to further examine the feasibility of including this item in the 2005 C&LM budget plan (DPUC Docket #04-11-01).

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency

Connecticut Department of Public Utility Control

19. High-Performance Schools and State-Funded Buildings

Recommended Action: Require high-performance buildings for schools and other State-funded projects.

This program would mandate high-performance energy requirements for State-funded buildings, including State facilities and local schools, as follows:

- *New construction and major renovations* of all building projects that receive some State funding (State facilities, local schools, etc.) must meet LEED standards and certify with the U.S. Green Buildings Council (USGBC). Although LEED identifies several building areas, the Energy and Atmosphere and the Indoor Environmental Quality areas have a significant GHG emissions impact. It is anticipated that these areas will be a strong focus for new buildings because they have a good payback and are easy to accomplish. After 2010, the State should consider requiring a higher level of LEED (e.g., silver, gold, or platinum). This requirement can be achieved through legislation, executive order, or the bonding process. The State will also need to provide education and outreach to towns, the Connecticut Department of Education, and others, so that they become familiar with LEED standards as well as the benefits (USGBC, 2003a,b,c).
- *Small construction and renovation projects* that use State funding should also be required to meet a high-performance building standard. Connecticut should not require LEED but should develop standards for small projects and mandate that they be met. This approach would be an alternative to the formal USGBC LEED process, which is often not supported by small project budgets. The Connecticut Department of Public Works (DPW) has begun to develop these standards and may initiate a pilot project in the near future. Some LEED principles could serve as an informal guide. For example, Connecticut could require expert review early in the design process for small projects. This approach can be achieved through legislation, executive order, or the bonding process.
- *Existing State buildings* and space leased to the State should also be required to meet certain energy standards. USGBC is piloting a new program, LEED for existing buildings, which will most likely be final in 2004. This certification program will examine ongoing maintenance and operations of building systems. Optimizing energy efficiency, renewable energy, and continual commissioning are included in the draft checklist. Once final, this program should be evaluated and, if appropriate, be promoted for private and public buildings. Certification with the USGBC could be optional, but the elements of the certification could be adopted independent of the actual certification process. This approach can be achieved through legislation or executive order.

- USGBC is developing a LEED program aimed at tenant space (LEED for Commercial Interiors). It is anticipated that this program may be final by late 2004 at the earliest. This program focuses on the core and shell of buildings. Low-emitting materials and other environmentally preferable products are included in the draft checklist. Once final, this program perhaps should be evaluated and, if appropriate, be promoted for private and public buildings that are leased. Certification with the USGBC could be optional, but the elements of the certification could be adopted independent of the actual certification process. This approach can be achieved through legislation or executive order.
- *Provide recognition* for projects that go beyond LEED certification. Currently, DEP's Green Circle Award is given for LEED-certified projects.

The State of Connecticut should work with the insurance industry to encourage it to identify green building measures that also decrease risk and liability. The insurance industry can leverage green building measures in their products (e.g., using renewables like solar can reduce fire and safety liability associated with current energy systems).

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.017 MMTCO$_2$e in 2010
0.058 MMTCO$_2$e in 2020

The GHG savings were estimated by multiplying the square footage of new State-funded buildings achieving LEED by the incremental electricity and fossil fuel savings associated with LEED by the appropriate GHG emission factor. The energy savings are based on experience with LEED buildings showing that it is relatively straightforward to achieve 20 to 30 percent reductions compared with the 1989 ICC building code standard. This savings translates into 15 to 25 percent compared with the 1999 or 2001 ICC building code standard (Steven Winters Associates, 2003). It was estimated that approximately 1.5 million square feet of qualifying buildings would be built each year. Emission reductions will include both direct and indirect emission reductions, as shown in Table 19.1.

Table 19.1
Estimated Emissions Reductions From State-Funded High Performance Buildings

	2010	2020
Direct emissions reductions (MMTCO$_2$e)	0.006	0.020
Indirect emissions reductions* (MMTCO$_2$e)	0.011	0.038
Total emission reductions (MMTCO$_2$e)	**0.017**	**0.058**

*Estimates of indirect emission reductions (due to decreased electricity consumption from the electricity grid) are based on the marginal grid emission factor for NEPOOL region. See EE Model Run for the interactive effects of all electricity demand-side measures.

Estimated Costs

Although many green buildings can be constructed at a cost comparable to or lower than that of conventional buildings, an estimate average of a 2% increase in initial costs is possible. These costs could be recouped in a relatively short time period. Given the incremental cost and the cost savings associated with reduced energy consumption, annual levelized costs for this measure were estimated to be \$464/tCO_2.

Estimated Co-Benefits

Numerous co-benefits are associated with implementing LEED. In addition to promoting energy efficiency and renewable energy, LEED promotes sustainable site planning, safeguarding water and water efficiency, conserving materials and resources, and improving indoor environmental quality. In addition to environmental benefits, LEED offers economic benefits, health and safety benefits, and community benefits. Savings associated with these benefits were not quantified.

Heschong Mahone Group (1999) found that well-designed high performance schools with daylighting correlated with improved student test scores. In addition, high performance building practices enhance acoustics, creating a better learning environment. Finally, the use of products with lower levels of volatile organic compounds (VOCs) should reduce the potential for "sick building syndrome" and create a better working and learning environment for employees, teachers, and students.

Progress – In Process

The Office of Policy and Management (OPM) held a public education seminar in October 2004 on high performance schools, and is planning another for 2005, to be held under the auspices of Rebuild America.

The Connecticut Green Building Council is planning to put together a report on high performance green schools in Connecticut. This nonprofit organization intends to initiate a public process to identify the opportunities and barriers with high performance green schools in Connecticut. It is anticipated that this report will be complete by the end of 2005.

Suggested Next Steps for Implementation:

- Consider legislation mandating state-funded projects meet particular green building standards.
- Consider requiring the Department of Education to evaluate all school projects for meeting green building standards.

Supplemental Information

There is not supplemental information on this recommended action.

Lead Agency

Office of Policy and Management

20. High-Performance Buildings: Privately Funded Projects

Recommended Action: Encourage high-performance buildings in privately funded projects.

This recommendation includes the following measures:

- Encourage privately financed new construction and renovation to be high-performance buildings by certifying LEED standards.
- Encourage privately occupied existing buildings and leased space to be high-performing (using future USGBC LEED programs or other programs to be determined).
- Provide tax credits and other financial incentives for green buildings, similar to those offered in New York and Massachusetts.
- Provide awards program to recognize LEED buildings or use other measure to determine high performance.
- Work with lending institutions and insurers to identify incentives that they could offer for high-performance buildings (i.e., preferred rates, utilizing lifecycle costs)
- Encourage municipalities to promote LEED or other high-performance standard for projects within their jurisdiction that require local review.

The State of Connecticut should work with the insurance industry to encourage them to identify green building measures that also decrease risk and liability and to leverage their use in insurance products (e.g., using renewables like solar, could reduce fire and safety liability associated with current energy systems).

Results of Assessments for 2010, 2020, and Beyond (Where Applicable):

Estimated GHG emissions reductions: **0.019 MMTCO$_2$e in 2010** **0.052 MMTCO$_2$e in 2020**

The GHG savings were estimated by multiplying the square footage of new high-performance buildings by the incremental electricity and fossil fuel savings, by the appropriate GHG emission factor. The energy savings are based on experience with LEED buildings showing that it is relatively straightforward to achieve 20 to 30 percent reductions compared with the 1989 ICC building code standard. This savings translates into 15 to 25 percent compared with the 1999 or 2001 ICC building code standard (Steven Winters Associates, 2003). It was estimated that approximately 1.2 million square feet per year would be built under this program. Emission reductions will include both direct and indirect emission reductions, as shown in Table 20.1.

Table 20.1 Estimated Emissions Reductions From Privately Funded High-Performance Buildings		
	2010	**2020**
Direct emissions reductions ($MMTCO_2e$)	0.007	0.018
Indirect emissions reductions* ($MMTCO_2e$)	0.012	0.034
Total emission reductions ($MMTCO_2e$)	**0.019**	**0.052**

*Estimates of indirect emission reductions (due to decreased electricity consumption from the electricity grid) are based on the marginal grid emission factor for NEPOOL region. See EE Model Run for the interactive effects of all electricity demand-side measures.

Estimated Costs

Although many green buildings can be constructed at a cost comparable to or lower than that of conventional buildings, an average of 2 to 7 percent increase in initial costs is estimated (USGBC, 2002). Those costs could be recouped in a relatively short period of time. Given these incremental costs and the cost savings associated with the reduced energy consumption, annual levelized costs for this measure were estimated to be $\$343/tCO_2$.

Estimated Co-Benefits

Numerous co-benefits are associated with implementing LEED. In addition to promoting energy efficiency and renewable energy, LEED promotes sustainable site planning, safeguarding water and water efficiency, conserving materials and resources, and improving indoor environmental quality. In addition to environmental benefits, LEED promotes economic benefits, health and safety benefits, and community benefits. Savings associated with those benefits were not quantified.

Progress – In Process

While advancing the LEED standard is currently not addressing privately owned buildings, progress is being made to address that sector in other ways. Through a grant from US DOE's Rebuild America program and funding provided by the State's electric utilities through the C&LM fund, privately owned commercial buildings in SW CT are being benchmarked. A subset of these buildings will undergo retro-commissioning, (the process of evaluating the building's systems to ensure that the building is operating as was originally intended when designed and built). The project will also include training facility managers, providing education, and development of case studies and other tools to permit easy replication of the project in other regions of the state.

Supplemental Information

There is not supplemental information on this recommended action.

Lead Agency

Office of Policy and Management

21. Shared Savings Program for Government Agencies

Recommended Action: Revise the shared savings program for government agencies.

The State should revise the program referenced in CGS 16a-37c so that savings are claimed under more controlled terms and the program is workable within the OPM budget. It should then promote its use by State agencies. In addition, the State should review the Federal Energy Management Program (FEMP) Super Energy Savings Performance Contracts program and consider adopting a similar program for Connecticut State agencies. A portion of the savings should go toward the purchase of green power for State agencies.

In addition to the shared savings program, a joint program to provide technical assistance to benchmark all qualifying State facilities in Connecticut over the next 5 years is recommended. This program will provide valuable information to the State during this period of budget crises and cost containment.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.124 MMTCO_2e in 2010
0.198 MMTCO_2e in 2020

These savings were based on the assumption that State buildings can reduce energy use by 20 percent in 2010 and 35 percent in 2020. OPM has provided energy use data for State government facilities. The data include annual use by agency for fiscal years 2001 and 2002. State energy consumption was estimated to grow at the same rate as total State energy consumption: 1.1 percent. This measure will result in both direct and indirect emission reductions (Table 21.1).

Table 21.1
Estimated Emissions Reductions From Government Shared-Savings Programs

	2010	2020
Direct emissions reductions (MMTCO_2e)	0.026	0.039
Indirect emissions reductions* (MMTCO_2e)	0.098	0.160
Total emission reductions (MMTCO_2e)	**0.124**	**0.198**

*Estimates of indirect emission reductions (due to decreased electricity consumption from the electricity grid) are based on the marginal grid emission factor for NEPOOL region. See EE Model Run for the interactive effects of all electricity demand-side measures.

Estimated Costs

Costs have not been estimated.

Estimated Co-Benefits
Co-benefits have not been estimated.

Progress - In Process
Executive Order 32 passed revising the shared savings program to facilitate implementation. It also requires a portion of the savings to go to green power purchases for state agencies. Internal meetings have taken place to determine the best strategy for full implementation.

Supplemental Information
There is not supplemental information on this recommended action.

Lead Agency
Office of Policy and Management

22. Training of Building Operators

Recommended Action: Train building operators to use maintenance approaches that improve energy efficiency.

Ramp up existing Connecticut training programs to serve a larger number of building operators (including maintenance technicians, lead custodians, maintenance foremen, and plant engineers), who typically have little formal training in building efficiency. Currently, Connecticut Light & Power (CL&P) and United Illuminating (UI) offer training courses for building operators that are funded in part by the Conservation & Load Management Fund. Participants pay a fee to enter. Sessions are approximately once per month; maximum participation is 30 students. As a result of the great interest from building operators, the program is oversubscribed. The training includes such topics as where to find and how to use building codes; how to read utility meters and bills; how to maximize heating, ventilation, and air conditioning controls; when to call for help; and how to improve a host of other operation and maintenance techniques.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.032 MMTCO$_2$e in 2010

0.033 MMTCO$_2$e in 2020

GHG savings were estimated by multiplying the number of students trained per year by the average annual electricity and fossil fuel savings per student by the appropriate GHG emission factor (Table 22.1). These average annual energy savings were based on average savings reported from program evaluation (NEEP, 2002), including electricity savings of 238,500 kWh per student, and fossil fuel savings of 930 MMBtu per student. Savings are expected to be generated in the year after training and last for only 5 years.

Table 22.1
Estimated Emissions Reductions From Building Operator Training

	2010	2020
Direct emissions reductions (MMTCO$_2$e)	0.011	0.011
Indirect emissions reductions* (MMTCO$_2$e)	0.020	0.022
Total emission reductions (MMTCO$_2$e)	**0.032**	**0.033**

*Estimates of indirect emission reductions (due to decreased electricity consumption from the electricity grid) are based on the marginal grid emission factor for NEPOOL region. See EE Model Run for the interactive effects of all electricity demand-side measures.

Estimated Costs

Levelized annual costs were estimated to be –\$159/tCO_2, which is based on an estimated cost per student of \$1,400 for an eight-course session and the financial savings associated with reduced energy use.

Estimated Co-Benefits

Co-benefits have not been estimated.

Progress – In Process

The DPUC forwarded this item to the Energy Conservation Management Board (ECMB) for its review and consideration for possible inclusion in its draft 2005 C&LM budget plan (7/04). The ECMB conducted a preliminary review of this item, and has provided initial commentary to the DPUC (10/04). The DPUC is currently conducting an administrative proceeding to approve the 2005 C&LM budget, and it intends to further examine the feasibility of including this item in the 2005 C&LM budget plan (DPUC Docket #04-11-01).

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency

Connecticut Department of Public Utility Control

23. Green Campus Initiative

Recommended Action: Promote a "green campus initiative" with Connecticut institutions of higher learning and secondary schools.[3]

Promote a "green campus initiative" with all Connecticut colleges, universities, and private and secondary schools to minimize environmental impact and create "learning labs" for sustainability. This program would develop and support an effective process to promote energy and environmental sustainability with Connecticut educational institutions. The program would provide leadership and resources to engage schools and interest them in taking a comprehensive approach to lowering energy use and cost, reducing GHGs from building systems and transportation, improving water and wastewater management, increasing recycling, reducing the need for hazardous waste disposal, and promoting procurement of environmentally friendly products. The program would use a team-based approach that engaged administrative staff, students, faculty, and technical experts.

The program would be implemented over the course of five years in Connecticut's 48 colleges and universities. The measures could be funded through the Connecticut Conservation and Load Management Fund, the proposed "oil and natural gas conservation fund," or the Connecticut Clean Energy Fund. In addition, financing for comprehensive renovation programs could be made available through performance contracts by energy service companies.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.183 MMTCO$_2$e in 2010
0.190 MMTCO$_2$e in 2020

Energy savings (Table 23.1) were estimated using the Department of Energy's "Energy Smart Guide to Campus Cost Savings." An average potential cost reduction of 35 percent and 25 percent for electric savings and fossil fuels savings, respectively, was estimated. Savings were calculated using regional-average data for three categories of schools (savings per student), and the number and student enrollment of Connecticut colleges and universities.

[3] The green campus initiatives strawman proposal, prepared by the Institute for Sustainable Energy, is the primary source of information on the green campus initiatives recommendations, costs, and benefits. Significant portions of this section are excerpted verbatim from the green campus initiative strawman proposal, and the full strawman proposal is available in the RCI Assumptions Document (October 30, 2003).

The square footage of and actual energy bills for Connecticut colleges and universities are not currently available. Energy-use projections were calculated using DOE regional inventory data on costs per student and applying those values to the "full-time equivalent" student enrollment in Connecticut colleges and universities, as provided by the U.S. Department of Education. It was estimated that 20 percent of the market would be enrolled in the program each year.

Table 23.1
Estimated Emissions Reductions From Green Campus Initiatives

	2010	2020
Direct emissions reductions ($MMTCO_2e$)	0.084	0.084
Indirect emissions reductions* ($MMTCO_2e$)	0.099	0.106
Total emission reductions ($MMTCO_2e$)	**0.183**	**0.190**

*Estimates of indirect emission reductions (due to decreased electricity consumption from the electricity grid) are based on the marginal grid emission factor for NEPOOL region. See EE Model Run for the interactive effects of all electricity demand-side measures.

Estimated Costs

The program is estimated to include the following costs:

- Program development: $50,000 (first year only)
- Outreach, training, and rollout: $50,000 annually
- GHG and energy inventory of all Connecticut colleges and universities: $250,000
- Administration, benchmarking and action plan development: $1,000,000 annually.

The cost of the energy savings measures were not estimated.

Estimated Co-Benefits

Additional environmental benefits, which were not quantified, will be derived beyond energy conservation by instituting improved recycling, sustainable-purchasing policies, new building design, water conservation, and other activities outlined above. See stakeholder report appendix for more details.

Progress – In Process

During the past year considerable activity has occurred 1) 17 Connecticut universities have signed the New England Board of Higher Education (NEBHE) pledge to support the NEG-ECP 2001 Climate Change Action Plan, 2) 3 Connecticut universities have joined the Clean Air Cool Planet's Campuses for Climate Action program and 3) The first meeting of the CT Green Campus Initiative occurred which included participation by Yale, University of Connecticut, Connecticut College, St. Joseph College, ECSU, ISE, and DEP.

Suggested Next Steps for Implementation

- Continue to hold quarterly meetings of the CT Green Campus Initiative and promote voluntary actions by colleges.

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency

Connecticut Department of Environmental Protection and the Institute for Sustainable Energy at Eastern Connecticut State University

24. Energy Benchmarking and Tracking Program for Municipal Buildings

Recommended Action: Promote energy measurement, tracking, benchmarking, and strategic planning with municipal facilities.[4]

This program would promote energy measurement, tracking, benchmarking, and strategic planning with municipal facilities, including public schools, to increase their participation in existing and new energy conservation and environmental programs and raise their energy efficiency and Energy Star level. It would involve creating a program that engages communities in developing energy-sustainability plans and implementing those plans by measuring, tracking, and assessing their current efficiency levels. Communities also would use existing energy conservation and environmental programs to improve targeted inefficient municipal facilities.

The program would include the following components:

- Energy and emission inventory and measurement, including benchmarking and ongoing tracking of municipal office buildings and schools
- Identification and ranking of inefficient facilities and development of a strategic plan for improving energy efficiency to Energy Star performance levels
- Prescriptive solutions, such as coordinating participation in existing State, federal, and utility conservation programs; changing local public policy; providing energy education for better understanding of energy, environmental, and cost-reduction issues and options; enhanced energy management and ongoing energy accounting and monitoring to achieve reduction of energy costs in public buildings; addressing difficult environmental issues; and providing energy education for department heads and maintenance staff
- Energy and environmental education programs throughout the public schools.

The proposed program is estimated to be implemented over the next five years. It will target 169 towns incorporating 161 secondary schools, 170 middle or junior high schools, 654 elementary schools, and more than 500 municipal office buildings. Funding for retrofits for electric saving measures could come from the Conservation and Load Management Fund. Funding for retrofits to fossil-fueled building systems should be included in the proposed natural gas and oil

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[4] The energy measurement, benchmarking and tracking program for municipal buildings strawman proposal, prepared by the Institute for Sustainable Energy, is the primary source of information on the energy measurement, benchmarking and tracking program recommendations, costs and benefits. Significant portions of this section are excerpted verbatim from the energy measurement, benchmarking and tracking program for municipal buildings strawman proposal and the full strawman proposal is available in the RCI Assumptions Document (October 30, 2003).

conservation funds. Total building renovation for energy performance improvements and building envelope improvements can be financed by municipal bonds, performance contracts, or the proposed pay-as-you-save strategy.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.119 MMTCO$_2$e in 2010
0.190 MMTCO$_2$e in 2020

Annual energy savings are estimated to be 20 percent in Year 5 and 35 percent in Year 10 (Table 24.1). Savings would be derived from both electric efficiency improvements and fossil fuel equipment upgrades. It was estimated that public schools represent the greatest opportunity for savings in this sector. Savings were estimated using 2003 Connecticut Department of Education data on total schools by type and total students by grade level. The estimate was extrapolated on a cost per student basis using a representative sample of 30 schools benchmarked in 2003. Savings projections were estimated using EPA Energy Star Portfolio Manager Benchmarking and the DOE High-Performance Schools manuals.

A comparable levels of savings can be achieved in the 500 or so Connecticut public buildings, including town office buildings, police stations, fire stations, recreation centers, senior citizens centers, and libraries. However, data for projection are not readily available, so those estimates were not included here.

Table 24.1
Estimated Emissions Reductions From Energy Measurement, Benchmarking, and Tracking Program for Municipal Buildings

	2010	2020
Direct emissions reductions (MMTCO$_2$e)	0.073	0.104
Indirect emissions reductions* (MMTCO$_2$e)	0.046	0.086
Total emission reductions (MMTCO$_2$e)	**0.183**	**0.190**

*Estimates of indirect emission reductions (due to decreased electricity consumption from the electricity grid) are based on the marginal grid emission factor for NEPOOL region. See EE Model Run for the interactive effects of all electricity demand-side measures.

Estimated Costs

The estimated annual cost of program administration and outreach to communities is $250,000, including workshops, strategic planning meetings, reporting, and tracking. The estimated cost for benchmarking is $0.005 per square foot. Costs were not estimated for implementing the specific energy saving measures.

Estimated Co-Benefits

Co-benefits have not been estimated.

Progress – In Process

The Office of Policy and Management has provided a grant to the Institute for Sustainable Energy (ISE) at Eastern Connecticut State University to benchmark approximately 26 buildings by June of 2005. In addition, ISE has benchmarked schools in several communities: among them are Hartford, Stamford, Derby, Waterford and Windham.

Beyond the benchmarking of state and municipal facilities, there will be over 8.5 million square feet of commercial buildings benchmarked in southwestern Connecticut.

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency

Office of Policy and Management

Connecticut Climate Change

25. Pilot Fuel-Switching Project

Recommended Action: Implement a pilot fuel-switching project.

In Year 1, the State should undertake a pilot project for B20 biodiesel blend for heating applications at two State facilities (i.e., one State university campus and one State office facility). The pilot facilities will be determined with the assistance of DPW. Assuming the pilot project proves the fuel to be acceptable, the State should begin to require additional State buildings to use B20 in Year 2 and beyond. The State should also consider promoting the use of B20 for heating applications beyond State facilities (e.g., to the general public, private institutions).

The State should also consider promoting biodiesel in marine vehicles, such as boats and ferries provided air quality issues are not a concern and availability is possible. Government-operated marine vehicles could be required to use B20.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

<0.001 MMTCO_2e in 2010
<0.001 MMTCO_2e in 2020

The GHG savings were estimated by calculating the GHG emissions of two State facilities (assuming heating oil is burned) and subtracting the GHG emissions of two State facilities (assuming B20 is burned) (Table 25.1). It was assumed that additional buildings would switch in 2006 and in 2011 following positive results of the pilot program.

Table 25.1
Estimated Emissions Reductions From Pilot Fuel-Switching Project

	2010	2020
Direct emissions reductions (MMTCO_2e)	<0.001	<0.001
Indirect emissions reductions* (MMTCO_2e)	NA	NA
Total emission reductions (MMTCO_2e)	**<0.001**	**<0.001**

*Estimates of indirect emission reductions (due to decreased electricity consumption from the electricity grid) are based on the marginal grid emission factor for NEPOOL region. See EE Model Run for the interactive effects of all electricity demand-side measures.
NA: not applicable

Estimated Costs

Annual levelized costs were estimated to be –\$123/tCO_2, given the incremental cost between biodiesel and heating oil.

Although using biodiesel in transportation emissions has been associated with increased NOx emissions, this is not the case with the stationary application of this fuel.

Costs to do a one-year pilot project at ECSU are estimated to be about $40,000, which includes emissions testing.

Estimated Co-Benefits

Co-benefits have not been analyzed, however reduced particulate matter could have positive impacts on public health.

Progress – In Process

Funding has been identified to begin a pilot project utilizing a B20 blend (20% biodiesel blended with 80% #2 fuel oil) for space heating for one year. The pilot, which will commence in early 2005, will identify all regulatory steps needed for a facility to use biodiesel (i.e., permit modifications), gather data on fuel efficiency and emissions factors and monitor air emissions associated with using a B20 blend, test fuel quality, impacts on equipment (maintenance and performance satisfaction), and costs. Eastern Connecticut State University, South Campus is the site for the pilot; between 12,500 – 21,000 gallons of fuel would be utilized during the pilot project, 20% of which would be biodiesel.

Suggested Next Steps for Implementation

- Develop a work plan, authorize a Public Service Agreement (PSA) between CT DEP and ECSU, contract for fuel and other services in order to begin pilot.
- Review results at end of pilot (approximately 15 months from start date).
- Initially select projects that provide distributed generation sized to satisfy the need and are below de minimis levels needed for environmental review.
- If results of pilot are positive, consider expansion within context of permitting requirements.
- Budgetary concerns will need to be addressed if increased fuel costs for biodiesel blend.

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency

Connecticut Department of Environmental Protection

26. Remove Current Barriers to Third-Party Load-Management Techniques

Recommended Action: Remove current barriers to third-party load-management techniques.[5]

The State should overcome existing regulatory barriers that prohibit the increased market diffusion of third-party load management for non-intrusive commercial loads.[6] Many regulatory barriers prevent the mass penetration of real-time electric information and load-management services from penetrating the mass commercial markets. Those barriers can be easily overcome but require fundamental structural changes to occur. Recommended changes include:

3. *Integration of information and load management solutions into the local distribution company (LDC) bill.* Allowing customers to select these services through their local utility would facilitate streamlined penetration into the mass commercial markets. They could be included as an optional part of a comprehensive standard-offer generation rate or in some other fashion. This option is viable because real-time energy-use information and proactive load management have significant value to the commodity suppliers or marketers and could reduce customer bills.
4. *Ability of demand resources to participate in the wholesale electric markets.* The wholesale electric generation market today is currently a bid-only market in which dispatching of resources is managed by the independent system operator(s) with no consumer participation. The current emergency-response programs are the only opportunity for loads to participate in the wholesale commodity markets. These programs provide only limited opportunity in instances in which the electricity system is constrained to the point of affecting reliability. Until a robust day-ahead bidding market is developed, consumer participation will be limited, resulting in potential price instability and variability. The development of these markets is critical to the development of a competitive electric industry.
5. *Including an EE component in the alternative transitional standard offer.* Non-intrusive load reductions are implemented when the reductions in specific energy use are not intrusive to occupants; they typically occur without occupant involvement or knowledge that they are taking place. Typical examples of these types of solutions include lighting dimming at slight

[5] The third-party load management techniques strawman proposal, prepared by NXEGEN, is the primary source of information on third-party load management techniques recommendations, costs and benefits. Significant portions of this section are excerpted verbatim from the third-party load management techniques strawman proposal and the full strawman proposal is available in the RCI Assumptions Document (October 30, 2003).

[6] Non-intrusive loads refer to reductions in specific energy use that are not intrusive to occupants and typically occur without occupant involvement or knowledge that they are taking place. Typical examples of these types of solutions include dimming lights during peak hours where ambient light levels are high and planned cycling of refrigeration compressors.

reductions during peak hours when ambient light levels are high and planned cycling of refrigeration compressors.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.018 MMTCO_2e by 2010
0.033 MMTCO_2e by 2020

Emission reductions were calculated by multiplying the market potential for reductions by the marginal CO_2 emission rate for the regional electricity grid (Table 26.1). The potential non-intrusive commercial load in Connecticut is approximately 4 to 6 percent of the market size, or 100 to 150 MW (NXEGEN, 2003). The relevant market segments include the commercial (office, retail, warehouse), industrial (process, fabrication), and municipal (city buildings, police, fire, library, schools) markets.

Table 26.1
Estimated Emissions Reductions Through the Removal of Regulatory Barriers to Third-Party Load Management Techniques

	2010	2020
Direct emissions reductions (MMTCO_2e)	NA	NA
Indirect emissions reductions* (MMTCO_2e)	0.018	0.033
Total emission reductions (MMTCO_2e)	**0.018**	**0.033**

*Estimates of indirect emission reductions (due to decreased electricity consumption from the electricity grid) are based on the marginal grid emission factor for NEPOOL region. See EE Model Run for the interactive effects of all electricity demand-side measures.
NA: not applicable

The current utility emergency-response programs are offering a customer rebate of $500 per KW to participate in real-time monitoring and load-management services. This incentive level is adequate. The incentive is calculated as a percentage of the long-term market benefits that can be derived from the solutions.

Estimated Costs

Costs have not been estimated.

Estimated Co-Benefits

Co-benefits have not been estimated.

Progress – In Process

On segments 1 & 2 of this recommendation action is still pending. On segment 3: Energy Efficiency Optional Service under the Transitional Standard Offer, the DPUC intends to conduct an administrative proceeding to develop this program following the implementation of the Clean Energy Option (RA 49) in the first quarter of 2005, with the objective of having the energy efficiency program in place by the end of 2005.

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency
Connecticut Department of Public Utility Control

27. State Procurement of Environmentally Preferable Services and Products

Recommended Action: Consider increasing preferences for products and services that decrease GHG emissions and/or mitigate climate change impact.

Several policies currently require the State of Connecticut to consider environmentally preferable products, recycled content, and other "green" goods and services. For example, CGS 4a-67h requires Connecticut Department of Administrative Services to establish procedures that promote procurement of environmentally preferable products and services, and an environmental purchasing advisor position was created to develop the program. State agencies should consider increasing preferences for products and services that decrease GHG emissions and/or mitigate the impact of climate change.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)
GHG emissions reductions have not been estimated.

Estimated Costs
Costs have not been estimated.

Estimated Co-Benefits
Co-benefits have not been estimated.

Progress – Implemented
Many EPP contracts and products available through DAS have EPP requirements. Municipalities can also piggy back on these contracts. Climate Change Showcase at Connecticut Shops Expo in 2004 highlighted these program benefits and opportunities.

Supplemental Information
There is no supplemental information on this recommended action.

Lead Agency
Department of Administrative Services

28. Review New England Demand Response Initiative (NEDRI)

Recommended Action: Review the New England Demand Response Initiative (NEDRI) recommendations.

The State should consider the NEDRI report as a whole. The New England Independent System Operator (NE ISO) and various State DPUCs, wires companies, and various states' DEP worked together to develop a series of recommendations over an 18-month period. The NEDRI report provides a good overview and identifies many measures that can be implemented at the federal and State level. In addition, the Federal Energy Regulatory Commission (FERC) plans to use NEDRI as a model for other state ISOs. The working group cannot recommend the whole package of measures because of time limitations and potential conflict of interest by select stakeholders (e.g., DPUC and DEP cannot prejudge proposals that may come before them).

Results of Assessments for 2010, 2020, and Beyond

GHG emissions reductions have not been estimated.

Estimated Costs

Costs have not been estimated.

Estimated Co-Benefits

Co-benefits have not been estimated.

Progress – Action Pending

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency

Connecticut Department of Public Utility Control and the Connecticut Department of Environmental Protection

29. Promote Voluntary Programs and Actions

Recommended Action: Promote voluntary programs and actions.

The State should strongly promote voluntary programs and actions for the appropriate sectors. State agencies would need to play a coordinating role and devote some resources to this. Partners who have joined these programs could also be supportive by playing a mentoring role. Although some programs already exist at the national level, opportunities to develop additional programs in Connecticut may exist. The Connecticut State government does not necessarily devote resources toward promoting participation in existing national programs.

The following voluntary programs could be included in this measure:

For Municipalities

- Cities for Climate Protection (ICLEI program)
- Rebuild America (DOE program run by Connecticut OPM)

For Business and Industry

- Climate Leaders (EPA program)
- GHG Protocol Initiative (WRI Program)
- Green Power Market Development Group (WRI Program)
- Working 9 to 5 on Climate Change (WRI Program)
- Best Practices Program (DOE)
- Connecticut Sustainable Business Network (Sustainable Step New England program)
- Energy Star Benchmarking (EPA program)
- Negotiated Agreements (These would need to be custom developed with DEP or another regulatory agency with individual companies; they are a policy mechanism.)
- SF_6 Reduction Program (EPA program)

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)
GHG emissions reductions have not been estimated.

Estimated Costs
Costs have not been estimated.

Estimated Co-Benefits
Co-benefits have not been estimated.

Progress – In Process

Efforts to promote participation in existing programs have resulted in:

- 16 CT towns joining the International Council for Local Environmental Initiatives (ICLEI) Cities for Climate Protection program;
- commitments from CT towns, the state, and faith communities join the 20% by 2010 Clean Energy Campaign of SmartPower and purchase over 100 GWh of electricity from clean energy by 2010;
- the launch of the new CT Clean Energy Communities program by CCEF, SmartPower, and CCM;
- 3 CT universities joining Clean Air-Cool Planet's Campuses for Climate Action program;
- 30 CT towns participating in Rebuild America program;
- EPA holding its Climate Leaders conference in CT in October 2004 (first time outside of Washington, D.C.) with DEP Acting Commissioner as a speaker and several CT companies are members.
- Presentation and promotion of EPA Energy Star program geared to hospitals and medical offices at 2 separate fall workshops for this sector; The Institute for Sustainable Energy and OPM also presenting workshops throughout the state on EnergyStar benchmarking, beginning Fall 2004.
- CT also joined EPA's Green Power Partnership program.

Supplemental Information

See websites of various voluntary programs for further information.

Lead Agency

Connecticut Department of Environmental Protection

30. Encourage Clean Combined Heat and Power

Recommended Action: Encourage clean combined heat and power.[7]

The goal of this policy is to push the development of new, clean, combined heat and power (CHP) electricity generation using existing and available technology, which is extremely clean and efficient. The policy consists of two elements:

6. Reducing the current barriers to development of CHP projects (e.g., permitting and interconnection hurdles, standby power rates)
7. Exploring further mechanisms to promote CHP, such as a CHP portfolio standard.

With regard to the second recommendation, the stakeholder group explored one mechanism to promote CHP in Connecticut: mandating that a small but growing percentage of the portfolio of power delivered to Connecticut customers come from clean CHP. In effect, this policy could be considered a third class of power generation within the Connecticut RPS (Class 1 Renewables, Class 2 Renewables, and Class 3 CHP). Under such a measure, a CHP portfolio standard would be developed that mandates that a minimum portion of the electric power sold by suppliers in the State come from clean CHP generation. The power generation should be tracked using the GIS system, with certificates generated for every MWh of production. The certificates could be traded among retail providers of electricity to satisfy the portfolio standard. CHP generation eligible for the portfolio standard would have to meet minimum standards for emissions and efficiency. The portfolio standard would begin with small percentages of power having to be generated by CHP sources and would increase with time.

The following is an outline of a proposed CHP portfolio standard.[8] The stakeholder group agreed to further explore the details of this mechanism, including the start-up date (e.g., postponing until 2007), the required emissions rate to qualify as clean CHP, and the percentage targets required each year.

[7] The clean combined heat and power strawman proposal, prepared by Environment Northeast and United Technologies, is the primary source of information on the clean combined heat and power recommendations. Significant portions of this section are excerpted verbatim from the clean combined heat and power strawman proposal and the full strawman proposal is available in the RCI Assumptions Document (October 30, 2003).

[8] The portfolio standard draws on the current Connecticut RPS policy, the work and recommendations of the European Union for the promotion of cogeneration (http://europa.eu.int/scadplus/leg/en/lvb/l27021.htm), and the proposed framework for a "European CHP Certificate Trading System" presented by Oko-Institute at the ECoCerT workshop in February 2003 (http://www.cogen.org/Downloadables/Presentations/Ecocert/Presentation_Ecocert_Oekoinstitute.pdf).

State Certification and Review (Reducing Barriers to CHP Development)

- Facilities must be certified by DPUC as eligible. (Facility owners are responsible for ensuring and documenting compliance with emissions and efficiency requirements.)
- The Connecticut Siting Council will expedite review of eligible CHP facilities for interconnection.
- The DEP may expedite review of eligible CHP facilities for permitting.
- Connecticut should request that FERC set standby power prices that promote distributed generation (DG) and CHP construction (economically justified).

Definition of Eligible CHP Facilities

- Facilities must be located in the State of Connecticut.
- Minimum average quarterly system efficiency must be greater than or equal to 70 percent.
  - This is a total efficiency measure based on electricity and useful heat, so ultra-high-efficiency electricity generation that met the 70 percent minimum efficiency would also qualify.
  - The facility owner must document a heat load and the use of that heat to meet the efficiency target.
  - The facility owner must track system efficiency (metering) and document that the heat was used and not dissipated through the use of cooling towers, vents, or exhaust stacks.

Must Meet or Exceed the Following Emissions Requirements (Under Control)

- These emissions numbers may require additional analysis.
- The following emissions rates are per megawatt hour for electricity output alone:
  - NOx less than or equal to 0.15 lbs/MWh
  - SO_2 less than or equal to 0.05 lbs/MWh
  - PM_{10} less than or equal to 0.08 lbs/MWh
  - CO_2 less than or equal to 1350 lbs/MWh.
- Documentation must be completed on a quarterly basis and submitted to DEP and/or DPUC.

Generation of CHP Certificates

- Facilities that are certified by DPUC as being eligible will generate one CHP certificate per MWh of electricity generated.
- The certificates will be the same as the New England GIS certificates for the facility and will be traded and tracked using the GIS system.
- In the same method as renewable certificates, CHP certificates can be generated at the facility even if power is not sold into the grid, as long as approved metering is used.

CHP Portfolio Standard Requirements

- Every retail supplier of electricity will be required to purchase CHP certificates to satisfy the CHP percentage mandated by this portfolio standard.
- GIS certificates can only count toward one of the portfolio standards. Fuel cells, which may qualify for both Class 1 renewables and the CHP standard, would only be allowed to count toward one requirement. No double counting will be permitted.
- The schedule and percentage requirements should begin at 0.50 percent in 2005 and increase at a rate of 0.5 percent per year until they reach 8 percent in 2020; the percentage is based on the portion of total delivered kilowatt hours.
- Failure to meet the portfolio requirements would lead to a payment by the retail supplier equal to $0.02/kWh to the Connecticut Clean Energy Fund for the development of high efficiency, clean CHP systems within the State (money earmarked for this use).

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.532 MMTCO$_2$e (based on 4 percent CHP in 2010) in 2010
1.414 MMTCO$_2$e (based on 8 percent CHP in 2020) in 2020

Indirect emission reductions were calculated by estimating the amount of electricity the new CHP units generate. It is assumed that the new CHP generation would be offsetting an equivalent amount of electricity from the grid. The amount of total delivered kilowatt hours from new CHP units was estimated by subtracting the delivered kWh from CHP plants built under the Reference Case scenario from the total delivered kWh required by this portfolio standard. To estimate savings, the resulting kWh was multiplied by the marginal CO_2 emission factor for the electricity grid.

The direct emissions reductions were estimated by subtracting the CO_2 emissions generated from the new CHP plants from the CO_2 emissions generated by the business-as-usual (BAU) boilers, which were assumed to be oil fired (Table 30.1).

Table 30.1
Estimated Emissions Reductions Through Clean Combined Heat and Power Policies

	2010	2020
Direct emissions reductions (MMTCO$_2$e)	0.009	0.025
Indirect emissions reductions* (MMTCO$_2$e)	0.523	1.389
Total emission reductions (MMTCO$_2$e)	**0.532**	**1.414**

*Estimates of indirect emission reductions (due to decreased electricity consumption from the electricity grid) are based on the marginal grid emission factor for NEPOOL region. See EE Model Run for the interactive effects of all electricity demand-side measures.

Estimated Costs

Costs have not been estimated.

Estimated Co-Benefits

Co-benefits have not been estimated.

Progress – Action Pending

Supplemental Information
There is no supplemental information on this recommended action.

Lead Agency
Connecticut Department of Environmental Protection and the Connecticut Clean Energy Fund

31. Restore Conservation and Load Management Fund

Recommended Action: Restore the Conservation and Load Management Fund.

The State should restore full funding ($87 million) to the Conservation and Load Management Fund. BAU assumes $50 million in Years 1 and 2 and $60 million in years beyond that. In addition, the State should consider expanding the fund in light of the findings of a recent Energy Conservation Management Board (ECMB) study. Funds should be directed and applied to the intended use for the lifetime of the fund.

The Energy Efficiency and Conservation Potential study (GDS Associates and Quantum Consulting, 2003) highlights specific cost-effective measures that could be implemented within the next 10 years to reduce electricity consumption, assuming available funding from the ECMB. Special attention should be given to EE measures in the Commercial and Industrial (C/I) sectors (e.g., standard retrofit/lost opportunity and C/I incentives and rebates).

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.279 $MMTCO_2e$ in 2010
0.606 $MMTCO_2e$ in 2020

Because the fund targets measures that reduce electricity consumption, the emission reductions are indirect (Table 31.1).

Table 31.1
Estimated Emissions Reductions Through Restoration of the Conservation and Load Management Fund

	2010	2020
Direct emissions reductions ($MMTCO_2e$)	NA	NA
Indirect emissions reductions* ($MMTCO_2e$)	0.279	0.606
Total emission reductions ($MMTCO_2e$)	**0.279**	**0.606**

*Estimates of indirect emission reductions (due to decreased electricity consumption from the electricity grid) are based on the marginal grid emission factor for NEPOOL region. See EE Model Run for the interactive effects of all electricity demand-side measures.
NA: not applicable

Estimated Costs

Costs have not been estimated.

Estimated Co-Benefits

Co-benefits have not been estimated.

Progress Update – Action Pending

Supplemental Information

There is no supplemental information for this recommended action.

Lead Agency

Connecticut Department of Public Utility Control

32. Heating Oil Conservation Fund

Recommended Action: Establish a Heating Oil Conservation Fund.

The State should establish an annual fund, based on a 3 percent surcharge on oil consumption, that will provide approximately $20 million per year for EE investment programs for equipment and buildings that use heating oil. Funds should be directed and applied to the intended use for the lifetime of the fund. The fund's board will report annually on the cost effectiveness of the fund's programs (in terms of \$/tCO_2 saved).

Current Connecticut "public benefits" EE investment programs are funded through electricity surcharges and do not fund programs that improve the energy efficiency of heating oil consumption (due to equity issues between ratepayer classes). This action would establish new programs that would improve the efficiency of heating oil use in Connecticut.

The program would involve the following measures:

- *Creating a heating oil conservation fund and associated conservation programs*. The fund would be earmarked for improving efficiency of oil use and would focus on buildings with heating oil service for space and water heating; new construction and building renovation as well as long-lived equipment (e.g., furnaces) that operates on heating oil; and market-based programs that would stimulate EE investments in this area.
- *Creating a new oil conservation management board to supervise the program*; the board would report annually on the cost-effectiveness of the funds' programs (\$/tCO_2 saved).
- *Ensuring that funds are directed and applied to the intended use for the lifetime of the fund.*

In addition, the board would work with existing electricity conservation programs to implement fuel-blind programs that address energy efficiency and conservation of all energy sources and building envelopes (10 to 20 percent of funding). The program would also need to work closely with related programs, such as those undertaken by the National Oil heat Research Alliance (NORA), to ensure that work already being done is not duplicated.

Results of Assessments for 2010, 2020, and Beyond

The program is estimated to reduce GHG emissions by
1.02 MMTCO_2e in 2010
1.89 MMTCO_2e in 2020

These estimates are derived from assessing a 3 percent charge on residential, commercial, and industrial fuel use.[9] A percentage charge was used in order to maintain fuel neutrality between oil and natural gas (see Recommended Action #33).[10] Over the life of the project, this creates an average annual fund of $20 million. Technology costs were estimated using two methods. First, the Industrial Assessment Center (IAC) database of energy efficiency projects was queried for fuel oil projects. This provided cost effectiveness ($/gallon reduced) information for the industrial sector. Administrative costs were added for an aggregate technology cost measure. Second, technology cost effectiveness for the residential and commercial sectors were set equal to those used in the natural gas analysis (See 33. *Creating a Natural Gas Conservation Program*) on a MMBtu/$ basis. To confirm this method, the IAC costs for the industrial sector were scaled based on the relative costs of technology for each sector in the natural gas analysis. The two methods yielded consistent results.

The funds were used each year to invest in technology improvements and pay administrative costs. The size of the fund decreases every year. This is due to the success of the program: as consumption decreases, there is less purchased oil, and fewer gallons are assessed the surcharge.

The funded projects are modeled to provide benefits for fifteen years. At the end of fifteen years, consumers are expected to replace the technology with equipment that has at least the same energy efficiency.[11] This makes the energy efficiency improvements purchased through the fund permanent.

The reductions in the first years of the program are relatively large because the fund is used to fund low-cost projects. In later years, the projects become more expensive. Consumption continues to decrease, but at a slower rate.

Reasons Behind Differences From Previous Analysis and for Differences Between Sectors

There are two primary reasons for why the benefits of the new analysis substantially exceed the old analysis. The largest is due to changing the assumption that the fund will pay the entire cost of each project. The new assumption is that consumers will need to match the fund on a 1 to 1 basis (on average) in order to obtain help from the fund. Essentially, this leveraging doubles the benefits of the program. Second, the original analysis was based on a technology cost effectiveness of $29/Mcf for each sector on the natural gas side. This was converted to MMBtu and applied to the oil fund as well. Though this was accurate for the residential sector, the cost effectiveness ratios for the commercial and industrial were much lower ($9.6/Mcf and $6.9/Mcf respectively). These lower cost effectiveness ratios resulted in more GHG reductions per dollar available for these two sectors over the previous study.

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9 Fuel oil prices were taken from the EIA long term energy forecast (EIA, *Energy Outlook 2004*, January 2004).

10 The work group assumed that a uniform rate along with uniform prices on a heat rate basis would be sufficient to make the policies neutral between oil and gas.

11 The workgroup agreed that this was the most realistic option for several reasons such as voluntary equipment standards improving over time, the economics of investment in these types of projects, and the fact that some technologies are old and will no longer be available.

Several factors explain why benefits for the oil fund are substantially lower than those for natural gas. First, consumption is more heavily weighted to the residential side which is less cost-effective. Second, consumption over time in the oil sector is predicted to decrease and consumption on the natural gas side is predicted to increase. Third, the natural gas prices were adjusted beyond the conservative estimate provided by the U.S. Energy Information Administration using reliable market predictors. Similar predictors were unavailable for oil, meaning that the price was lower and that the revenue from a surcharge were commensurately lower. Finally, decreasing marginal returns on energy efficiency technology kicked in more quickly for oil consumption than natural gas. Based on the conservative price and marginal returns assumptions, the oil analysis is very conservative and benefits will likely be greater.

Estimated Costs

There are two separate costs used in the model. The first is the charge to consumers of 3 percent. Second, it is assumed that consumers will pay for a portion of the energy efficiency projects. The model assumes that consumers will pay for 50 percent. This conservative estimate was used to ensure that the benefits of the program were not overstated. It further allows flexibility, as some consumers will be able to afford a higher match, while others may not be able to provide any matching funds (e.g. low-income residential consumers). These costs are then used to pay for the technology, installation, and administration. Finally, an indirect cost, considered for the REMI modeling described below (see "Co-Benefits"), was lost revenue to oil suppliers.

Table 32.1
Details of the Heating Oil Conservation Fund Analysis

	2010	2020
Total Demand w/o Fund (millions of gallons)	773	733
Reduction in Consumption (millions of gallons)	90	167
Percentage Consumption Reduction	11.6%	22.7%
GHG reduction (MMTCO_2e)	1.02	1.89
Cumulative Cost to Create Fund*/** (millions)	$131	$320
Cumulative Benefits (millions)**	$319	$1,715
Benefit to Cost Ratio*	2.43	5.36
Net Cost Effectiveness ($/ton CO_2e)	-$184	-$737

*excludes matching funds provided by consumers; including this would cut the benefit to cost ratio in half
** cumulative beginning in 2005

Estimated Co-Benefits

Two different types of co-benefits were analyzed. First, the direct costs and benefits to consumers were run through the REMI regional economic analysis model. This model assesses the economy-wide costs and benefits of the policy. The following summarizes the REMI results:

Table 32.2
Major Economic Effects of Heating Oil Conservation Fund
(Cumulative 2005-2010)

Employment (Average Increase) *	430

Table 32.2 Major Economic Effects of Heating Oil Conservation Fund (Cumulative 2005-2010)	
Output (millions of 1996 dollars)	$82
Gross State Product (millions of 1996 dollars)	$266
Real Disposable Personal Income (millions of 1996 dollars)	$294
State Revenues (millions of 1996 dollars) [12]	$66

*Employment is the average annual increase from the baseline. Employment is not cumulative and is based on output growth.

Reductions in criteria pollutants were also analyzed, using the U.S. EPA's COBRA model (beta version). This model takes air pollution reductions, translates them into improvements in health, and then monetizes the benefits of the health improvements. The following are the combined results of the COBRA analysis for both the oil and natural gas funds:

Table 32.3 Criteria Pollutant Reductions and COBRA Results from the Heating Oil and Natural Gas Conservation Funds		
	2010	**2020**
NOx Reductions (tons)	1,848	3,025
SO2 Reductions (tons)	2,554	4,562
PM Reductions (tons)	137	207
Lives Saved	3	7
Value of Lives Saved (millions)	$18	$42
Value of Other Health Benefits (millions)*	$1.5	$3.4

* Includes non-fatal heart attacks, chronic and acute bronchitis, respiratory hospital visits, cardiovascular hospital visits, upper and lower respiratory symptoms, asthma, minor restricted activity days (code red air quality days), and work loss days.

The COBRA results were also run through the REMI model. The REMI model run includes a "compensation differential," which accounts for economic improvements due to quality of life improvements such as air pollution reductions. The following table shows the impacts of COBRA with and without the compensation differential:

Table 32.4 Major Economic Effects of Heating Oil and Natural Gas Conservation Funds Due to Health Benefits from Decreased Criteria Pollutants (Cumulative 2005-2020)		
	COBRA Only	**COBRA + Comp. Diff.**
Employment (Average Increase) *	-15	-9
Output (millions of 1996 dollars)	-$22.57	-$11.00
Gross State Product (millions of 1996 dollars)	-$12.36	-$3.98
Real Disposable Personal Income (millions of 1996 dollars)	-$5.75	$3.30
State Revenues (millions of 1996 dollars)	-$1.26	$0.81

[12] This is due to a loss in gas tax revenue, which is inevitable in any successful transportation measure.

The results of the REMI model show a small negative effect upon the economy. The negative effect is due to the loss in revenue for the medical and insurance industry. Even though Connecticut benefits economically from an increase in labor productivity and the compensating differential, the benefits do not outweigh the loss in revenue for the medical and insurance industry

Progress – In Process

Further analysis has been done to quantify co-benefits. Significant Positive economy-wide benefits have been determined. Implementation actions are pending. Legislation will be necessary.

Supplemental Information

See detailed REMI analysis report entitled "Economic Impact of Oil and Natural Gas Conservation Policies."

Lead Agency

Department of Public Utility Control

Connecticut Climate Change

33. Natural Gas Conservation Fund

Recommended Action: Establish a Natural Gas Conservation Fund.

The State should establish an annual fund, based on a 3 percent surcharge on oil consumption, that will provide approximately $30 million for EE investment programs for equipment and buildings that utilize natural gas. Funds should be directed and applied to the intended use for the lifetime of the fund. The fund's board will report annually on the cost effectiveness of the fund's programs (in terms of $\$/tCO_2$ saved).

Current Connecticut "public benefits" EE investment programs are funded through electricity surcharges and do not fund programs that improve the energy efficiency of natural gas consumption (due to equity issues between ratepayer classes). This action would establish new programs that would improve the efficiency of natural use in Connecticut. Because the programs would operate in conjunction with electric efficiency programs, joint-fuel and fuel blind initiatives could increase the ability to treat whole buildings regardless of fuel type.

The program would involve the following measures:

- *Creating a natural gas conservation fund and associated conservation programs*. The fund would be earmarked for improving efficiency of natural gas use and would focus on buildings with natural gas service for space and water heating; new construction and building renovation as well as long-lived equipment (e.g., furnaces) that operates on natural gas; and market-based programs that would stimulate EE investments in this area.
- *Creating a new natural gas conservation management board to supervise the program*; the board would report annually on the cost-effectiveness of the fund's programs ($\$/tCO_2$ saved).
- *Addressing natural gas leaks at large industrial and commercial sites*.

In addition, the board would work with existing electricity conservation programs to implement fuel-blind programs that address energy efficiency and conservation of all energy sources and building envelopes (10 to 20 percent of funding). The program would be funded at a level of $30 million annually. Funds would be directed and applied to the intended use for the lifetime of the fund.

Result of Assessments for 2010, 2020, and Beyond

Estimated GHG emissions reductions: **1.44 $MMTCO_2e$ in 2010** **2.07 $MMTCO_2e$ in 2020**

These estimates are derived from assessing a 3 percent surcharge on residential, commercial, and industrial natural gas use.[13] A percentage charge was used in order to maintain fuel neutrality between oil and natural gas (see Recommended Action #32).[14] Over the life of the project, this creates an average annual fund of $29 million. Using technology and program cost estimates developed by the American Council for Energy Efficient Economy (ACEEE),[15] the fund invested in technology improvements and paid for administrative costs. The size of the fund decreases every year. This is due to the success of the program: as consumption decreases, there is less purchased oil, and fewer gallons are assessed the 3 percent surcharge.

The funded projects are modeled to provide benefits for fifteen years. At the end of fifteen years, consumers are expected to replace the technology with equipment that has at least the same energy efficiency.[16] This makes the energy efficiency improvements purchased through the fund permanent.

The reductions in the first years of the program are relatively large because the fund is used to fund low-cost projects. In later years, the projects become more expensive. Consumption continues to decrease, but at a slower rate.

Reasons Behind Differences From Previous Analysis

There are several reasons for why the benefits of the new analysis substantially exceed the old analysis. The largest is due to changing the assumption that the fund will pay the entire cost of each project. The new assumption is that consumers will need to match the fund on a 1 to 1 basis (on average) in order to obtain help from the fund. Essentially, this leveraging doubles the benefits of the program. Second, the assumption of a 3 percent surcharge raised, on average, $30 million annually instead of $20 million. Third, the original analysis was based on a technology cost effectiveness of $29/Mcf for each sector. Though this was accurate for the residential sector, the cost effectiveness ratios for the commercial and industrial were much lower ($9.6/Mcf and $6.9/Mcf respectively). These lower cost effectiveness ratios resulted in more GHG reductions per dollar available. Finally, the average price of natural gas across sectors over the period of analysis was $9.50 instead of the original $8.50.[17]

Estimated Costs

[13] Natural gas prices were used by taking the prices developed by the Regional Greenhouse Gas Initiative (RGGI) for the electricity sector. These were used because they were deemed more accurate than the currently available EIA long term forecast. They are based on a combination of the Henry Hub and EIA price forecasts for delivered natural gas to New England. The EIA long term forecast (EIA, *Energy Outlook 2004*, January 2004) was used to adjust the price for each sector. Final delivered costs in the residential, commercial, and industrial sectors are significantly higher than the costs to electricity generators.

[14] The work group assumed that a uniform rate along with uniform prices on a heat rate basis would be sufficient to make the policies neutral between oil and gas.

[15] ACEEE, *Natural Gas Price Effects of Energy Efficiency and Renewable Energy Practices and Policies* (December 2003).

[16] The workgroup agreed that this was the most realistic option for several reasons such as voluntary equipment standards improving over time, the economics of investment in these types of projects, and the fact that some technologies are old and will no longer be available.

[17] This is based on the delivered cost to the end sectors, which includes the Henry Hub price and then adjustments for delivery to the sectors in Connecticut. See note 1.

There are two separate costs used in the model. The first is the charge to consumers of 3 percent. Second, it is assumed that consumers will pay for a portion of the energy efficiency project. The model assumes that consumers will pay for 50% of the project. This conservative estimate was used to ensure that the benefits of the program were not overstated. It further allows flexibility, as some consumers will be able to afford a higher match, while others may not be able to provide any matching funds (e.g. low-income residential consumers). These costs are then used to pay for the technology, installation, and administration. Another cost, considered for the REMI modeling described below (see "Co-Benefits"), was lost revenue to natural gas suppliers. Natural gas utilities are assumed to be compensated for any loss of revenue dedicated to capital cost recovery.

Table 33.1
Details of Natural Gas Conservation Fund Analysis

	2010	2020
Total Demand w/o Fund (Mcf)	127	135
Reduction in Consumption (Mcf)	24	34
Percentage Consumption Reduction	18.8%	25.5%
GHG reduction ($MMTCO_2e$)	1.44	2.07
Cumulative Cost to Create Fund*/** (millions)	$205	$462
Cumulative Benefits (millions)**	$979	$3,483
Benefit to Cost Ratio*	4.78	7.54
Net Cost Effectiveness ($/ton CO_2e)	-$360	-$1,450

*excludes matching funds provided by consumers; including this would cut the benefit to cost ratio in half
** cumulative beginning with 2005

Estimated Co-Benefits

Two different types of co-benefits were analyzed. First, the direct costs and benefits to consumers were run through the REMI regional economic analysis model. This model assesses the economy wide costs and benefits of the policy. The following summarizes the REMI results:

Table 33.2
Major Economic Effects of Natural Gas Conservation Fund
(Cumulative 2005-2010)

Employment (Average Increase) *	1,668
Output (millions of 1996 dollars)	$3,020
Gross State Product (millions of 1996 dollars)	$1,773
Real Disposable Personal Income (millions of 1996 dollars)	$1,459
State Revenues (millions of 1996 dollars) [18]	$314

*Employment is the average annual increase from the baseline. Employment is not cumulative and is based on output growth.

Reductions in criteria pollutants were also analyzed, using the U.S. EPA's COBRA model (beta version). This model takes air pollution reductions, translates them into improvements in health, and then monetizes the benefits of the health improvements. The following are the combined results of the COBRA analysis for both the oil and natural gas funds:

[18] This is due to a loss in gas tax revenue, which is inevitable in any successful transportation measure.

Table 33.3 Criteria Pollutant Reductions and COBRA Results from the Heating Oil and Natural Gas Conservation Funds		
	2010	**2020**
NOx Reductions (tons)	1,848	3,025
SO2 Reductions (tons)	2,554	4,562
PM Reductions (tons)	137	207
Lives Saved	3	7
Value of Lives Saved (millions)	$18	$42
Value of Other Health Benefits (millions)*	$1.5	$3.4

* Includes non-fatal heart attacks, chronic and acute bronchitis, respiratory hospital visits, cardiovascular hospital visits, upper and lower respiratory symptoms, asthma, minor restricted activity days (code red air quality days), and work loss days.

The COBRA results were also run through the REMI model. The REMI model run includes a "compensation differential," which accounts for economic improvements due to quality of life improvements such as air pollution reductions. The following table shows the impacts of COBRA with and without the compensation differential:

Table 33.4 Major Economic Effects of Heating Oil and Natural Gas Conservation Funds Due to Health Benefits from Decreased Criteria Pollutants (Cumulative 2005-2020)		
	COBRA Only	**COBRA + Comp. Diff.**
Employment (Average Increase) *	-15	-9
Output (millions of 1996 dollars)	-$22.57	-$11.00
Gross State Product (millions of 1996 dollars)	-$12.36	-$3.98
Real Disposable Personal Income (millions of 1996 dollars)	-$5.75	$3.30
State Revenues (millions of 1996 dollars)	-$1.26	$0.81

The results of the REMI model show a small negative effect upon the economy. The negative effect is due to the loss in revenue for the medical and insurance industry. Even though Connecticut benefits economically from an increase in labor productivity and the compensating differential, the benefits do not outweigh the loss in revenue for the medical and insurance industry

Progress – In Process

Further analysis has been done to quantify co-benefits. Significant Positive economy-wide benefits have been determined. Implementation actions are pending. Legislation will be necessary.

Supplemental Information

See detailed REMI analysis report entitled "Economic Impact of Oil and Natural Gas Conservation Policies."

Lead Agency
Department of Public Utility Control

34. Identify Measures to Reduce High Global Warming Potential Gases

Recommended Action: Identify measures to reduce high-global-warming potential gases.

The State should further explore measures to reduce high-global-warming potential (GWP) gases. High-GWP gas emissions are a growing share of emissions from the RCI sector, rising from 8 percent in 2010 to 17 percent in 2020. The largest area for growth is projected to be from ozone-depleting substance (ODS) substitutes. One potentially significant opportunity for reducing high-GWP gas emission is to implement a leak-reduction and -maintenance program at supermarkets. Refrigeration in piping is considerable, and leak rates are estimated to be between 15 and 30 percent. This opportunity should be explored further. In addition, the State should identify other programs and opportunities to reduce emissions associated with ODS substitute use.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

GHG emissions reductions have not been estimated.

Estimated Costs

Costs have not been estimated.

Estimated Co-Benefits

Co-benefits have not been estimated.

Progress – Action Pending

Suggested Next Steps for Implementation:

- Since the current focus is on CO2 rather than other gases, need to determine how to identify through new efforts.
- Explore opportunities for regional collaboration; track progress in other states.
- Consider working with ConnSTEP or other organization to identify potential areas of reduction at CT manufacturers.
- Explore potential opportunity to implement a leak reduction and maintenance program at supermarkets for refrigeration piping, etc.

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency

Connecticut Department of Environmental Protection

Connecticut Climate Change

Action Plan 2005

AGRICULTURE, FORESTRY, AND WASTE SECTOR

Connecticut Climate Change

35. Install Centralized Manure Digesters

Recommended Action: Support the installation of centralized manure digesters.

This program would support the installation of one centralized manure digester by 2010, two by 2015, and three by 2020. Installing anaerobic digesters to process agriculture manure into energy (e.g., heat, hot water, or electricity) reduces GHG emissions from manure storage and can offset GHG emissions from energy use. It also produces digested manure, which can contain valuable nitrogen for crop production.

The group deliberated on a number of implementation approaches for the manure digester option; however, no specific actions were suggested. The electricity working group highlighted a number of options for renewable energy that may assist in implementing this option. The working group discussed options that included funding support from the State and federal government and private developers, technical assistance, supporting removal of transmission barriers, and increasing outreach to farmers and communities about the benefits and costs of manure digesters.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.017 MMTCO$_2$e by 2010 [1]
0.052 MMTCO$_2$e by 2020 [2]

The installation of each centralized manure digester is assumed to use manure from 3,870 cows for a total of 3,870 cows in 2010 and 11,610 in 2020. Table 35.1 outlines the key assumptions for direct and indirect emissions reductions used in the analysis of the manure digester program.[3]

Table 35.1
Key Assumptions for GHG Analysis (per digester)

Emission Reductions from CH_4 Manure Management ($MMTCO_{2e}$)	Emissions Created Through Transport ($MMTO_2e$)	Net Emissions Reduction ($MMTCO_2e$)	Total Electricity Generated (kWh/yr)
0.007458	0.0012	0.00866	4,469,850.00

1 (0.0087 MMTCO$_2$e direct and 0.0084 MMTCO$_2$e indirect)
2 (0.0260 MMTCO$_2$e direct and 0.0255 MMTCO$_2$e indirect)
3 Methane reductions from manure management were based on standard assumptions used by NESCAUM in the analysis of the Connecticut GHG emissions inventory. For more details on the assumptions for manure transport, see chapter appendix.

Note: Assumptions about the number of cows and the manure generated from each cow were based on CERC Inc., Connecticut Academy of Science and Engineering (CASE), Connecticut Department of Agriculture, Pines, D., & Day, W. (2003). *An Analysis of Energy Available from Animal Biomass in Connecticut*. Connecticut Department of Agriculture. Methane reductions from manure management were based on standard assumptions used by NESCAUM in the analysis of the Connecticut GHG emissions inventory. For more details on the assumptions for manure transport, see the supporting documents.

Estimated Costs

The estimated costs of this program are $111.56 to $125.78 per $MTCO_2e$, depending on the type of turbine installed.[4] This analysis was based on the net present value of the estimated GHG benefits of the total energy savings (both direct and indirect) and the net present value of the estimated costs. Table 35.2 outlines the key cost assumptions for the analysis.

Table 35.2
Capital and Operating Cost Assumptions (Per Digester)

Total Capital Costs (Turbine A)	Total Capital Costs (Turbine B)	Operating costs
$1,800,000	$1,950,000	$74,753

Note: Values are from CERC, et al. (2003).

Estimated Co-Benefits

Implementation of this option could provide ancillary benefits not quantified during the process. Manure digesters provide benefits related to odor control; water quality; potential improvement of farm economics (by supporting generation of additional income); and continuation of farming in the State, which can support both smart growth initiatives and the "increase purchase of locally grown food" option mentioned later in this section. Digesters also provide benefits for manure management by avoiding the potential leakage of excess manure into water bodies (e.g., Long Island Sound).

Progress – Action Pending

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency

Connecticut Department of Environmental Protection, Connecticut Department of Agriculture, and the Connecticut Clean Energy Fund.

[4] Both costs and emissions reductions for the cost-effectiveness analysis were discounted at a rate of 7 percent.

36. Reduce Use of Non-Farm Fertilizer

Recommended Action: Reduce non-farm fertilizer use.

This program would seek to reduce the amount of non-farm fertilizer use (e.g., residential and commercial) from today's levels by 7.5 percent in 2010 and 15 percent in 2020. A portion of nitrogen applied to the soil is subsequently emitted as N_2O (which has a global warming potential that is 310 times that of carbon dioxide); therefore, a reduction in the quantity of fertilizer applied can reduce N_2O emissions. This measure would, in part, expand on existing programs to reduce residential and commercial fertilizer use in Connecticut and would include the following elements:

- *Organic Land Care Program.* This program of the Connecticut chapter of the Northeast Organic Farming Association (NOFA) promotes reducing the use of chemical fertilizers and fosters ecological stewardship in designing and maintaining landscapes. The program includes the *Standards for Organic Land Care,* an education and accreditation program for organic land-care professionals, and information and events for citizens.[5]
- *Freedom Lawn Initiative.* This initiative is a voluntary program to decrease the use of pesticides and chemical fertilizers on residential lawns. The Board of Alderman in Milford, Connecticut, passed a resolution in 2002 requesting citizen participation in the program. A local environmental coalition has distributed informational brochures and lawn signs and sponsors a Freedom Lawn competition. At least one street in Milford boasts 100 percent participation in the program.

In addition, a requirement to report non-farm fertilizer use was considered. Such a measure would help provide better information to track progress toward reducing non-farm fertilizer use and measure the success of the program. Although the working group initially considered reduction of farm fertilizer use, it was not a priority for analysis as agreed by the stakeholders.

The non-farm fertilizer reduction program would be implemented within Connecticut but could benefit from regional efforts to reduce non-farm fertilizer consumption.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.003 MMTCO_2e in 2010
0.006 MMTCO_2e in 2020

[5] From the Connecticut NOFA website. For more information, see www.ctnofa.org/programs/landcare.php.

The amount of fertilizer reduced through this program was based on an estimate of non-farm fertilizer consumption in Connecticut of 25 million kg.[6] Because no estimates were available for projections of non-farm fertilizer use, the group chose to use existing consumption data. If non-farm fertilizer use is projected to decline in the State, the benefits of this program may occur in the reference case instead.[7] These values were converted to nitrogen in order to calculate the GHG emissions; the assumption was that the fertilizer was 15 percent nitrogen. Values were converted to GHG emissions using the standard assumptions of direct and indirect emissions that NESCAUM used in calculating the GHG inventory. The GHG emissions reductions do not include reductions that could occur from other results of the program, such as decreased truck traffic, passenger vehicles, and fertilizer production.

Estimated Costs

Costs have not been estimated.

Estimated Co-Benefits

The co-benefits of this recommendation have not been quantified at this time. Ancillary benefits of this program include reducing the nutrient runoff into Long Island Sound and other water bodies, increasing the organic content of soil (thus increasing carbon sequestration), reducing GHG emissions (because lawn mowing usually decreases with natural lawn-care methods), and reducing water consumption (because lawn watering usually decreases with natural lawn care methods), and increasing biodiversity.

Progress – In Process

The Organic Landcare Program continues to run outreach, training, and accreditation programs for organic landcare professionals. There are currently 56 accredited organic land care professionals in Connecticut. There was one accreditation course in Connecticut in 2004; another will take place in February 2005. In addition, there have been numerous presentations, articles, and displays on the organic landcare standards to groups such as the CT Chapter of the Association of Landscape Architects, organic farming groups, garden clubs, environmental organizations, and faith based communities.

In addition to Milford's Freedom Lawn Program, the town of Cheshire has announced a "Freedom Lawn" policy for town-owned land.

Suggested Next Steps for Implementation

- Identify funding and grant opportunities to support and expand programs to reduce residential and commercial fertilizer use in Connecticut.
- Provide more outreach to lawn maintenance companies, homeowners, and municipalities on reduced fertilizer methods and corresponding benefits and co-benefits.
- Quantify co-benefits (e.g., improved water quality, soil quality, public health) from reduced chemical fertilizer use.

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[6] Source: Connecticut Department of Agriculture. Data provided by Rich Meinert, University of Connecticut.

[7] A number of factors may affect the reference case, including the impact of existing programs to reduce non-farm fertilizer consumption, landscape size (e.g., size of lawns), landscape type (e.g., some plantings require lower fertilizer consumption to retain health, and land use (e.g., retaining natural tree cover instead of plantings could require lower fertilizer use).

- Identify means to monitor and evaluate progress on meeting goals on chemical fertilizer use reduction and corresponding GHG reductions and co-benefits.

Supplemental Information
There is no supplemental information on this recommended action.

Lead Agency
Connecticut Department of Environmental Protection

37. Buy Locally Grown Food[8]

Recommended Action: Increase the purchase of locally grown food.

This program would seek to increase the amount of food consumed by Connecticut residents from locally grown sources by 10 percent in 2010 and 2020. Food processing, packaging, transportation, and marketing consume 75 to 85 percent of the energy used in the commercial food industry. Food miles—an estimate of the distance food travels from where it is grown to where it is purchased—for conventional produce can equal more than 20 times the distance of locally grown produce.[9] In place of commercial produce markets, Connecticut boasts 65 farmers' markets. The program would be implemented through the following actions:

- Enhance the Connecticut-Grown Program to increase consumer awareness of Connecticut agriculture and promote the regular purchase of Connecticut agricultural products.
- Create an agricultural identity for Connecticut so that residents prefer purchasing a certain type of Connecticut agricultural product (e.g., *Connecticut Blooms*)
- Increase the development of farmers' markets and ensure that participating farmers sell Connecticut-grown products exclusively.
- Encourage and promote the purchase, marketing, and sale of State-grown produce by State institutions and agencies. Potential institutional purchasers include prisons, hospitals, schools, and colleges (e.g., the Connecticut Department of Administrative Services has an agreement with its prime vendor to reserve 25 percent of its contract for local providers).
- Support Senior and WIC Farmers Market Nutrition Programs that enable low-income seniors and mothers to receive coupons redeemable for State-grown produce at State farm stands and farmers' markets.
- Support programs and efforts to facilitate increased access to farmers' markets by low-income households (e.g., funding for wireless EBT machines in farmers' markets for food stamp recipients).

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8 The letter to the Connecticut Climate Change Stakeholder Process from the Connecticut Food Policy Council, October 10, 2003, prepared for the AFW working group, is the primary source of information on the implementation approaches for this action. Significant portions of this section are excerpted verbatim from this letter.

9 A study in Iowa demonstrated that locally grown produce traveled an average of 56 miles, whereas conventional produce traveled 1,494 miles. See *Checking the food odometer: Comparing food miles for local versus conventional produce sales to Iowa institutions.* (2003). Ames, IA: Leopold Center for Sustainable Agriculture.

- Facilitate efforts by farmers to develop value-added agricultural products through a through a business development or grant program or general marketing assistance from the Department of Agriculture or other supporting agency. [10]

This program would be implemented within Connecticut, but several components could benefit from regional efforts. Although the actions recommended above would be undertaken within the State, the GHG emissions reductions would occur both within the State and outside because the transport of food crosses several geographic boundaries.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Achieving this level of recycling and source reduction is estimated to reduce GHG emissions by **0.003 MMTCO$_2$e in 2010** **0.003 MMTCO$_2$e in 2020**

The estimates of GHG emissions reductions were based on a study conducted in Iowa that considered the impact of increasing the consumption of locally produced food by 10 percent.[11] The study considered the GHG emissions of transporting food from the conventional system (e.g., national retail and wholesale markets) and a local system (e.g., farmers who market and sell directly to food buyers). Information was not available on the quantity of food currently consumed from local Connecticut sources. The results include the GHG emissions reductions occurring through the entire transportation chain; however, they do not include other potential reductions. For example, a study by the Rodale Institute found that using organic farming practices increased soil carbon content by 15 to 28 percent.[12]

A recent survey found that Connecticut residents believe that locally grown foods are healthy (76 percent) and fresher (88 percent) than non-locally grown or produced foods.[13] Local markets for local agricultural products deliver items to consumers in a cost-effective, resource-efficient way.

Estimated Costs

Costs have not been estimated.

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[10] Most of the implementation strategies were originally endorsed by the Connecticut Food Policy Council, Northeast Sustainable Agricultural Working Group, and the Hartford Food Systems. Available at: www.foodpc.state.ct.us/images/Full%20Report.pdf

[11] More details on the assumptions are available in: *Food, Fuel, and Freeways: An Iowa perspective on how far food travels, fuel usage, and greenhouse gas emissions.* (2001). Ames, Iowa. Leopold Center for Sustainable Agriculture. Available at: www.leopold.iastate.edu/pubinfo/papersspeeches/food_mil.pdf

[12] Rodale Institute, Farming Systems Trial™, 2003. Available at: www.rodaleinstitute.org/bookstore/products/farm_books/main.shtml

[13] Locally Grown - An Agricultural Survey of Connecticut and Massachusetts Residents. (2003). Study conducted for the Quinnebaug-Shetucket Heritage Corridor. Available at: www.workinglandsalliance.org/OtherDocs/Q_Slocallygrown.pdf

Estimated Co-Benefits

This program can provide a number of ancillary benefits not fully addressed as part of this process, including reduction of air emissions from reduced food transport; support for economic development for Connecticut farms; and pesticide and water pollution, depending on the type of farming practice supported. Other ancillary benefits include helping to preserve farmland from energy-intensive development; ensuring the continued economic viability of the small family farm; supporting clean, environmentally sensitive farming practices; helping maintain biodiversity in food plants; and contributing to regional prosperity. The quantification of co-benefits associated with this recommendation has net yet been determined.

Progress – In Process

The CT Grown program of the Connecticut Department of Agriculture continues to increase the purchase of locally grown foods in the state. Currently there are 19 schools and 25 farmers participating in the Farm to Schools program and buying local produce for school cafeterias. This program has increased significantly in the past two years when 3 schools and 3 farmers participated. In 2004, there are 70 farmers' markets in the state selling locally grown produce. In addition, a number of large institutions are currently purchasing or considering purchasing locally grown produce, including the Department of Corrections and the University of Connecticut. At the end of 2004, the Department of Agriculture was able to hire another employee to work on the CT Grown program, using funds from the USDA.

The CT General Assembly passed legislation in 2004 to require DAS to give preference to CT grown in contracts for diary, poultry, eggs, fruits, and vegetables (An Act Concerning Preservation of the Family Farm and Long Island Sound, PA 04-222) and to require DOA to establish a "Connecticut Farm Fresh" promotional program.

Suggested Next Steps for Implementation

- Support Department of Agriculture's CT Grown program.
- Coordinate with Department of Agriculture to promote a greater understanding of GHG reduction benefits from purchase of locally grown foods.
- Continue outreach to institutions and state agencies on purchase of locally grown food.
- Coordinate with Department of Agriculture to monitor progress towards goal and to quantify, where possible, GHG reductions and co-benefits from increased purchase of locally grown food.

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency

Connecticut Department of Environmental Protection

38. Research on Connecticut Forest Management and Carbon Offsets[14]

Recommended Action: Foster a research program on Connecticut forest management and carbon offsets.

A research program is needed to examine Connecticut's public and private forests and determine how they could be best managed to maximize carbon sequestration and to develop markets for offsets from terrestrial carbon sinks. Land-based carbon sequestration typically involves conserving threatened forest; planting trees and restoring badly degraded agricultural or mineral extraction lands, where without intervention, forests would take decades to establish themselves; improving management of productive forestland; and promoting reduced-impact agriculture. Considering its population density, Connecticut is already heavily forested, and due to various factors, most agricultural land quickly reverts to forest when abandoned. Thus, few opportunities exist to prudently expend significant resources on restoration or planting initiatives in this State.

The State should encourage a research program involving a cooperative team from universities, industry, and the non-governmental organization community; the goal would be to conduct research on Connecticut's forest ecosystems and identify the management systems and standards for carbon "sink" offset projects that would maximize sequestration of carbon. Such a program would likely be a multiyear project that could seek funding from a wide range of sources. State funding should be considered, but additional research funds could be secured through foundation support or federal research funds.

It appears that most of the research on measuring carbon stocks and increasing carbon storage in forests has focused on merchantable trees, in large part because forest management research has, since its inception, focused on growing timber and the results of that research are easily convertible to analyzing management for carbon sequestration in merchantable forest products. A much wider range of investigation is possible and necessary in order to answer the many questions that have arisen as a result of concerns with atmospheric CO_2 levels. For example, to maximize carbon absorption and storage, what management methods should be used in forests that will be preserved?

The research project on carbon offsets would also be directly related to potential forest-based carbon offset projects and how to quantify the reductions (see the section on cap-and-trade). The market-based programs would rely on the science and consensus developed through this project (see supporting document six).

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[14] The carbon sequestration straw proposal, prepared by Environment Northeast and The Nature Conservancy, is the primary source of information on this recommendation. Significant portions of this section are excerpted verbatim from the carbon sequestration straw proposal.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

The GHG benefits and costs of this program were not analyzed because the results would depend on the results of the research and the extent to which they were implemented.

Estimated Costs

Costs have not been estimated.

Estimated Co-Benefits

Co-benefits have not been estimated.

Progress – Action Pending

Suggested Next Steps for Implementation

- Identify any current or recent carbon sequestration research in New England forests and determine relevance to Connecticut forests.
- Initiate discussions with universities, industry, and the non-governmental organizations to develop a research program on carbon sequestration in Connecticut forests.
- Coordinate with those involved in development of Cap and Trade Program to determine research needs for a potential carbon offset program.

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency

Connecticut Department of Environmental Protection

39. Urban Tree Planting Program

Recommended Action: Create an urban tree-planting program.

The State should provide funding and other support to plant 15,000 more sufficiently sized urban trees than is currently planted by 2010 and an additional 20,000 by 2020. Properly planted trees in urban areas can decrease energy use by reducing wind speed in winter and by shading buildings and lowering air temperatures in summer. Improperly planted trees in urban environments can actually increase energy use by shading buildings in winter and adding humidity in summer. Tree effects on wind in summer may or may not be beneficial, depending on air temperature.

To implement this program, Connecticut will need to ensure additional funding for the direct costs of the trees, maintenance, and technical assistance. Limited funding is currently available from the U.S. Forest Service. Connecticut will also need to provide technical assistance to ensure that trees are properly planted (ensuring survival and the largest emissions-reduction potential). The key factors that affect the ability of a tree to provide direct shading of a building include placement relative to buildings and seasonal solar angle; type; species foliage characteristics; height; and crown form, spread, and density.[15]

This program would be implemented within Connecticut, but the GHG emissions reductions would occur both within the State and outside because the resulting reductions in electricity consumption would have an impact on regional electricity emissions.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.0009 MMTCO$_2$e in 2010 [16]
0.0019 MMTCO$_2$e in 2020 [17]

It is estimated that this program would lead to the following energy demand reductions:

- Electricity savings of 1.7 and 3.72 GWh in 2010 and 2020, respectively
- Home heating oil savings of 1,092 and 2,340 MMBtu in 2010 and 2020, respectively
- Natural gas savings of 693 and 1,485 MMBtu in 2010 and 2020, respectively.

[15] Abdollahi, K., Ning, Z., & Appeaning, A. (Eds.). (2000). *Global climate change and the urban forest.* Baton Rouge, LA: Gulf Coast Regional Climate Change Council.
[16] (0.00003 MMTCO$_2$e direct and 0.0008 MMTCO$_2$e indirect)
[17] (0.00007 MMTCO$_2$e direct and 0.0019 MMTCO$_2$e indirect)

The GHG estimates mentioned above do not include the emissions reductions resulting from carbon sequestration. Table 39.1 outlines the key assumptions used in the analysis of this option.

Table 39.1 Key Assumptions for Urban Tree Planting Program	
Trees Planted per Year	
2004–2009	2,500
2010–2020	2,000
Tree survival rate (% of planted trees that survive)	80%
Planting and maintenance costs per tree	$200
Energy Savings per Tree	
Cooling savings (kWh)[18]	200
Heating savings (MMBtu)[19]	0.15
Distribution of Connecticut Heating by Fuel Type[20]	
Electricity	14%
Oil	52%
Natural gas	33%
Percentage of Buildings With Air Conditioning[21]	62%

Electricity reductions were converted to GHG emissions using the marginal emissions rate of electricity from the demand-reduction scenario conducted by the electricity working group since the electricity demand reductions from this program were included in that scenario. Home heating oil and natural gas reductions were converted to GHG emissions using emissions factors developed by the RCI working group.

Estimated Costs

The estimated costs of this program are $9,815 per $MTCO_2e$. This analysis was based on the net present value of the estimated GHG benefits of the total energy savings (both direct and indirect) and the net present value of the estimated costs.[22]

Estimated Co-Benefits

This program would also lead to reductions in other air emissions. A recent study suggested that a similar tree-planting system could lead to reductions of carbon monoxide (CO), nitrous oxide (N_2O), ozone (O_3), particulate matter of 10 microns or less (PM_{10}), and SO_2.[23] In addition,

[18] Studies have shown that a well-placed 25 ft tall tree can produce energy savings from cooling of 100–400 kWh/yr (McPherson & Rowantree, 1993). Value assumed for the analysis in Connecticut assumed electricity savings for both cooling and heating of 200 kWh/yr.

[19] Studies have shown that energy savings from a single tree range from 0.15 to 5.5 MMbtu (Heisler, 1990).

[20] The assumptions for this distribution are identical to the assumptions utilized by the RCI working group.

[21] Data are based on the percentage of homes in New York that have air conditioning—18% central and 44% room (U.S. Energy Information Administration, *Residential Energy Consumption Survey 1997*. Available at: www.eia.doe.gov/emeu/recs/four_states/overview_ny.html). In comparison, the national average is 83% (U.S. Census Bureau, *American Housing Survey for the United States: 2001*. Available at: www.census.gov/hhes/www/housing/ahs/ahs01/tab1a4.htm).

[22] Both costs and emissions reductions for the cost-effectiveness analysis were discounted at a rate of 7 percent.

[23] The study looked at a program to increase new canopy cover of more than 125,000 acres in the New York

planting programs in urban areas should have few barriers to implementation because many communities are actively pursuing tree-planting programs for reasons other than climate change, such as aesthetics. The group raised some concerns over whether this level of tree planting could be achieved, given that many communities are already making significant efforts to replace their existing forest stock, let alone increase the stock, as envisioned by this program.[24]

Progress – In Process

The DEP Forestry Division has had an urban forestry grant program for CT towns for about 12 years. The funding, approximately $50 – 60K/year, comes from the USDA Forest Service. DEP grants are given to towns and non-profit organizations. In 2004, a total of $76,860 was awarded to CT towns for urban forestry programs. Of this, $28,260 was specifically for urban tree planting in the towns of East Haddam, Bristol, and Norwalk.

Suggested Next Steps for Implementation

- Continue DEP urban forestry grant program and explore options for additional funding as necessary to meet goal.
- As feasible, quantify energy and other air quality co-benefits of urban tree planting.
- Develop means to monitor progress towards goal and to quantify GHG reductions and co-benefits from urban tree planting.

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency

Connecticut Department of Environmental Protection

Metropolitan region. Reductions per day (in metric tons) were estimated as follows: CO, 1.1; NO_2, 4.0; O_3, 10.2; PM_{10}, 5.5; and SO_2, 1.9 (Luley & Bond, 2002. *A Plan to Integrate Management of Urban Trees into Air Quality Planning*. Naples, New York.

[24] A survey conducted in 1994 in Connecticut showed that municipalities reported planting 8,000 to 9,000 trees annually. The report concluded that the ratio of plantings to removals was 1.42:1 in 1992 and 1.34:1 in 1993.

40. Forest and Agricultural Land Preservation[25]

Recommended Action: Preserve existing forest and agricultural land.

This program would seek to avoid releases of carbon due to conversion of forest and agricultural land to development. When forest and agricultural land is converted carbon is emitted when trees are cut and when the ability of agricultural soil to sequester carbon from the atmosphere is diminished, since forest and agricultural land sequester carbon in plant matter (e.g., trees) and soils. Therefore, avoiding the conversion of this land to development, in conjunction with smart growth measures, preserves the carbon-absorption capacity of existing forest and agricultural lands and enables continued carbon sequestration from the atmosphere. According to one federal study, on average, 8,200 acres per year—4,700 acres of forest and 3,500 acres of agricultural land—are converted to development in Connecticut. This program would be implemented through the following measures (more details are available in Supporting Document 4):

- Open-space conservation and stewardship programs to ensure that future releases of carbon occurring through conversion of forest and grasslands to development are reduced below current levels and are balanced by land-acquisition and -management initiatives
- Acceleration of farmland preservation by expanding the Farmland Preservation Program, including exploring alternative means of funding the program, taking advantage of available federal and other matching funding, and considering additional criteria for selecting land through the program
- Measures to reduce the consumption of land by sprawling development, such as those outlined in the smart growth recommendation
- Possibly other measures, such as impact fees, which would be used to preserve open space on farmlands.

The State of Connecticut has set the following goal for open space: to have at least 10% of Connecticut's land area held by the state as open space for the beneficial use and enjoyment of the public as additions to the State's system of parks, forests, wildlife, fisheries and natural resource management areas; and to have a total of 21% of Connecticut's land (673,210 acres) preserved as open space by the year 2023 in state, municipal, private nonprofit, water utility and federal ownership.[26] In addition, Section 23-74 of the Connecticut General Statutes lists carbon sequestration as one of the purposes of the state's recreation and natural heritage trust program:

[25] The carbon sequestration straw proposal, prepared by Environment Northeast and The Nature Conservancy, is the primary source of information on this recommendation. Significant portions of this section are excerpted verbatim from the carbon sequestration straw proposal.

[26] From the Connecticut Department of Environmental Protection website http://www.dep.state.ct.us/rec/openspace/acquisition.htm.

to acquire land to “offset carbon dioxide produced through combustion of fossil fuels by preserving lands that naturally absorb it.”

In addition to the 21% open space goal, the Connecticut Department of Agriculture has a goal of preserving 130,000 acres, including 85,000 acres of cropland. This goal will enable Connecticut farms to produce at least 50 percent of milk needs and 70 percent of in-season fresh fruits and vegetables, output that has implications for the support of local farm products mentioned earlier in this section.[27]

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.283 MMTCO_2e in 2010 [28]

0.283 MMTCO_2e in 2020 [29]

Wide ranges of estimates exist for the carbon currently sequestered in forests. Essentially, the estimates range from 20 to 100 metric tons per acre per year for Connecticut forests. For this analysis, it was assumed that Connecticut forests sequester an average of 60 metric tons per acre. The amount of natural land targeted for preservation is based on the analysis of the Natural Resources Conservation Service (NRCS) of the USDA, which found that from 1982 to 1997, an average of 4,700 acres of forestland was converted to development each year in Connecticut.[30] The quantity of carbon sequestered by agricultural land will depend on the time the land has been under tillage. Estimates range from 0.367 to 0.734 MTCO_2e per acre per year. A conservative estimate of 0.367 MTCO_2e per acre per year was used. The amount of farmland lost was assumed to be 3,500 acres per year, similar to the rate from the NRCS analysis between 1982 and 1987.

With any of the approaches for implementation mentioned above, it is difficult to assess precise carbon emission offsets due to the "leakage" factor—the fact that at least some indeterminable amount of avoided development and resulting emissions will simply be displaced to other communities or states. The leakage factor would make it difficult to impose restrictions or fees on specific development proposals that could be tied to precise carbon impacts. Therefore, statewide open space, agricultural land preservation, and smart growth measures were considered as the most appropriate mechanisms.

Estimated Costs

These emissions reductions are estimated to cost $137 per MT$CO_2$e.[31] The forestland preservation program is estimated to cost $6,000 per acre across the State, the average amount the DEP has paid for land in the past four years. At that rate, the acquisition of 4,700 acres of forestland would cost a total of $28.2 million per year. For the four and a half years from mid-

[27] Connecticut Department of Agriculture (2001). *Connecticut’s Farmland Preservation Program, 2001 Annual Report*.

[28] (forest land of 0.282 MMTCO_2e and agricultural land of 0.0013 MMTCO_2e)

[29] (forest land of 0.282 MMTCO_2e and agricultural land of 0.0013 MMTCO_2e)

[30] The estimate is from the Natural Resources Conservation Service of the USDA. The working group recognized the benefit of having a more accurate future projection of land use, but one was not available during the process.

[31] Both costs and emissions reductions for the cost-effectiveness analysis were discounted at a rate of 7 percent.

1998 through 2002, the State of Connecticut bonded approximately $210 million through four open-space programs and initiatives, acquiring outright ownership or conservation restrictions over or assisting towns and nonprofit groups in acquiring approximately 44,000 acres. Annually, the State averaged expenditures of $46.6 million and preserved or helped to preserve an average of 9,777 acres. A significant portion of the land preserved through State funds was done under a matching grant program in which the DEP provided towns and private conservation groups with matching grants, usually 50 percent of the land cost. If such a program were to comprise half of the DEP's efforts, the 4,700 acres could be acquired at a cost of approximately $21.4 million per year.

The cost of the farmland preservation program was based on the historical cost of the Connecticut Farmland Preservation program—$3,000 per acre to purchase the development rights. At that rate, the preservation of 3,500 acres is estimated to cost $10.5 million per year.

Estimated Co-Benefits

A program aimed at preserving open space (both forest and agricultural land) provides ancillary benefits, which can further diminish the ratio cost per ton of this approach. These benefits have not been specifically quantified as part of this process, but they were a subject of deliberations during the working group and stakeholder meetings. Benefits of the forestland-preservation program include promoting wildlife habitat, protecting and improving water quality, improving the "livability" of the State, and supporting smart growth initiatives in the State. The agricultural land-preservation program can provide ancillary benefits, including support for economic development (especially in rural parts of the State) by maintaining agricultural capacity, enabling the continued consumption of locally grown agricultural products (which can further enhance and enable Recommended Action #37 Buy Locally Grown Food), and supporting smart growth initiatives in the State.

Progress – In Process

To date, 23% of the Connecticut Department of Agriculture's 130,000-acre preservation goal has been met through the purchase of development rights program. In 2004, $2.2 million was allocated by State Bond Commission to purchase development rights on 1,133 acres of prime farmland. This is significant progress over 2003, in which no farmland was preserved. As of December 2004, 29,980 acres total on 211 Connecticut farms have been preserved through the program.

In addition, approximately 1,000 acres were preserved as open space in DEP land holdings during 2004.

Suggested Next Steps for Implementation

- Work with land conservation organizations to promote carbon sequestration as a criteria/benefit in addition to traditional land preservation goals.
- Determine total number of acres of open space in CT and identify means to monitor progress toward meeting goals and quantify GHG reductions from land preservation.
- Coordinate land preservation efforts with smart growth initiatives.

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency
Connecticut Department of Environmental Protection

41. Promote Use of Durable Wood Products[32]

Promote use of durable wood products.

This program would promote the use of durable wood products over other construction materials through a voluntary education campaign on climate change and what consumers can do to minimize their impacts. This program should encourage individual and business consumers to consider certified-sustainable wood products when buying furniture, building homes, and working on other structures. In addition, the State in its procurement process should lead by example and maximize its purchase of wood products. To ensure that increased use of timber results in a benefit to the environment, wood products should be produced and manufactured as a result of certified-sustainable harvesting practices.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

The GHG benefits and costs of this program were not analyzed because data on the potential increase in durable wood use was unavailable.[33]

The substitution of durable wood products for other materials is beneficial both because of the carbon that wood building materials sequester and because of the energy use they avoid. For example, production of steel, aluminum, plastic, brick, and concrete has high energy requirements compared with wood. The "embodied energy," or the amount of energy used to produce a given material, varies from product to product. Following are estimates of embodied energy for typical building materials:

- Simple sawed wood product: 3 GJ Mg^{-1}
- Plywood: 14 GJ Mg^{-1}
- Steel: 20–25 GJ Mg^{-1}
- Plastic: 60–80 GJ Mg^{-1}
- Aluminum: 190 GJ Mg^{-1}

Most energy used in the manufacture of these materials comes from sources that emit significant GHGs. Unless materials are currently produced using energy from clean renewable or non-fossil sources, products with lower embodied energy are responsible for lower GHG emissions.

[32] The carbon sequestration straw proposal, prepared by Environment Northeast and The Nature Conservancy, is the primary source of information on this recommendation. Significant portions of this section are excerpted verbatim from the carbon sequestration straw proposal.

[33] For durable wood products, the benefits would depend on the extent to which the program achieved purchase of durable wood products over other construction materials.

Estimated Costs

Costs were not estimated.

Estimated Co-Benefits

Durable wood products, which are used for furniture or construction and have been in use for decades or more, sequester carbon as they sit in a home or office building. Increased use of locally grown and manufactured durable wood products could also be a benefit to the Connecticut timber industry and thereby help prevent the conversion of forestland into commercial or residential use.

Progress – In Progress

DAS is using contract language to encourage proposals that include the reuse of durable wood furniture. EPP Program working on promotion of used/refurbished furniture contract.

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency

Connecticut Department of Administrative Services

42. Support Economically Viable Landfill Gas to Energy Projects

Recommended Action: Encourage landfill gas-to-energy (LFGE) projects.

This program would seek to increase the number of landfills in Connecticut that reduce methane and generate electricity through the following actions:

- Encourage the generation of an additional 18.5 MW of electricity from landfill gas-to-energy (LFGE) projects in the State through the Connecticut renewable portfolio standard.
- Support interconnection of these projects by working with the DPUC to ensure that LFGE projects are allowed to connect to the grid (even projects under 1 MW). In addition, work with DPUC and DEP to provide streamlined permitting for these projects.
- Join the EPA Landfill Methane Outreach Program (LMOP) State Partnership Program, which provides assistance with developing regulations and funding opportunities, among other things.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

In the analysis of the electricity sector reference case, an additional 18.5 MW of landfill gas generation was installed. Therefore, the GHG benefits of this program were included in the electricity- and waste-sector baselines.[34] Although the GHG benefits of this action should not be considered as reductions from the reference case (they are estimated to occur in the electricity sector reference case without additional steps), it is important to note the GHG reductions from this program.

Estimated GHG emissions reductions:

0.447 MMTCO_2e in 2010 [35]

0.452 MMTCO_2e in 2020 [36]

The State provided EPA's LMOP staff with revised data on existing landfills in Connecticut. The LMOP staff reviewed the landfill data and provided a preliminary estimate that 18.5 MW of LFGE potential exists in the State.[37] The electricity working group chose to include all 18.5 MW

[34] The GHG impact from the conversion of methane to energy is included in the electricity sector reference case (see the detailed discussion of electricity sector baseline). The GHG impact of methane conversion was calculated outside the electricity sector analysis and accounted for in the waste sector baseline.

[35] (0.37 MMTCO_2e direct and 0.077 MMTCO_2e indirect)

[36] (0.37 MMTCO_2e direct and 0.082 MMTCO_2e indirect)

[37] See CCAP. (2003, September 2). Revised assumptions for Connecticut landfill gas to energy and flaring option. Memo to the AFW working group.

as potential new LFGE in the IPM modeling (see the electricity sector recommendations for more details). In 2006, IPM estimated that in the electricity reference case, an additional 18.5 MW of electricity generation from LFGE projects would be installed in Connecticut and that additional LFGE generation would take place in surrounding regions (see electricity sector analysis). The GHG benefits from the conversion of methane were calculated outside the electricity sector analysis using standard assumptions of LMOP staff. Because some of the landfills envisioned currently flare their methane, the landfills currently with flaring were subtracted from the additional benefit of this program to avoid double counting (see Table 42.1).

Table 42.1
Connecticut Landfill Candidates for Landfill Gas-to-Energy Projects

Landfill	Town	County	WIP (tons)	MW Potential	Existing Flaring*
Branford Landfill	Branford	New Haven	1,340,419	1.0428	No
Bristol Landfill	Bristol	Hartford	599,004	0.4660	No
Enfield Landfill	Enfield	Hartford	1,405,757	1.0937	No
Lebanon Landfill	Lebanon	New London	1,094,990	0.8519	No
Manchester Sanitary Landfill	Manchester	Hartford	5,102,297	3.9696	Yes
NORCAP Regional Landfill	East Windsor	Hartford	2,600,017	2.0228	Yes
North End Disposal Area Landfill	Waterbury	New Haven	5,932,824	4.6157	No
Putnam Landfill	Putnam	Windham	954,606	0.7427	No
Windham Landfill	Windham	Windham	1,500,010	1.1670	No
Windsor-Bloomfield Sanitary Landfill	Windsor	Hartford	3,251,763	2.5299	Yes
Total			**23,781,687**	**18.5022**	
Total Without Existing Flaring			**12,827,610**	**9.9799**	

*Based on analysis conducted by Environment Northeast.

Estimated Costs
Costs have not been estimated.

Estimated Co-Benefits
Co-benefits have not been estimated.

Progress – In Process
The Connecticut Clean Energy Fund is currently investigating several LFGE projects in Connecticut. It is anticipated that these projects may qualify for long-term power purchase agreements underneath Project 100.

Supplemental Information
There is no supplemental information on this recommended action.

Lead Agency
Connecticut Clean Energy Fund

43. Increase Recycling and Source Reduction[38]

Recommended Action: Increase recycling and source reduction to 40 percent.

This program would seek to increase source reduction and recycling of municipal solid waste (MSW) to 40 percent by 2010 and to maintain at least 40 percent source reduction and recycling through 2020.[39] Some potential implementation strategies include: increasing education and enforcement of recycling requirements; adopting "Pay as You Throw" (PAYT) programs for residential waste; increasing composting of source-separated organics (from commercial, industrial, and institutional generators and residential sources); increasing small-business recycling; supporting recycling markets; increasing electronics recycling; increasing "producer responsibility" requirements for products.

This program would be implemented within Connecticut, but several components could benefit from regional efforts. Although the actions recommended above would be undertaken within the State, the GHG emissions reductions would occur both within the State and outside because recycling and source reduction lower emissions from "mine-to-mouth."

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.91 MMTCO$_2$e in 2010
0.97 MMTCO$_2$e in 2020

Using the waste-generation baseline described earlier in this report, it is estimated that this approach would require recycling or source reduction of an additional 416,000 tons of MSW in 2010 and 443,000 tons in 2020. This waste avoidance was included in EPA's Waste Reduction Model (WARM) using an assumption of mixed recyclables.[40] The WARM model uses life-cycle emission factors to calculate the GHG savings, so a share of those emissions reductions will occur outside the State.

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[38] The recycling and source reduction straw proposal, prepared by the Connecticut Department of Environmental Protection, is the primary source of information on this recommendation. Discussions of resource recovery facilities were drawn from draft write-ups prepared by the Connecticut Resource Recovery Facilities Authority. Significant portions of this section are excerpted verbatim from those write-ups.

[39] The Connecticut DEP estimates that the State is currently recycling 23.3 percent of its waste and source reducing 1.3 percent. Analysis conducted by the Connecticut Resources Recovery Authority estimates that the level of recycling and source reduction is significantly higher, 42 percent. Regardless of the absolute percentages, the group agreed that doubling the current level of recycling and source reduction is the important goal.

[40] The WARM model and details on the key assumptions are available at www.epa.gov/globalwarming/actions/waste/usersguide.htm

Estimated Costs

The estimated costs of this program are \$4 to \$5 per $MTCO_2e$. The cost estimates were based upon values by DEP staff indicating that implementing this program could cost \$4.1 million per year (see the chapter appendix for detailed estimates).[41] The working group and stakeholders were not able to consider whether this level of funding was sufficient to meet the level or recycling and source-reduction envisioned given time and resource limitations.

Estimated Co-Benefits

The potential ancillary impact of this program includes the following benefits:

- Ancillary benefits of recycling include decreases in raw materials acquisition (through fossil fuel energy and other emissions and changes in forest carbon sequestration), manufacturing (fossil fuel energy emissions), and transportation-related emissions.
- Source-reduction and recycling programs avoid the need for new disposal facilities and thus avoids land-use and siting issues; waste transportation issues; other pollutants from waste combustion; and generation of ash residue, which requires handling, transportation, and disposal.
- Electronic recycling and producer responsibility provide co-benefits through reduced toxicity of the waste stream.

Progress – Action Pending

The Department of Environmental Protection has issued a Request for Proposals for the development of a statewide solid waste management plan. This plan, which should be completed by early 2006, will further identify and analyze measures to increase recycling and source reduction to 40%.

Suggested Next Steps for Implementation

- DEP select contractor to help with development of statewide solid waste management plan. Ensure that solid waste management plan: addresses climate change impacts associated with various waste management methods; provides detailed implementation strategies to attain 40% source reduction/recycling by 2010 or suggests appropriate revision to goal; and identifies dedicated funding sources and timeline to implement source reduction/recycling measures.
- Continue to monitor waste generated, disposed, and recycled in Connecticut.

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency

Connecticut Department of Environmental Protection

[41] This estimate does not include estimated costs for the electronics-recycling program.

44. Voluntary Carbon Offset Program

Recommended Action: Encourage voluntary carbon offset programs from agriculture, forestry, and waste reductions.

The State should encourage voluntary programs on carbon offsets (i.e., efforts to reduce GHG emissions by sources not covered by specific recommendations from the stakeholders and outside the State or the country).

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

GHG emissions reductions have not been estimated.

Estimated Costs

Costs have not been estimated.

Estimated Co-Benefits

Co-benefits have not been estimated.

Progress – In Process

There is at least one voluntary carbon offset program operating in Connecticut. Reforest The Tropics, Inc. is a non-profit organization committed to the development and demonstration of projects that offset US-generated carbon dioxide emissions by planting new tropical forests. Reforest The Tropics has linked a number of CT carbon dioxide emitters with reforestation projects in Costa Rica. Connecticut's voluntary participants include the Mohegan Tribal Nation, Connecticut College, the CT Municipal Electric Energy Cooperative, schools and individuals.

Suggested Next Steps for Implementation

- Continue to encourage voluntary carbon offset programs.

Supplemental Information

See also Recommended Action 29 – Promote Voluntary Programs and Actions

Lead Agency

Connecticut Department of Environmental Protection

Connecticut Climate Change

Action Plan 2005

ELECTRICITY SECTOR

45. Renewable Energy Strategy (RES)

Recommended Action: Implement the renewable energy strategy (RES).

Promote the development of renewable energy in Connecticut and in the region as a long-term GHG emissions-reduction strategy and encourage the renewable industry in Connecticut. The RES consists of a number of policy components: adoption of an enhanced RPS in the State, purchases of renewable energy by State government, and a PTC. The IPM model was used to quantify the RES.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:[1] **0.0 $MMTCO_2e$ in 2010** **1.33 $MMTCO_2e$ in 2020**

The estimated emissions reductions from the implementation of the RES in Connecticut for the 10-state region are **0.09 $MMTCO_2e$ in 2010** **2.02 $MMTCO_2e$ in 2020**

- Total CO_2 emissions in Connecticut from the electricity sector do not change in 2010, but they will decline by 0.46 $MMTCO_2e$ in 2015 and by 1.33 $MMTCO_2e$ in 2020. CO_2 emissions therefore decline from reference-case levels by 5.3 percent in 2015 and 11.6 percent in 2020.
- Through 2010, no additional capacity is added in Connecticut. Through 2020, 409 MW of projected fossil-fired capacity in Connecticut would be displaced by the construction of 204 MW of biomass-fired IGCC and additional capacity construction outside the State. The cumulative combined-cycle capacity built decreases from 656 MW to 470 MW, while the coal IGCC falls from 825 MW to 602 MW. The total cumulative capacity added in 2015 increases to 817 MW; the cumulative capacity added through 2020 falls to 1,456 MW, which is 205 MW below the projected capacity in the reference case.

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[1] Note – this recommended action is a combined renewable energy policy strategy that includes: Renewable Portfolio Standards (RA 46), Government Clean Energy Purchase (RA 47), and Production Tax Credit (RA 48). The stakeholders ran this scenario as a combined IPM scenario to inform the judgment of the group in its decision-making. No GHG emissions reductions will be reported towards the target for this recommended action. There is no efficienct way of separating out the GHG emissions reductions associated with this combined policy run and its individual components, therefore each policy recommendation's associated GHG emissions reductions are reported separately.

- In 2010, the generation profile in Connecticut does not change. Generation from all fossil sources declines by 8.7 percent in 2015 and 11.7 percent in 2020. Combined-cycle generation decreases by 13.2 percent in 2015 and 6.2 percent in 2020; oil/gas steam-unit generation increases by 120.5 percent in 2015; and coal IGCC generation falls by 27.0 percent in 2020. Total renewable generation increases dramatically by 354.3 percent in 2015 and 250.3 percent in 2020. Generation from biomass IGCC increases from zero to 1,432 GWh in both 2015 and 2020. Biomass IGCC accounts for nearly all the increase in renewable generation, although wind generation increases by 11.1 percent in 2015. Total in-state generation in 2020 decreases by 2.1 percent, and the proportion of generation from renewable sources rises from 1.5 to 5.2 percent.
- The average wholesale electricity price in Connecticut changes only slightly over the forecast period. It does not change in 2010, but it decreases by 0.4 percent (–$0.13 /MWh) in 2015 and 0.2 percent (–$0.09/MWh) in 2020.
- Average wholesale capacity prices increase by less than 0.1 percent in 2010 and then decline by 0.2 percent in both 2015 and 2020.
- Average wholesale firm power prices increase by less than 0.1 percent in 2010; they then decrease by 0.3 percent in 2015 and 0.2 percent in 2020.
- Compared with the reference case, total program and policy costs to Connecticut through 2020 increase by $253.91 million. Total cost changes by component are as follows:
  - Power expenditures: –$17.51 million
  - Renewable premium: $138.32 million
  - State production tax credit: $133.10 million

Estimated Costs
See above.

Estimated Co-Benefits
Co-benefits have not been estimated.

Progress – In Process
See individual recommended actions for an update on progress.

Supplemental Information
There is no supplemental information on this recommended action.

Lead Agency
Connecticut Clean Energy Fund, Office of Policy and Management, Connecticut Department of Public Utility Control, and the Connecticut Department of Revenue Services.

46. Renewable Portfolio Standard

Recommended Action: Expand and extend the Renewable Portfolio Standard.

This recommendation involves increasing the required percentage for the State's Renewable Portfolio Standard (RPS). The existing RPS will require seven percent renewable content by 2010. The recommendation would extend the RPS through 2020 and increase the level of renewable energy required to 20 percent by 2020 (see Table 46.1).

Table 46.1
Recommended RPS Class I Renewable Energy Targets

Year	Energy Target (%)
2011	8.0
2012	9.0
2013	10.0
2014	11.0
2015	12.5
2016	14.0
2017	15.5
2018	17.0
2019	18.5
2020	20.0

The Center for Clean Air Policy (CCAP) sponsored modelling to evaluate the costs and carbon reductions of the electric sector policy recommendations. This modelling, using the IPM® model, provided useful information about the policies, but the results must be interpreted carefully to discern the benefits of the existing and expanded RPSs accurately. First, Connecticut's existing RPS was included in the Reference Case model run, along with a number of other existing RPSs in the region. Thus, the results of the Renewable Energy Case do not reveal the regional CO_2 benefits of Connecticut's existing RPS policy – only the expanded policy. Second, the expanded RPS is modelled along with two other energy policies in a "Renewable Energy Strategy," making it difficult to discern the effect of the RPS alone. Finally, it is important to note that all of the CO_2 reductions occurring in the Renewable Energy Strategy are attributable to the Connecticut programs, though these reductions take place at fossil-fired power plants across the Northeast.

Below, we review the CCAP modelling results pertaining to the two Connecticut RPS policies (existing and proposed).[2]

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reduction:
1.3 $MMTCO_2e$ in 2010 [3]
3.2 $MMTCO_2e$ in 2020 [4]

Connecticut's Existing RPS

Connecticut's existing RPS requires that an increasing percentage of the electricity consumed in the State be generated by renewable resources. This percentage peaks at seven percent in the year 2010. As noted, this policy was included in the Reference Case in the CCAP modelling. Thus, the Reference Case CO_2 emissions are lower than they would have been absent the Connecticut RPS. There is no way to discern the CO_2 benefits of the Connecticut RPS from the modelling outputs. However, we can estimate the benefits of this policy using an assumed marginal CO_2 emission rate for the northeastern US.

The emission impacts of energy efficiency programs and renewable resources are commonly estimated using system marginal emission rates, based on the idea that reduced demand for energy reduces the operation of the marginal generating unit. Synapse has performed a number of analyses evaluating system marginal emission rates, and based on this work, we have used a marginal CO_2 rate of 1,100 lb/MWh.[5]

This marginal emission rate reflects the fact that the CT RPS affects fossil-fired generators primarily in New England (based on the IPM modelling results) but also in New York and the Pennsylvania/New Jersey/Maryland Interconnection (PJM). Currently, marginal CO_2 rates are lower in New England than in PJM or New York, due to a larger percentage of gas-fired generation in New England than in these other regions. (The CO_2 emission rate of a gas-fired combined-cycle plant is in the range of 850 lb/MWh, and that of a coal-fired power plant is in the range of 2,000 lb/MWh.) The Table below shows the calculation of 1.3 $MMTCO_2e$ reduced by Connecticut's existing RPS in 2010.

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[2] The modelling results are included in the final report of the Connecticut Climate Change Stakeholder Dialogue, available at: http://www.ccap.org/Connecticut.htm

[3] Existing RPS

[4] Recommended RPS expansion beyond 2010

[5] Recent Synapse reports on marginal emission rates include: Keith, et. al., *The OTC Displaced Emissions Workbook 2.1: Description and User's Manual*, Prepared for the Ozone Transport Commission, December 9, 2002, and Keith, et. al., *Estimating the Emission Reduction Benefits of Renewable Electricity and Energy Efficiency in North America: Experience and Methods, Prepared for the Commission on Environmental Cooperation, September 22, 2003*. Both reports are available at: www.synapse-energy.com.

Table 46.2

Estimating CO_2 Emissions Offset by the Existing CT RPS in 2010

2010 CT Electricity Use (MWh)	36,305,000
CT RPS Percentage	7%
CT RPS Demand (MWh)	2,541,350
Marginal CO_2 Rate (lb/MWh)	1,100
CO_2 Emissions Offset (metric tons)	1,268,000

An Expanded RPS in Connecticut

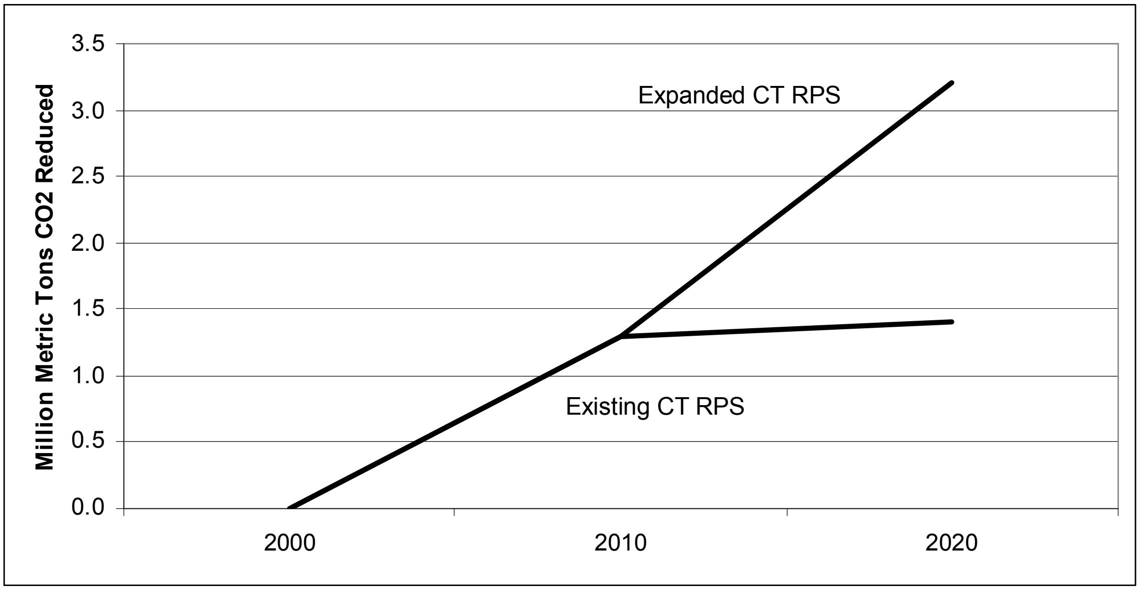
The Renewable Energy Strategy evaluated in the CCAP modelling included the expanded RPS in Connecticut, as well as additional purchases of renewable energy from state agencies and a Production Tax Credit (PTC) for renewable energy in the state. These three Connecticut policies together result in reductions of 2.02 $MMTCO_2e$ throughout the region.

Because these policies were modelled together, it is impossible to discern exactly what the impact would be of the RPS in isolation, however, the other two policies would likely have much smaller impacts than the RPS. First, the large number of MWhs involved in the RPS represents much greater demand than the state power purchases modelled, and the limited renewable resources in Connecticut would limit the effect of the Connecticut PTC. (Indeed, the model only adds two MW of wind in CT in this scenario.)

The CCAP report estimates the effect of the RPS alone at 1.25 $MMTCO_2e$ by estimating the effects of the RPS with a marginal emission rate (similar to the calculation in Section 1 above) and then reducing the result dramatically with a factor to account for "limited renewable availability." Considering the three Connecticut policies involved, however, this estimate probably understates the effects of the RPS. A better estimate would probably come from simply assuming that the RPS generated 90 percent of the reductions achieved by the three programs together. This assumption yields an estimate of 1.8 $MMTCO_2e$ reduced by the expanded RPS.

Regardless of the exact portion of the emission reductions attributable to the RPS, it is clear that all of the modelled reductions are attributable to the Connecticut policies, regardless of where in the region the emission reductions occur. The figure below shows the reductions estimated in Section 1 above for the existing RPS (in 2010) as well as the 1.8 $MMTCO_2e$ of additional reductions from the expanded RPS, as estimated in Section 2.

Figure 46.1
Estimated CO2 Reductions from the Existing and Expanded CT RPSs[6]



Estimated Costs
Costs have not been estimated.

Estimated Co-Benefits
By virtue of reducing conventional power plant production, increased utilization of clean energy resources would yield a number of additional pollutant benefits in terms of reduced SO_2, NOx, and mercury emissions. Other potential co-benefits include greater fuel diversity; fuel cost savings; and increased electric system reliability and security — as well as economic development benefits.

Progress – In Process (2010) / Action Pending (2020)

Supplemental Information
There is no supplemental information on this recommended action.

Lead Agency
Connecticut Department of Public Utility Control and the Connecticut Clean Energy Fund

[6] This graph reflects the assumption that, as part of the existing RPS, Connecticut maintains a seven-percent RPS between 2010 and 2020. Thus the benefits of the existing RPS grow slightly over this period, as Connecticut electricity use grows.

47. Government Clean Energy Purchase

Recommended Action: Implement a Government Clean Energy Purchase program.

The State should increase its purchase of Class I renewable energy to 20 percent in 2010, 50 percent in 2020, and 100 percent in 2050.

To promote and encourage the deployment of renewable energy resources in the region (beyond RPS requirements) by Connecticut businesses, municipalities, institutions, and households, government can "lead by example" by purchasing increasing amounts of renewable energy.[7] The adoption of a portfolio of strategies could yield a zero-cost solution. These strategies include the following measures:

1. *Use energy conservation savings to finance the premium for renewable energy.* A shared savings policy requires the Office of Policy and Management to rebate 50 percent of the energy savings achieved by State agencies. The stakeholders recommend that the 50 percent of the savings received by the State through this measure be earmarked for renewable energy purchases. Clearly demonstrated energy savings (based on comparable kWh numbers from year to year) could substantially finance the State purchase of renewable energy and help it achieve the recommended goals. This strategy is coordinated with the RCI working group and its recommendations for State government energy conservation targets.
2. *Competitive power procurement.* Deregulation offers State government the opportunity to issue a competitive bid in the open market to achieve a reduced rate. Energy savings of 5 to 10 percent can be achieved through a competitive offer. The State could also specify increasing quantities of renewable energy in its mix to achieve the recommended targets.
3. *Supplemental environmental projects.* Supplemental environmental projects (SEPs) can help companies mitigate all or part of the penalties imposed as a result of air pollution violations. SEPs are environmentally beneficial projects administered by the DEP that offer pollution prevention, EE, green energy, and community-based programs. SEPs can reduce the renewable premium, help finance renewable energy projects, and support the purchase of green tags.

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[7] Renewable energy means Class I from one of the following sources: (1) renewable energy certificates purchased in Delaware, Maryland, New England, New Jersey, New York, and Pennsylvania, (2) green power offerings, or (3) onsite distributed-generation deployment at State facilities.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.08 $MMTCO_2e$ in 2010
0.21 $MMTCO_2e$ in 2020

The Office of Policy and Management (OPM) has provided annual energy usage data for State government facilities for FYs 2001 and 2002. Data provided by OPM and the Connecticut Siting Council show that State government energy consumption equates to roughly 2 percent of Connecticut's total, making it an important target for leading by example. Electricity costs represent less than 0.5 percent of the general budget. The market size is estimated to be 650,000,000 kWh, including 34 State agencies and 18 State colleges and universities.

Government procurement has significant positive benefits in spurring market demand. State government's commitment to purchase renewable energy creates opportunities for clean energy technology commercialization, energy reliability and security through distributed generation, and economic development prospects for nascent industries in which Connecticut companies are recognized leaders (e.g., fuel cells).

The assumptions that went into the initial quantification and the resulting carbon impacts are shown in Table 47.1:

Table 47.1
Government Clean Energy Purchase Assumptions

	2002	2010	2020
Estimated government demand for electricity (GWh)	647	702	781
Percentage renewable	1%	20%	50%
Estimated renewable electricity demand (GWh)	6	140	391
Marginal CO_2 emissions rate (lbs CO_2/MWh)	1,400	1,300	1,200
$MMTCO_2e$ reduction	0.004	0.08	0.21

This option was also analyzed within the IPM RES scenario. See the summary of the RES scenario for joint quantification estimates.

Estimated Costs

Table 47.2
Estimated Annual Costs
(20% Clean Energy by 2010 and 50% Clean Energy by 2020)

	2010		2020	
	High	Low	High	Low
REC Price ($/MWh)	13.50	8.20	10.10	2.40
Estimated Clean Energy Demand (GWh)	140		391	

Estimated Annual Costs	$1,890,000	$1,148,000	$3,949,100	$938,400

Estimated Co-Benefits
By virtue of reducing conventional power plant production, increased utilization of clean energy resources would yield a number of additional pollutant benefits in terms of reduced SO_2, NOx, and mercury emissions. Other potential co-benefits include greater fuel diversity; fuel cost savings; and increased electric system reliability and security — as well as economic development benefits.

Progress - In Process
Executive Order 32 passed requiring state government and universities to purchase Class I renewables: 20% by 2010, 50% by 2020, and 100% by 2050. OPM has hired a consultant to update state building load profiles to assist the state in carrying out this measure.
There should be a minimum 20 percent government green power purchase by 2010 and 50 percent in 2020. A consultant has been hired to evaluate load curves and energy consumption patterns at State facilities as a precursor to clean energy purchasing.

Supplemental Information
There is not supplemental information on this recommended action.

Lead Agency
Office of Policy and Management

48. Production Tax Credit

Recommended Action: Explore a production tax credit (PTC) for new Class I renewable projects.

The State should explore a production tax credit (PTC; equal to $0.018/kWh for 10 years) for new Class I renewable projects in Connecticut that are not covered by the federal renewable PTC (i.e. fuel cells, solar, landfill gas, biomass, hydrogen, and small hydro). This would be a potential mechanism to achieve RPS and promote development of in-state renewables in light of future information on the availability of and competition for biomass resources.

A PTC can encourage the deployment of renewable energy resources in Connecticut; generators in Connecticut should be provided a State PTC to complement the federal PTC. A Connecticut PTC would cover Class I renewable energy resources constructed in Connecticut and not covered by the federal program. Under this policy, projects eligible for the federal PTC (e.g., wind) would not receive State assistance, but ineligible projects (e.g., solar) would. A Connecticut PTC would apply to projects constructed beginning in the year legislation was passed and continue indefinitely. Projects would have to first seek federal assistance; if they did not qualify, they would be eligible for the State tax credit. This policy should ensure that renewables that are close to the margin economically will get built in Connecticut.

The Connecticut PTC would be for the same amount as the federal credit (currently $0.018/kWh). Like the federal PTC, the credit period would be 10 years from the start of service.

Provision of PTC will be handled by the Department of Revenue Services for qualifying projects.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

The PTC was quantified together with two other measures (government green power purchase and RPS) as the RES using the IPM model (see the summary of the RES scenario for joint quantification estimates).

Estimated Costs

See the summary of the RES scenario for joint quantification estimates.

Estimated Co-Benefits

Co-benefits have not been estimated.

Progress – In Process

Although not directly a Connecticut-based production tax credit, P.A. 03-135 requires Connecticut Light and Power (CL&P) and United Illuminating (UI) to sign long-term PPA's for no less than 100 MW of clean energy. This unprecedented act requires that contracts for no less than a 10-year period (the length of the federal PTC is 10-years) be signed at a wholesale market price plus up to $0.055 per kWh (the federal PTC is inflation adjusted at a rate of $0.015 per kWh).

The implementation of this public policy requires:

1. Evaluation and recommendation of project feasibility and qualification by the Connecticut Clean Energy Fund;
2. Negotiation of contracts by CL&P and UI; and
3. Approval of contracts by the Connecticut Department of Public Utility Control.

Actions taken to date include:

- Connecticut Department of Public Utility Control conducted a proceeding that established a procedure and process guidelines to implement the statute.

- Connecticut Clean Energy Fund organized a kick-off meeting to prospective developers and financiers to discuss the process and issue a draft RFP for public comment.

This act, in its current design, exceeds the benefits offered to clean energy developers and financiers through a federal PTC model, however, project siting is currently designated to the statutory region of the Northeast and not restricted to only Connecticut, which this recommendation was based on.

The need to develop a Connecticut-based PTC will depend upon how PA 03-135 is successfully implemented.

Supplemental Information

- http://www.dpuc.state.ct.us/dockcurr.nsf/Web+Main+View/Search+Electric?OpenView&StartKey=03-07-17

Lead Agency

Connecticut Clean Energy Fund, Connecticut Department of Public Utility Control, and the Connecticut Department of Revenue Services

49. Clean Energy Option

Recommended Action: Provide a clean energy option to ratepayers and default customers.

The State should establish and launch a clean energy option for all ratepayers and default customers pursuant to SB 733 by January 1, 2005. The clean energy option targets recommended by the renewable energy subcommittee are as follows: 3 to 4 percent by 2010; 5 to 10 percent by 2020; and 11 to 20 percent by 2050. These targets exceed the RPS requirements.

To promote and encourage the deployment of renewable energy resources in the region (beyond RPS requirements), Connecticut ratepayers should be able to choose where their power comes from through one or more clean energy option offerings. Several years ago, two competitive power suppliers offered Green-e certified renewable energy products: Green Mountain Energy and the Connecticut Energy Cooperative. At their peak, the two providers were satisfying less than 0.1 percent of the market with a renewable energy product based on the number of ratepayers being served. Currently, no clean energy offerings are available to Connecticut ratepayers. The implementation of clean energy offerings would therefore provide choices for Connecticut ratepayers while improving the portfolio of renewable energy strategies to support market development and deployment of clean-energy technologies.

The recommended targets for clean energy option offerings are as follows:

- 3 to 4 percent by 2010
- 5 to 10 percent by 2020
- 11 to 20 percent by 2050

Note that these targets exceed the RPS requirements. In other words, by 2010, 10 percent of the power supply will come from Class I and Class II renewable energy resources through the RPS, and 3 to 4 percent of ratepayers will be supplied by 100 percent renewable energy (90 percent more than is required by the RPS for this block of customers) through competitive offering(s) explicitly purchased by them.

The program would be administered by the Alternative Transitional Standard Offer Providers Connecticut Light and Power (CL&P) or United Illuminating (UI) and by any competitive power supplier offering clean energy choice product(s) in the marketplace.

- *Consumer Education and Outreach Program*. Research indicates that a continuous commitment to marketing green offerings contributes to program success. The Consumer Education and Outreach Program, managed by Department of Public Utility Control (DPUC), should set aside a portion of its funding to specifically inform ratepayers about green offerings. Strategic funding efforts by DPUC to capable organizations operating in Connecticut can improve upon the effectiveness and efficiency of education and outreach programs.

- *Connecticut Clean Energy Fund (CEF)*. The CEF, through its existing education and outreach initiatives, will provide support for the benefit of Connecticut ratepayers.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.43 MMTCO$_2$e in 2010
0.81 MMTCO$_2$e in 2020

The estimates are based on the output of the renewable IPM modeling run. The State energy-use and fossil fuel emissions factors are taken from the run. The impact of the clean energy choice is quantified by taking the minimum target level, as determined by the stakeholders for specified years, adjusted for the expected generation source (renewable vs. nonrenewable) and multiplied by the expected emission rate.

Estimated Costs

The range of cost premiums for renewable energy is based on the costs of the generation technologies and fuels (e.g., wind, solar, biomass, landfill gas, fuel cells, hydrogen, etc.), pricing pressures due to limited supplies in the Northeast, and natural gas prices. Cost estimates (Table 49.1) are based on projected consumption (kWh) and number of ratepayers as well as on the estimated ranges of cost premiums for renewable energy.

It should be noted that these are voluntary purchases by Connecticut ratepayers and therefore there is no direct cost to the state beyond program support to promote this program.

Table 49.1
Details of the Clean Energy Option Quantification

	2010	2020
Electricity demand (GWh)	32,933	38,560
Fossil fuel generation displaced	2.8%	4%
Fossil (marginal) emission rate (lb CO_2/MWh)	1,035	1,155
Carbon reduction (MMTCO$_2$e)	0.43	0.81
Total cost (millions)	\$14.49	\$17.76

Estimated Co-Benefits

Co-benefits have not been estimated.

Progress – In Process

On October 20, 2004, the Connecticut Department of Public Utility Control Docket 03-07-16, “Investigation of Alternative Transitional Standard Offer (ATSO) Services for United

Illuminating and CL&P Customers" reached a decision. It is expected that there will be a Clean Energy Choice provided to CL&P and UI customers in the 1st quarter of 2005. This REC (renewable energy credit) based program will provide Connecticut residential, commercial, and industrial ratepayers with a 50% or 100% electricity product made from clean energy resources.

The Connecticut Clean Energy Fund, in partnership with SmartPower, has created a program called "Connecticut's Clean Energy Communities." This program will provide "free" solar photovoltaic (PV) systems for Connecticut cities and towns that: (1) commit to the 20% x 2010 Clean Energy Campaign, (2) sign-up local residents and businesses to the Clean Energy Choice, and (3) allocate 100% of the electricity savings resulting from the "free" PV towards a local purchase of clean energy. This program is designed to compliment the ATSO program and support greater market penetration to achieve the recommended action targets.

Supplemental Information

There is no supplemental information on this recommended action at this time.

Lead Agency

Connecticut Department of Public Utility Control and the Connecticut Clean Energy Fund

Connecticut Climate Change

50. Renewable Energy Credits

Recommended Action: Allow for renewable energy credit (REC) trading in the Northeast Region to meet compliance and voluntary market requirements for clean energy in Connecticut.

To meet the RPS, the clean energy choice, and state government clean energy purchase, allow purchase of REC's generated in New England as well as Delaware, Maryland, New Jersey, New York, and Pennsylvania, assuming they have compatible certificate markets and mechanisms.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)
There are no direct or indirect GHG emissions reductions associated with this measure. However, what clean energy Connecticut creates as a result of regional REC trading through its compliance and voluntary markets, it expects to count towards its GHG emissions reductions. This assumes that a REC includes all associated environmental attributes.

Estimated Costs
There are no costs to this measure, however, this measure will reduce compliance costs to ratepayers for the implementation of Connecticut's RPS.

Estimated Co-Benefits
Estimated co-benefits associated with this recommended action have yet to be analyzed. By developing clean energy projects upwind of Connecticut, significant public health co-benefits are anticipated as upwind state pollution is naturally transported and deposited into Connecticut causing poor air quality conditions.

Progress – In Process
DPUC Docket 04-01-13 "DPUC Review of RPS Standards and Trading Programs in New York, Pennsylvania, New Jersey, Maryland, and Delaware" is currently open and accepting public comments.

Supplemental Information
There is no supplemental information on this recommended action.

Lead Agency
Connecticut Department of Public Utility Control and the Connecticut Clean Energy Fund

Connecticut Climate Change

51. Restore Clean Energy Fund

Recommended Action: Restore funding for the Connecticut Clean Energy Fund

This recommended action calls for the restoration of the Connecticut Clean Energy Fund (CCEF) to its full funding level of roughly $29 million annually, generated by a 1 mil per kWh surcharge on electricity sales. The CCEF provides incentives for new renewable generation capacity and pilot programs. Under business-as-usual (BAU), a total of $8.6 million in annual revenues from the Fund will be diverted for other state budget purposes for each of fiscal years 2005–2011. The potential greenhouse gas (GHG) reduction benefits associated with instead applying these diverted funds to directly purchase Renewable Energy Credits, or leverage voluntary green power purchases by commercial, industrial, and institutional entities in Connecticut are described below. As an alternative, a scenario in which diverted funds are used to support distributed fuel cell or renewable system installations in high value applications in Connecticut was also evaluated.

Scenario 1: Leveraging Clean Energy Purchases

One potential use of diverted CCEF funds would be to directly purchase Renewable Energy Credits (RECs) from renewable power generators. These generators could be located in Connecticut or in other parts of the Northeast that have compatible generation reporting systems and/or are participating in a common, region-wide GHG registry system. Potentially greater GHG reductions could be achieved if, instead of directly purchasing RECs, CCEF funds were used to leverage voluntary green power purchases by commercial, institutional and industrial entities in Connecticut. In this case, $1 of CCEF funding could theoretically leverage more than $1 of REC purchases. Importantly, for associated GHG reductions under either approach to be additional to the BAU case, RECs purchased with CCEF funding would need to be retired and could not be counted toward compliance with Connecticut's renewable portfolio standard.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

Estimated GHG emissions reductions:

0.31 MMTCO_2e in 2010
0.41 MMTCO_2e in 2020

Table 51.1 below summarizes kWh of conventional electricity generation displaced by renewable generation in 2010 and 2020 under different assumptions concerning the future price of RECs. Table 51.2 summarizes corresponding GHG benefits in million metric tons of carbon dioxide (CO_2) equivalent per year for a range of scenarios combining different REC prices, different leveraging ratios of state to private funds, and different assumptions about the emissions characteristics of power displaced by the renewable generation associated with each REC. In both tables, results are shown for 2020 to illustrate the potential benefits of continued

CCEF funding over a longer timeframe, recognizing that the current program, current funding levels, as well as the planned diversion of funds from the current program, may not continue — or may change — beyond 2011. Note that all of the calculations assume $1 million in annual program implementation costs, such that the total remaining from otherwise diverted CCEF funds to support additional REC purchases is $7.6 million per year. In the High Price case, RECs are assumed to cost $13.50 per MWh in 2010 and $10.10 per MWh in 2020, whereas in the Low Price case RECs are assumed to cost $8.20 and $2.40 per MWh in 2010 and 2020, respectively.[8] Accordingly, the amount of conventional electricity generation displaced in 2010 ranges from 563 million kWh to 4,634 million kWh, depending on REC prices and on whether and to what extent state funds are leveraged. The corresponding range for 2020 under worst case to best case assumptions is 752–15,833 million kWh.

Table 51.1
Conventional Electricity Generation Displaced by REC Purchases
(GWh)

	2010		2020	
REC Price	High	Low	High	Low
Direct REC Purchase (1:1 Leverage)	563	927	752	3,167
Leveraged REC Purchase (2:1 Leverage)	1,126	1,854	1,505	6,333
Leveraged REC Purchase (5:1 Leverage)	2,815	4,634	3,762	15,833

In Table 51.2, emission reduction estimates are shown for three different assumptions concerning CO_2 emissions avoided as a result of added renewable generation: (1) renewable generation displaces conventional coal generation at an avoided emissions rate of 2000 lb/MWh; (2) renewable generation displaces average utility generation at an avoided emissions rate of 1200 lb/MWh; and (3) renewable generation displaces natural gas combined-cycle generation at an avoided emissions rate of 850 lb/MWh.

Table 51.2
Estimated CO_2 Reductions Associated with Using CCEF Funds to Purchase REC's
($MMTCO_2e$)

		2010	2020
Direct REC Purchase (1:1 Leverage)	**High REC Price**		
	▪ Avoid Coal	0.51	0.68
	▪ Avoid Average Utility	0.31	0.41
	▪ Avoid Natural Gas CC	0.22	0.29
	Low REC Price		
	▪ Avoid Coal	0.84	2.87
	▪ Avoid Average Utility	0.50	1.72
	▪ Avoid Natural Gas CC	0.36	1.22

[8] The figures for the High Price case correspond to modelled predictions from Integrated Planning Model (IPM) runs conducted by the Center for Clean Air Policy (CCAP) under its Renewable Policy Case; the Low Price figures correspond to IPM projections under CCAP's Reference Case.

Direct REC Purchase (2:1 Leverage)	**High REC Price**		
	▪ Avoid Coal	1.02	1.37
	▪ Avoid Average Utility	0.61	0.82
	▪ Avoid Natural Gas CC	0.43	0.58
	Low REC Price		
	▪ Avoid Coal	1.68	5.75
	▪ Avoid Average Utility	1.01	3.45
	▪ Avoid Natural Gas CC	0.71	2.44
Direct REC Purchase (5:1 Leverage)	**High REC Price**		
	▪ Avoid Coal	2.55	3.41
	▪ Avoid Average Utility	1.53	2.05
	▪ Avoid Natural Gas CC	1.09	1.45
	Low REC Price		
	▪ Avoid Coal	4.20	14.36
	▪ Avoid Average Utility	2.52	8.62
	▪ Avoid Natural Gas CC	1.79	6.10

For 2010, Table 51.2 indicates a range of potential annual CO_2 reductions from 0.22 million metric tons CO_2-equivalent (MMTCO_2e) to as much as 4.20 MMTCO_2e. The low end of this range assumes no leveraging of state funds, avoided emissions corresponding to natural gas combined-cycle generation, and a high price for RECs. The high end of this range assumes that state funds are leveraged 5:1, avoided emissions correspond to a conventional coal power plant, and REC prices are low. Corresponding costs for CO_2 reductions in 2010 (assuming a total state expenditure of $8.6 million/year for REC purchases and program implementation) range from as much as $39.09 per metric ton to as little as $2.05 per metric ton.[9] The range of potential reductions for the same expenditure of CCEF funds in 2020 is larger, from 0.29–14.36 MMTCO_2e, depending on whether conservative versus best-case assumptions are used concerning leverage ratio, avoided emissions, and REC prices. Corresponding costs per metric ton of CO_2 reduction in 2020 range from a high of $29.66 to a low of $0.60. For purposes of this summary, we take a conservative estimate of likely GHG reductions assuming direct state purchase of RECs (i.e., no leveraging), high REC prices, and avoided emissions at the average utility rate of 1200 lbs/MWh. This yields estimates for 2010 and 2020 emissions reductions of 0.31 and 0.41 MMTCO_2e, respectively. Corresponding cost-effectiveness figures for these two years are $27.74 and $20.97 per metric ton, respectively.

Scenario 2: Promoting Distributed Fuel Cell or Renewable Installations in Connecticut

If used to purchase RECs, CCEF funds may in many cases support renewable energy projects outside the state of Connecticut. Accordingly, there may be a preference for instead using these

[9] Note that these cost-per-ton figures include only cost to the state but take full credit for resulting reductions. In cases where state funds are leveraged, total public and private costs per ton of CO_2 reduction range from as much as $31.76/ton to as low as $5.65/ton where RECs are assumed to be displacing natural gas combined cycle generation and from $13.50/ton to $2.40/ton where RECs are assumed to be displacing conventional coal generation.

funds to promote distributed fuel cell or renewable system installations in high value applications inside the state. Specifically, CCEF funds could be used to "buy down" the cost of on-site fuel cell installations on suitable facilities in locations where distributed generation has high value to the transmission and distribution (T&D) system; in this case, areas of southwest Connecticut where T&D is constrained. An initial analysis suggests that the potential CO_2 reductions associated with this use of otherwise-diverted CCEF funds (again assuming annual program implementation costs of $1 million per year) total approximately 9,000 metric tons of CO_2 per year or less than 0.01 $MMTCO_2e$ per year, considerably less than the range of potential reductions associated with REC purchases as described above. This approach would also be far less cost-effective from a GHG reduction standpoint, costing as much as $950 per metric ton of CO_2 reduction. It should also be noted, however, that these results are highly sensitive to input assumptions, including the financing terms that would apply to such projects, the price of natural gas, and the value of reliability benefits to the host facility. The assumptions used for purposes of this analysis suggest that the CCEF would need to provide a rebate of approximately $2,150 per kW to make distributed fuel cell installations cost-effective; associated CO_2 benefits are calculated assuming average avoided utility emissions of 1200 lbs/MWh.

Estimated Costs

Estimated program implementation costs for either approach evaluated under this Recommended Action are assumed to total $1 million per year. If CCEF funds are leveraged to promote voluntary green power purchases, commercial, industrial, and institutional consumers in Connecticut would be expected to spend as much as $7.6 million annually on RECs in the 2:1 leverage case and $30.4 million in the 5:1 leverage case. If CCEF funds are used to buy down the cost of fuel cell installations, the buy-down would presumably be structured such that installations are cost-effective after the incentive is applied so that there are no additional costs in Connecticut.

Estimated Co-Benefits

By virtue of reducing conventional power plant production, increased utilization of renewable resources and new distributed fuel-cell installations would yield a number of additional pollutant benefits in terms of reduced SO_2, NOx, and mercury emissions. Other potential co-benefits include greater fuel diversity; fuel cost savings; and increased electric system reliability and security — as well as economic development benefits. These benefits are, of course, more likely to be concentrated in Connecticut if CCEF funds are used to promote renewable projects or fuel cell applications within the state. Accordingly, the state may wish to pursue a blended approach in which some funds are used to purchase RECs from a region-wide market (thereby yielding maximum GHG benefits, as indicated by the foregoing analysis), while remaining funds are used to leverage in-state fuel cell or renewable energy projects.

Progress – Action Pending

Supplemental Information

There is no supplemental information on this recommended action.

Lead Agency
Connecticut Clean Energy Fund and the Connecticut Department of Public Utility Control

52. Energy Efficiency and Combined Heat and Power

Recommended Action: Implement a package of energy efficiency and combined heat and power (CHP) measures.

All measures identified and assessed by the RCI and AFW working groups that result in electricity demand reductions are included in the EE package for the IPM model run. The measures include appliance standards, an appliance-swapping program, a heat pump and water heater (HPWH) replacement program, bulk purchasing of appliances, mandatory upgrades to commercial and residential building codes, energy efficiency and energy improvement mortgages, a weatherization program, an Energy Star homes program, high-performance schools and State-funded buildings, high-performance commercial buildings, a shared savings program for government buildings and benchmarking, training of building operators, a green campus initiative, a benchmarking and tracking program for municipal buildings, third-party load management, combined heat and power, restoration of the Conservation and Load Management Fund, installation of centralized manure digesters, and an urban tree-planting program.

Estimated GHG emissions reductions:[10]

0.25 MMTCO_2e in 2010
4.90 MMTCO_2e in 2020

For the 10-state region, the emissions-reduction estimates are

1.17 MMTCO_2e in 2010
3.86 MMTCO_2e in 2020

This program includes demand-side reductions made in the RCI and AFW sectors and measures to encourage combined heat and power. The IPM model was used to quantify this package. Demand was assumed to be reduced by 3 percent in 2006, increasing to a 14 percent reduction in 2020. The measures and the costs of implementing them were developed within the stakeholder process.

- Total CO_2 emissions in Connecticut from the electricity sector will decline by 0.25 MMTCO_2e in 2010, 1.05 MMTCO_2e in 2015, and 4.90 MMTCO_2e in 2020. CO_2

[10] Note – this recommended action is a combined energy efficiency and CHP policy strategy that includes: numerous measures from the RCI sector. The stakeholders ran this scenario as a combined IPM scenario to inform the judgment of the group in its decision-making. No GHG emissions reductions will be reported towards the target for this recommended action. There is no efficienct way of separating out the GHG emissions reductions associated with this combined policy run and its individual components, therefore each policy recommendation's associated GHG emissions reductions are reported separately.

emissions therefore decline from reference-case levels by 3.5 percent in 2010, 12.3 percent in 2015, and 42.8 percent in 2020.

- Through 2010, no additional capacity is added in Connecticut. Through 2020, the cumulative combined-cycle capacity built decreases by 484 MW, and the coal IGCC falls from 825 MW to zero. The total additional cumulative capacity projected to be built therefore decreases to only 314 MW in 2015 and 352 MW in 2020. Total projected capacity additions decline due to the decrease in generation levels resulting from increased energy efficiency.
- Generation in Connecticut from combined-cycle units decreases significantly, falling by 1.1 percent in 2010, 27.5 percent in 2015, and 25.3 percent in 2020. Coal IGCC generation falls to zero in 2020; generation from oil/gas steam units falls to zero in 2010, increases by 120.5 percent in 2015, and rises from zero to 244 GWh in 2020. Generation from renewable sources does not change. Total in-state generation falls by 1.7 percent in 2010, 8.6 percent in 2015, and 21.0 percent in 2020; fossil generation decreases by 4.2 percent in 2010, 18.9 percent in 2015, and 43.1 percent in 2020.
- Average wholesale electricity prices in Connecticut decrease slightly: by 0.9 percent (–$0.28 /MWh) in 2010 and 0.3 percent (–$0.12/MWh) in 2015. In 2020, however, wholesale electricity prices increase by 1.3 percent ($0.45/MWh).
- Average wholesale capacity prices decrease by less than 0.1 percent in 2010, 0.6 percent in 2015, and 12.6 percent in 2020.
- Average wholesale firm power prices decrease slightly throughout the forecast period, falling by 0.8 percent in 2010, 0.4 percent in 2015, and 1.3 percent in 2020.
- Compared with the reference case, total program and policy costs to Connecticut through 2020 decrease by $481.26 million. Total cost changes by component are as follows:
    - Power expenditures: –$1,108.26 million
    - Renewable premium: –$10.56 million
    - Efficiency programs: $637.55 million

Estimated Costs
See above.

Estimated Co-Benefits
Co-benefits have not been estimated.

Progress – Action Pending

Supplemental Information
There is no supplemental information on this recommended action.

Lead Agency
Connecticut Department of Public Utility Control and the Connecticut Clean Energy Fund

53. Regional Cap-and-Trade Program

Recommended Action: Work with other northeastern states to develop a regional cap-and-trade program.

Connecticut should work with other northeastern states through continued participation in the Regional Greenhouse Gas Initiative (RGGI) and/or the New England Governors' Conference process to develop a regional cap-and-trade program for the electricity generation sector. These processes should use existing NEG targets as applied to the electricity generation sector as a starting point for recommended cap levels and timing (1990 emission levels by 2010 and 10 percent below 1990 levels by 2020). Given the results of advanced modeling by IPM in Connecticut that predict substantial loss of emissions benefits due to offsetting increases in emissions (i.e., "leakage") inside and outside the region (in Pennsylvania and the eastern interconnect region), Connecticut should support the design of a program covering the broadest possible geographical region and the widest range of potential sources and develop policy mechanisms to control offsetting emissions (such as a generation performance standard, offsets, or other approaches). In addition, Connecticut should support development of an effective federal cap-and-trade program for electricity generation sector.

Results of Assessments for 2010, 2020, and Beyond (Where Applicable)

The CCAP modelling of a regional cap-and-trade program provides a useful estimate of the regional impacts of such a program. However, the final CCAP report focuses on the CO_2 reduction impacts of the program within Connecticut. Focusing on emission changes in Connecticut only is inappropriate given the regional nature of the electric power system. Because electricity is provided via an interconnected, regional grid, generators outside of Connecticut commonly serve Connecticut customers, and generators in Connecticut commonly serve users in other northeastern states. Thus, the impact of *any* electric-sector actions taken by Connecticut consumers will be regional in scale. However, it is even more critical to view the results of a cap-and-trade program regionally, as this is a regionally implemented program. Electricity consumers across the entire capped region would fund the emission reductions achieved by the power generating sector, and the generating sector would achieve those reductions where it was most efficient.

Results of Assessments for 2010, 2020, and Beyond (Connecticut portion of the regional savings – with leakage)

Estimated GHG emissions reduction:

0.95 $MMTCO_2e$ in 2010
2.26 $MMTCO_2e$ in 2020

Results of Assessments for 2010, 2020, and Beyond (Connecticut portion of regional savings – without leakage)

Estimated GHG emissions reduction:
1.98 $MMTCO_2e$ in 2010
5.13 $MMTCO_2e$ in 2020

For a discussion of "leakage," see the "Supplemental Information" section below. Regarding the leakage observed in the modelling, the final CCAP report notes: "leakage of power generation to areas outside the capped region is often a problem in cap-and trade scenarios. To counteract leakage, a Generation Performance Standard (GPS) may be implemented with the cap. The GPS sets a level of emissions permissible for power imports. By limiting leakage, the performance of the cap-and-trade mechanism may be improved."[11]

One could estimate the portion of total CO_2 savings attributable to Connecticut using either the state's fraction of the cost of implementing the cap or its fraction of total regional energy use under the cap. In fact, if the costs of the program were spread evenly across the region, these fractions would be the same. The modelling results show that, indeed, the increase in Connecticut wholesale electricity prices is very close to the average increase in prices across the capped region. Thus, Connecticut's fraction of total energy use is a very accurate proxy for its fraction of total costs.

While there is not a direct link between the costs paid by specific consumers in a cap-and-trade program and the CO_2 reductions at any specific power plant, Connecticut consumers would clearly pay for a significant portion of the costs of a regional carbon cap. This fact is reflected in the modelling results, as the cost of wholesale electricity increases in Connecticut as well as in the other states participating in the cap. Therefore, a reasonable way to estimate the benefits of Connecticut's participation in this program is based on Connecticut consumer's share of the total program costs.

The table below shows the calculation of the CO_2 savings attributable to Connecticut's participation in the cap-and-trade program, using the state's fraction of total regional energy use to apportion emissions. This table shows Connecticut's portion of the actual modelled reductions (0.95 $MMTCO_2e$ in 2010 and 2.26 $MMTCO_2e$ in 2020) and the state's portion of the reductions that would have occurred had there been no "leakage" (2.0 $MMTCO_2e$ in 2010 and 5.1 $MMTCO_2e$ in 2020). If the cap-and-trade program were implemented along with policies to minimize leakage, the savings attributable to Connecticut would probably fall between these "with leakage" and "without leakage" numbers.

[11] Center for Clean Air Policy, Connecticut Climate Change Stakeholder Dialogue: Recommendations to the Governors' Steering Committee, January, 2004, available at: http://www.ccap.org/Connecticut.htm.

Table 53.1

Estimated CO2 Reductions from Connecticut Action in a Cap-and-Trade Program[12]

	2010	2020
10-State Electricity Use (MWh)	613,688,000	691,632,000
CT Electricity Use (MWh)	35,948,000	39,617,000
CT % of Total Use (%)	5.86%	5.73%
CO_2 Reductions with “Leakage”		
10-State Reductions (MMTCO2e)	16.24	39.37
CT Reductions (MMTCO2e)	0.95	2.26
CO_2 Reductions without “Leakage”		
10-State Reductions (MMTCO2e)	33.80	89.54
CT Reductions (MMTCO2e)	1.98	5.13

Estimated Costs

From CT’s IPM runs:

- Average wholesale electricity prices in Connecticut increase significantly over the forecast period, rising by 8.6 percent ($2.58/MWh) with respect to the reference case in 2010, 9.1 percent ($3.12/MWh) in 2015, and 13.8 percent ($4.84/MWh) in 2020.
- Average wholesale capacity prices increase by 19.5 percent in 2010 and 0.8 percent in 2015; they fall by 3.2 percent in 2020.
- Average wholesale firm power prices increase significantly throughout the forecast period, rising by 10.2 percent in 2010, 7.7 percent in 2015, and 10.6 percent in 2020. Firm power prices increase in 2020 because the increase in wholesale electricity prices outweighs the fall in capacity prices
- The CO_2 allowance price for the 10-state region increases over the forecast period in the policy case, rising from $7.38/metric ton in 2010 to $9.59/metric ton in 2015 to $12.11/metric ton in 2020.

It should be noted that updated IPM runs currently being conducted by RGGI will provide revised cost figures.

Estimated Co-Benefits

Reductions in emissions of NOx, SO2 and Hg are often realized when CO2 reductions are achieved from electricity generating units. The magnitude of the estimated reductions of these pollutants will be known when updated modelling runs are completed as part of the RGGI process.

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[12] These numbers reflect compliance with the modeled cap of 217 million tons (197 $MMTCO_2e$) in 2020. In the CCAP modeling study, a number of offset credits equal to 10% of the 2020 cap were allowed to be used in lieu of CO_2 reductions from capped electricity generating units.

Progress – In Process

Continuing participation in the Regional Greenhouse Gas Initiative (RGGI) and coordination with other states in the northeast region. The goal is to have electricity sector modelling results and a model rule completed by April 2005. A RGGI Staff Working Group meeting is held monthly, and numerous sub-group conference calls are held each month.

RGGI will be using the same electricity sector model (IPM) that was used during the CT Stakeholder process. Model assumptions and inputs (e.g., participating states, unit applicability threshold, use of offsets, cap size and timing, fuel costs, renewable energy available curves, etc) will differ from those used in the CT process, so a direct comparison with CT modelling results will not be possible. One area of interest when the new results are available will be the magnitude of the leakage issue.

Once a model rule is created and finalized by RGGI, CT DEP will need to promulgate a regulation if it is decided to move ahead and implement this program.

Supplemental Information

Much more information on the RGGI process can be found at http://www.rggi.org/index.htm.

During the Connecticut Stakeholder dialog, leakage was identified as an area of concern. Leakage results when the adoption of a cap-and-trade program leads to a rise in imports of electricity into the region or state covered by the cap, in turn increasing emissions outside the region and diminishing the net emission-reduction benefits achieved. Stakeholders stressed that although cap-and-trade is effective as a regional policy, it is not very effective as a state-only policy (in part due to concerns over leakage). It was felt that Connecticut should therefore avoid implementing a Connecticut-only cap-and-trade program. It was further decided that Connecticut should embrace the RGGI process and should pursue a regional cap-and-trade program with as broad a geographic range (including the RGGI states or even the Eastern Interconnect region) and as many sources as possible.

Lead Agency

Connecticut Department of Environmental Protection

Connecticut Climate Change

55. Emissions Inventory and Registry

Recommended Action: Create appropriate tools for an effective inventory, reporting system, and registry of State emissions.

Connecticut should create appropriate tools for an effective inventory, reporting system, and registry of State emissions. The system should support the State's target, action plan, and regional leadership role—including mutual recognition by other jurisdictions. The State should explore working with the NEG/ECP on this effort. Development of such a system may include the following actions:

- Creating an annual state-wide GHG emissions inventory and related State inventories
- Instituting mandatory reporting of GHG emissions by appropriate sources
- Developing a voluntary GHG emissions registry
- Working with other states and regions on consistent and mutually recognized approaches for inventory and reporting.

Result of Assessments for 2010, 2020, and Beyond
GHG emissions reductions have not been estimated.

Estimated Costs
There will be shared costs for establishing and running a regional registry. Final costs and potential funding mechanisms are still being evaluated.

Estimated Co-Benefits
Co-benefits have not been estimated.

Progress – In Process
CT DEP is working with other northeast states and NESCAUM on the Regional Greenhouse Gas Registry (RGGR) project. The goal is to develop a GHG registry that can accommodate both mandatory and voluntary reporting programs. This registry is also being designed to handle the emissions and allowance tracking needs of the Regional Greenhouse Gas Initiative (RGGI). Pursuant to Public Act 04-252 (A.A.C. Climate Change), Connecticut sources will need to commence mandatory reporting of annual GHG emissions in April 2006.

Supplemental Information
More information on the RGGR process can be found at http://www.rggr.us

Lead Agency
Connecticut Department of Environmental Protection

Connecticut Climate Change
Action Plan 2005

EDUCATION

54. Public Education Initiative

Recommended Action: Promote the awareness and education of Connecticut citizens about the solutions and impacts of global warming.

The stakeholder group strongly supports measures to foster a broad awareness of climate change issues (including co-benefit issues, such as clean air and public health) and effects among Connecticut's citizens and to engage citizens in simple actions to reduce GHG emissions. The measures, detailed below, are cross-cutting and provide a foundation for the implementation of all the mitigation actions proposed in this report. The measures seek to integrate with and build on existing outreach efforts involving climate change and co-benefit issues in Connecticut.

The following actions are recommended to ensure success of the specific education and outreach measures proposed below:

1. Include the Commissioners of Education and Higher Education on the Governor's Steering Committee on climate change.
2. Establish an ongoing Climate Change Education Committee to develop broad awareness of climate change issues and to implement the education and outreach measures proposed in this report. Participation in the committee should be open to interested parties from all sectors, including State agencies, educators, community-based organizations, businesses and institutions, municipalities, and universities. The work of the committee should include the following components:
    - Implementation of the initiatives to implement the education and outreach measures proposed below
    - Education and marketing of the GHG mitigation actions in this report
    - Coordination of the agencies and organizations involved in climate change education in Connecticut
    - Identification of existing resources and programs to implement climate change education measures
    - Identification of additional needs and supplemental sources of funding for climate change education measures (e.g., eligibility for climate change education funding under renewables and energy conservation funds and from corporations and foundations)
    - Development of a clearinghouse for Connecticut climate change information and education resources (perhaps on www.ctclimatechange.com/).

The climate change education and outreach measures described below focus on the following target audiences:

- Policy makers (includes legislators, executive office, and State agencies)
- Community leaders (includes businesses, institutions, municipalities, and universities and colleges)
- Future generations (includes K-12 education, museums, science centers, curricula for colleges and universities, home schoolers, and education organizations)
- Community-based organizations (includes nonprofit advocacy and education organizations, faith based organizations, foundations)
- The general public.

Measure 1	**Educate policy makers on climate change issues to facilitate implementation of the mitigation actions proposed in this report and other GHG reduction actions.**

Implementation Strategies

- Educate policy makers on climate issues and GHG mitigation actions recommended in this report and endorsed by the Governor; promote acceptance and implementation of policies.
- Provide continuous outreach and coordination to implementing State agencies, the executive office, and the legislature, including information sessions on the GHG mitigation actions recommended in this report, updates on progress toward goals, monthly press releases, and collaboration on joint projects and events.
- Educate press secretaries from the executive office and State agencies. Develop relationships to maintain message consistency and coordinate monthly press releases on GHG reductions and events.
- Incorporate input from policy makers to continually develop new climate change mitigation strategies for Connecticut.

Measure 2	**Work with community leaders from businesses, institutions, municipalities, universities, and colleges that have reduced GHG emissions to develop a critical mass of leaders in each sector who are reducing GHG emissions and making it a way of doing business in their communities.**

Implementation Strategies

- Identify community leaders with effective GHG reduction programs and form partnerships to showcase successes and mentor to peers (speakers bureau, case studies, etc.).

- Engage associations (e.g., CBIA, SACIA, CCM) and use their meetings to educate their members about climate change and the specific mitigation actions in this report.
- Organize outreach events that focus on "leading by example" and include technical assistance, peer exchange, information on state-of-the-art practices and technologies, and co-benefits and cost savings of GHG mitigation actions.
- Develop statewide climate change recognition programs for community leaders.
- Convene a series of seminars on the financial risks and opportunities related to climate change for Connecticut-based insurance companies and financial institutions.

Measure 3	**Integrate climate change issues into curricula and outreach programming for future generations.**

Implementation Strategies

- Organize a group of professional educators to identify existing climate change curricula and coordinate with and leverage existing efforts to assemble statewide resources that address climate change problems and solutions.
- Coordinate with the Department of Education to align climate change education resources with Connecticut science frameworks.
- Provide educational resources on climate change to supplement teaching efforts to meet existing State standards for public and private schools and home schoolers.
- Work with existing and developing science centers and museums to help them focus on climate change science and related issues that link with their core missions.
- At universities and colleges, promote research on global climate change and its solutions, integrate global climate change into curricula, and educate students on the problems of global climate change and individual actions (in accordance with Gov. Rowland's October 17, 2003, letter to university presidents).
- Integrate climate change into existing and new education competitions, such as science fairs, the Invention Convention, the Future Problem Solving Program, the Envirothon, and higher education competitions.

Measure 4	**Identify community-based organizations involved in outreach on climate change and related issues and expand participation to support all sectors in achieving goals for GHG emissions reductions.**

Implementation Strategies

- Identify community-based organizations (e.g., nonprofit advocacy and education organizations, faith-based organizations, and foundations) with expertise in climate change and related issues (e.g., clean air, traffic congestion, smart growth).
- Facilitate peer outreach and education to support an understanding of climate change and related issues and actions within community-based organizations.

- Work with community-based organizations to focus on climate change and related issues that link with their core missions.
- Develop a communication and coordination network of community-based organizations to ensure message consistency, link events, and develop joint projects.
- Assist community-based organizations with organizing their constituencies to support strong climate change actions.

Measure 5:	**Increase the awareness of the general public of the impact and problems of climate change and engage the general public in actions to reduce GHG emissions in their personal and professional lives.**

Implementation Strategies

Connecticut Climate Change Action Plan Rollout and Implementation Updates

- Develop events, outreach to media, and "buzz" around the Governor's acceptance of stakeholder recommendations in this report.
- Declare March (or another month within the legislative session and school year) as Climate Change Awareness Month. Schedule events around a different theme for each week (e.g., transportation, energy efficiency, and renewable energy) and include outreach on GHG mitigation actions and promotion of success stories.
- Coordinate monthly press releases on successful implementation of GHG mitigation actions and GHG reductions. Ensure message consistency and link actions to progress toward goals.

Climate Change Messaging

- Set appropriate evaluation targets to gauge the level of public awareness needed to attain Connecticut's GHG reduction goals.
- Perform initial benchmarking and conduct periodic research on Connecticut public opinion regarding climate change and related topics; the goal is to develop appropriate messaging (including the most effective terms for concepts such as climate change, global warming). Use polling to establish benchmarks on public opinion, gain feedback on outreach measures, and re-evaluate the approach to messaging.
- Focus on positive messages, not negative forecasts.
- Develop a climate change action "brand," marketing line, or logo (similar to "Connecticut Rides" or "Keep America Beautiful") to unify efforts and foster public awareness and engagement.
- Coordinate outreach to promote consistent messaging with all organizations and sectors involved in climate change awareness and education (e.g., nonprofit organizations, State agencies, educators, and municipalities).

Public Information

- Further develop the www.ctclimatechange.com website as a clearinghouse for climate change information, a communication forum for events and success stories, and a resource for progress on plan implementation and total Connecticut GHG reductions.

- Coordinate existing utility outreach to consumers and businesses for message consistency and coordination with action plan strategies.
- Develop disclosure and labeling of electricity-generation fuel mixes to promote consumer awareness of GHG production from electricity generation.
- Develop a plan for adaptation to climate change in Connecticut.
- Incorporate information on co-benefits of GHG reductions in climate change outreach (e.g., clean air, reduced traffic congestion, and healthier communities).
- Provide targeted outreach to key sectors (e.g., faith-based communities, drivers, asthmatics, and outdoor recreation enthusiasts).

Media Outreach

- Work with media to get newspaper editorials, op/ed pieces, and media coverage of climate change issues, action plan strategies, and instances of successful plan implementation.
- Develop public service announcements to raise awareness.
- Develop a documentary about Connecticut climate change.
- Incorporate existing climate change education programs (e.g., the USDA and NASA Global Climate Change programs) into local public access programming.

Result of Assessments for 2010, 2020, and Beyond

GHG emissions reductions have not been calculated.

Estimated Costs

Costs have not been estimated.

Estimated Co-Benefits

Co-benefits have not been estimated, but include the increased awareness of the environmental, economic and health benefits associated with climate change actions.

Progress – In Process

The Climate Change Education Committee (formerly the education workgroup for the 2003 Stakeholder Dialogue) continues to meet regularly to coordinate on implementation of the actions listed above. During 2004, there was significant progress made on the development of the state's climate change web site: www.ctclimatechange.com. In addition, there were numerous climate change outreach and technical assistance events for municipalities and universities, a Connecticut Science Center Collaborative was formed to integrate climate science and research into the programming of the state's science centers and museums, various organizations continued to conduct research on messaging and public opinion in Connecticut on global warming, and the many organizations involved in outreach on climate change and related issues in Connecticut continued to network and collaborate.

Suggested Next Steps for Implementation

- Continue implementation and coordination through Climate Change Education Committee.
- Develop goals and timeframes for each targeted sector.

- Develop means to monitor progress towards goals and, where possible, to quantify GHG reductions and co-benefits.

Supplemental Information

Visit www.ctclimatechange.com

Lead Agency

Connecticut Department of Environmental Protection

Connecticut Climate Change

Action Plan 2005

APPENDICES

Connecticut Climate Change

APPENDIX 1

Participants in 2003 CT Climate Change Stakeholder Dialogue

The stakeholder dialogue was directed by the **Governor's Steering Committee on Climate Change (GSC)**, which included the following State officials in 2003:

- Arthur H. Diedrick (Chair): Chairman of the Connecticut Clean Energy Fund
- Donald W. Downes: Chairman of the Department of Public Utility Control
- Arthur J. Rocque, Jr.: Commissioner of the Department of Environmental Protection
- Barbara Waters: Commissioner of the Department of Administrative Services
- James F. Byrnes: Commissioner of the Department of Transportation
- John A. Mengacci: Undersecretary of the Office of Policy and Management

Stakeholders represented the following organizations:

City of New Haven
Connecticut Global Fuel Cell Center at the University of Connecticut
Connecticut Business and Industry Association
Connecticut Clean Energy Fund
Connecticut Fund for the Environment
Connecticut League of Conservation Voters
Connecticut Resource Recovery Authority
Department of Administrative Services
Department of Environmental Protection
Department of Public Utility Control
Department of Transportation
Environment Northeast
Fleet Bank
Institute for Sustainable Energy at Eastern Connecticut State University
International Brotherhood of Electrical Workers
Mohegan Tribal Nation
Motor Transport Association of Connecticut
The Nature Conservancy.
Northeast Utilities
Office of Policy and Management
Pitney Bowes
Public Service Enterprise Group
School of Forestry and Environmental Studies at Yale
SmartPower
United Technologies

Organizations that participated in technical **working groups** or **public meetings** included the following entities:

Alliance of Automobile Manufacturers
American Automobile Association
APX
Archdiocese of Hartford
Argonne National Laboratory
Capital Region Council of Governments

Center for Ecological Technology
Central Connecticut Regional Planning Agency
Clean Energy Group
Clean Water Action
Community Energy
Connecticut Climate Coalition
Connecticut Earth Science Teacher's Association
Connecticut Food Policy Council
Department of Revenue Services
Dominion Power
Don't Waste Connecticut
EMCON/OWT, Inc.
Enabling Technologies, LLC
Environmental Architecture, LLC
Environmental Defense
FANNIE MAE
Farmington River Watershed Association
Fuel Cell Energy
GE Global Research Center
Hydrogen Source
Independent Connecticut Petroleum Association (ICPA)
Interreligious Ecojustice Network
ISO New England
Merit Engineering
Middlesex Clean Air Association
MJ Bradley and Associates
National Renewable Energy Laboratory
Natural Resources Defense Council
New Haven Environmental Justice Network
Northeast Organic Farming Association
NRG Energy
Nuclear Energy Institute
Nuclear Information and Resource Service
NXEGEN
Office of the Connecticut State Treasurer
Phelps Dodge Corporation
Praxair
Proton Energy Systems
Pure Power
Quinnipiac River Association
Reforest the Tropics
Rep. Mary Mushinsky (85th District)
Robinson & Cole
Sierra Club Connecticut Chapter
Sterling Planet
The Retec Group
Toxics Action Center
UK Carbon Trust
University of New Hampshire
Waste Management
Wesleyan University
Ztek Corporation

APPENDIX 2

Substitute Senate Bill No. 119

Public Act No. 04-84

AN ACT CONCERNING CLEAN CARS.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Section 1. Section 22a-174g of the general statutes, as amended by section 10 of public act 03-218, is repealed and the following is substituted in lieu thereof (*Effective October 1, 2004*):

(a) On or before December 31, 2004, the Commissioner of Environmental Protection shall adopt regulations, in accordance with the provisions of chapter 54, to implement the light duty motor vehicle emission standards of the state of California, and shall amend such regulations from time to time, in accordance with changes in said standards. Such regulations shall be applicable to motor vehicles with a model year 2008 and later. Such regulations may incorporate by reference the California motor vehicle emission standards set forth in final regulations issued by the California Air Resources Board pursuant to Title 13 of the California Code of Regulations and promulgated under the authority of Division 26 of the California Health and Safety Code, as may be amended from time to time. Nothing in this section shall limit the commissioner's authority to regulate motor vehicle emissions for any other class of vehicle.

(b) As part of the state's implementation plan under the federal Clean Air Act, the Commissioner of Environmental Protection may establish a program to allow the sale, purchase and use of motor vehicles which comply with any regulations adopted by the commissioner which implement the California motor vehicles emissions standards for purposes of generating any emission reduction credits under said act. Nothing in this section shall prohibit the Commissioner of Environmental Protection from establishing a program to require the sale, purchase and use of motor vehicles which comply with any regulations adopted by the commissioner which implement the California motor vehicle emissions standards. [Such regulations may incorporate by reference the California motor vehicle emission standards set forth in final regulations issued by the California Air

Resources Board pursuant to Title 13 of the California Code of Regulations and promulgated under the authority of Division 26 of the California Health and Safety Code, as may be amended from time to time.]

Approved May 10, 2004

APPENDIX 3

Substitute Senate Bill No. 218

Public Act No. 04-231

AN ACT CONCERNING CLEAN AND ALTERNATIVE FUEL VEHICLES.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Section 1. Subdivisions (67) to (69), inclusive, of section 12-412 of the general statutes are repealed and the following is substituted in lieu thereof (*Effective July 1, 2004*):

(67) Sales of and the storage, use or other consumption, prior to July 1, **[**2004**]** 2008, of a new motor vehicle which is exclusively powered by a clean alternative fuel. As used in this subdivision and subdivisions (68) and (69) of this section, "clean alternative fuel" shall mean natural gas, hydrogen or electricity when used as a motor vehicle fuel or propane when used as a motor vehicle fuel if such a vehicle meets the federal fleet emissions standards under the federal Clean Air Act or any emissions standards adopted by the Commissioner of Environmental Protection as part of the state's implementation plan under said act.

(68) Sales of and the storage, use or other consumption, prior to July 1, **[**2004**]** 2008, of conversion equipment incorporated into or used in converting vehicles powered by any other fuel to either exclusive use of a clean alternative fuel or dual use of any other fuel and a clean alternative fuel, including, but not limited to, storage cylinders, cylinder brackets, regulated mixers, fill valves, pressure regulators, solenoid valves, fuel gauges, electronic ignitions and alternative fuel delivery lines.

(69) Sales of and the storage, use or other consumption, prior to July 1, **[**2004**]** 2008, of equipment incorporated into or used in a compressed natural gas or hydrogen filling or electric recharging station for vehicles powered by a clean alternative fuel, including, but not limited to, compressors, storage cylinders, associated framing, tubing and fittings, valves, fuel poles and fuel delivery lines used for clean alternative fuel storage and filling facilities.

Sec. 2. Section 4a-67d of the general statutes is repealed and the following is substituted in lieu thereof (*Effective October 1, 2004*):

(a) The fleet average for cars or light duty trucks purchased by the state shall: (1) On and after October 1, 2001, have a United States Environmental Protection Agency estimated highway gasoline mileage rating of at least thirty-five miles per gallon and on and after January 1, 2003, have a United States Environmental Protection Agency estimated highway gasoline mileage rating of at least forty miles per gallon, [and] (2) comply with the requirements set forth in 10 CFR 490 concerning the percentage of alternative-fueled vehicles required in the state motor vehicle fleet, and (3) obtain the best achievable mileage per pound of carbon dioxide emitted in its class. The alternative-fueled vehicles purchased by the state to comply with said requirements shall be capable of operating on natural gas or electricity or any other system acceptable to the United States Department of Energy that operates on fuel that is available in the state.

(b) The provisions of subsection (a) of this section shall not apply to cars or light duty trucks purchased for law enforcement or other special use purposes as designated by the Department of Administrative Services. [or to cars or light duty trucks purchased by the state and intended for conversion into natural gas or electric-powered vehicles.]

(c) As used in this section, the terms "car" and "light duty truck" shall be as defined in the United States Department of Energy Publication DOE/CE -0019/8, or any successor publication.

Sec. 3. Subdivision (2) of subsection (b) of section 12-587 of the general statutes is repealed and the following is substituted in lieu thereof (*Effective July 1, 2004*):

(2) Gross earnings derived from the first sale of the following petroleum products within this state shall be exempt from tax: (A) Any petroleum products sold for exportation from this state for sale or use outside this state; (B) the product designated by the American Society for Testing and Materials as "Specification for Heating Oil D396-69", commonly known as number 2 heating oil, to be used exclusively for heating purposes or to be used in a commercial fishing vessel, which vessel qualifies for an exemption pursuant to section 12-412, as amended; (C) kerosene, commonly known as number 1 oil, to be used exclusively for heating purposes, provided delivery is of both number 1 and number 2 oil, and via a truck with a metered delivery ticket to a residential dwelling or to a centrally metered system serving a group of residential dwellings; (D) the product identified as propane gas, to be used exclusively for heating purposes; (E) bunker fuel oil, intermediate fuel, marine diesel oil and marine gas oil to be used in any vessel having a displacement exceeding four thousand dead weight tons; (F) for any first sale occurring prior to July 1, [2004] 2008, propane gas to be used as a fuel for a motor vehicle; (G) for any first sale occurring on or after July 1, 2002, grade number 6 fuel oil, as defined in regulations adopted pursuant to section 16a-22c, to be used exclusively by a company which, in accordance with census data contained in the Standard Industrial Classification Manual, United States Office of Management and Budget, 1987 edition, is included in code classifications 2000 to 3999, inclusive, or in Sector 31, 32 or 33 in the North

American Industrial Classification System United States Manual, United States Office of Management and Budget, 1997 edition; (H) for any first sale occurring on or after July 1, 2002, number 2 heating oil to be used exclusively in a vessel primarily engaged in interstate commerce, which vessel qualifies for an exemption under section 12-412, as amended; (I) for any first sale occurring on or after July 1, 2000, paraffin or microcrystalline waxes; or (J) for any first sale occurring [on or after July 1, 2002, and] prior to July 1, [2004] 2008, petroleum products to be used as a fuel for a fuel cell, as defined in subdivision (113) of section 12-412, as amended.

Sec. 4. Subsection (a) of section 12-264 of the general statutes is repealed and the following is substituted in lieu thereof (*Effective July 1, 2004*):

(a) Each (1) Connecticut municipality or department or agency thereof, or Connecticut district, manufacturing, selling or distributing gas or electricity to be used for light, heat or power, in this chapter and in chapter 212a called a "municipal utility", (2) company the principal business of which is manufacturing, selling or distributing gas or steam to be used for light, heat or power, including each foreign municipal electric utility, as defined in section 12-59, and given authority to engage in business in this state pursuant to the provisions of section 16-246c, and (3) company required to register pursuant to section 16-258a, as amended, shall pay a quarterly tax upon gross earnings from such operations in this state. Gross earnings from such operations under subdivisions (1) and (2) of this subsection shall include (A) all income classified as operating revenues by the Department of Public Utility Control in the uniform systems of accounts prescribed by said department for operations within the taxable quarter and, with respect to each such company, (B) all income classified in said uniform systems of accounts as income from merchandising, jobbing and contract work, (C) income from nonutility operations, (D) revenues from lease of physical property not devoted to utility operation, and (E) receipts from the sale of residuals and other by-products obtained in connection with the production of gas, electricity or steam. Gross earnings from such operations under subdivision (3) of this subsection shall be gross income from the sales of natural gas. Gross earnings of a gas company, as defined in section 16-1, as amended, shall not include income earned in a taxable quarter commencing prior to June 30, [2004] 2008, from the sale of natural gas or propane as a fuel for a motor vehicle. No deductions shall be allowed from such gross earnings for any commission, rebate or other payment, except a refund resulting from an error or overcharge and those specifically mentioned in section 12-265. Gross earnings of a company as described in subdivision (2) of this subsection shall not include income earned in any taxable quarter commencing on or after July 1, 2000, from the sale of steam.

Sec. 5. Section 12-217i of the general statutes is repealed and the following is substituted in lieu thereof (*Effective July 1, 2004, and applicable to income years commencing on or after January 1, 2004*):

(a) There shall be allowed a credit for any taxpayer against the tax imposed by this chapter, chapter 209, 210, 211 or 212 in any income year or calendar quarter, as the case may be, commencing prior to January 1, [2004] 2008, in an amount equal to ten per cent of the amount of expenditures paid or incurred during such income year or such quarter, as the case may be, for the incremental cost of purchasing a vehicle which is exclusively powered by a clean alternative fuel.

(b) There shall be allowed a credit for any taxpayer against the tax imposed by this chapter in any income year commencing on or after January 1, 1994, and prior to January 1, **[**2004**]** 2008, in an amount equal to fifty per cent of the amount of expenditures, other than those described in subsection (a) of this section, paid or incurred during such income year directly for (1) the construction of any filling station or improvements to any existing filling station in order to provide compressed natural gas, liquefied petroleum gas or liquefied natural gas; (2) the purchase and installation of conversion equipment incorporated into or used in converting vehicles powered by any other fuel to either exclusive use of clean alternative fuel or dual use of such other fuel and a clean alternative fuel, including, but not limited to, storage cylinders, cylinder brackets, regulated mixers, fill valves, pressure regulators, solenoid valves, fuel gauges, electronic ignitions and alternative fuel delivery lines, if such converted vehicles, after conversion, meet generally accepted standards, including, but not limited to, the standards set by the American Gas Association, the National Fire Protection Association, the American National Standards Institute, the American Society of Testing Materials or the American Society of Mechanical Engineers; or (3) the purchase and installation of equipment incorporated into or used in a compressed natural gas, liquefied petroleum gas or liquefied natural gas filling or electric recharging station for vehicles powered by a clean alternative fuel, including, but not limited to, compressors, storage cylinders, associated framing, tubing and fittings, valves and fuel poles and fuel delivery lines.

(c) If the amount of any credit provided in this section exceeds the amount of tax otherwise payable in the income year or calendar quarter, as the case may be, in which such expenditure was paid or incurred, the balance of any such credit remaining may be taken in any of the three succeeding income years or twelve succeeding calendar quarters, respectively. Any taxpayer allowed such a tax credit against the tax imposed under this chapter, chapter 209, 210, 211 or 212 shall not be allowed such credit under more than one of said chapters. As used in this section "clean alternative fuel" shall mean compressed natural gas, liquefied petroleum gas, liquefied natural gas or electricity when used as a motor vehicle fuel and "incremental cost" shall mean the difference between the purchase price of a vehicle which is exclusively powered by a clean alternative fuel and the manufacturer's suggested retail price of a comparably equipped vehicle which is not so powered.

Sec. 6. Section 12-458f of the general statutes is repealed and the following is substituted in lieu thereof (*Effective July 1, 2004*):

On and after July 1, 1994, and until July 1, **[**2004**]** 2008, compressed natural gas, liquefied petroleum gas and liquefied natural gas shall not be subject to the tax imposed under section 12-458.

Sec. 7. Section 12-412 of the general statutes, as amended by section 98 of public act 03-1 of the June 30 special session, is amended by adding subdivision (115) as follows (*Effective October 1, 2004*):

(NEW) (115) On and after October 1, 2004, and prior to October 1, 2008, the sale of any passenger car utilizing hybrid technology that has a United States Environmental Protection Agency estimated highway gasoline mileage rating of at least forty miles per gallon.

Approved on June 8, 2004

APPENDIX 4

Substitute Senate Bill No. 145

Public Act No. 04-85

AN ACT CONCERNING ENERGY EFFICIENCY STANDARDS.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Section 1. Section 16a-48 of the general statutes, as amended by section 146 of public act 03-6 of the June 30 special session, is repealed and the following is substituted in lieu thereof (*Effective July 1, 2004*):

(a) As used in this section:

(1) **[**"Commissioner"**]** "Department" means the **[**Commissioner of Agriculture and Consumer Protection**]** Department of Public Utility Control;

(2) "Fluorescent lamp ballast" or "ballast" means a device designed to operate fluorescent lamps by providing a starting voltage and current and limiting the current during normal operation, but does not include such devices that have a dimming capability or are intended for use in ambient temperatures of zero degrees Fahrenheit or less or have a power factor of less than sixty-one hundredths for a single F40T12 lamp;

(3) "F40T12 lamp" means a tubular fluorescent lamp that is a nominal forty-watt lamp, with a forty-eight-inch tube length and one and one-half inches in diameter;

(4) "F96T12 lamp" means a tubular fluorescent lamp that is a nominal seventy-five-watt lamp with a ninety-six-inch tube length and one and one-half inches in diameter;

(5) "Luminaire" means a complete lighting unit consisting of a fluorescent lamp, or lamps, together with parts designed to distribute the light, to position and protect such lamps, and to connect such lamps to the power supply;

(6) ["New appliance"] "New product" means [an appliance] a product that is sold, offered for sale, or installed for the first time and specifically includes floor models and demonstration units;

(7) "Secretary" means the Secretary of the Office of Policy and Management;

(8) "State Building Code" means the building code adopted pursuant to section 29-252;

(9) "Torchiere lighting fixture" means a portable electric lighting fixture with a reflector bowl giving light directed upward so as to give indirect illumination;

(10) "Unit heater" means a self-contained, vented fan-type commercial space heater that uses natural gas or propane that is designed to be installed without ducts within the heated space. "Unit heater" does not include a product regulated by federal standards pursuant to 42 USC 6291, as amended from time to time, a product that is a direct vent, forced flue heater with a sealed combustion burner, or any oil fired heating system;

(11) "Transformer" means a device consisting of two or more coils of insulated wire that transfers alternating current by electromagnetic induction from one coil to another in order to change the original voltage or current value;

(12) "Low-voltage dry-type transformer" means a transformer that: (A) Has an input voltage of 600 volts or less; (B) is between 14 kilovolt-amperes and 2,501 kilovolt-amperes in size; (C) is air-cooled; and (D) does not use oil as a coolant. "Low-voltage dry-type transformer" does not include such transformers excluded from the low-voltage dry-type distribution transformer definition contained in the California Code of Regulations, Title 20: Division 2, Chapter 4, Article 4: Appliance Efficiency Regulations;

(13) "Pass-through cabinet" means a refrigerator or freezer with hinged or sliding doors on both the front and rear of the refrigerator or freezer;

(14) "Reach-in cabinet" means a refrigerator, freezer, or combination thereof, with hinged or sliding doors or lids;

(15) "Roll-in" or "roll-through cabinet" means a refrigerator or freezer with hinged or sliding doors that allows wheeled racks of product to be rolled into or through the refrigerator or freezer;

(16) "Commercial refrigerators and freezers" means reach-in cabinets, pass-through cabinets, roll-in cabinets and roll-through cabinets that have less than eighty-five feet of capacity. "Commercial refrigerators and freezers" does not include walk-in models or consumer products regulated under the federal National Appliance Energy Conservation Act of 1987;

(17) "Traffic signal module" means a standard eight-inch or twelve-inch round traffic signal indicator consisting of a light source, lens and all parts necessary for operation and communication of movement messages to drivers through red, amber and green colors;

(18) "Illuminated exit sign" means an internally illuminated sign that is designed to be permanently fixed in place and used to identify an exit by means of a light source that illuminates the sign or letters from within where the background of the exit sign is not transparent;

(19) "Packaged air-conditioning equipment" means air-conditioning equipment that is built as a package and shipped as a whole to end-user sites;

(20) "Large packaged air-conditioning equipment" means air-cooled packaged air-conditioning equipment having not less than 240,000 BTUs per hour of capacity;

(21) "Commercial clothes washer" means a soft mount front-loading or soft mount top-loading clothes washer that is designed for use in (A) applications where the occupants of more than one household will be using it, such as in multi-family housing common areas and coin laundries; or (B) other commercial applications, if the clothes container compartment is no greater than 3.5 cubic feet for horizontal-axis clothes washers, or no greater than 4.0 cubic feet for vertical-axis clothes washers;

(22) "Energy efficiency ratio" means a measure of the relative efficiency of a heating or cooling appliance that is equal to the unit's output in BTUs per hour divided by its consumption of energy, measured in watts.

(b) The provisions of this section apply to the testing, certification and enforcement of efficiency standards for the following types of new [appliances] products sold, offered for sale or installed in the state: (1) [Fluorescent ballasts for F40T12 and F96T12 lamps; (2) luminaires with fluorescent ballasts for F40T12 and F96T12 lamps; (3) showerheads] Commercial clothes washers; (2) commercial refrigerators and freezers; (3) illuminated exit signs; (4) large packaged air-conditioning equipment; (5) low voltage dry-type distribution transformers; (6) torchiere lighting fixtures; (7) traffic signal modules; (8) unit heaters; and (9) any other products as may be designated by the department in accordance with subdivision (3) of subsection (d) of this section.

(c) The provisions of this section do not apply to (1) new [appliances] products manufactured in the state and sold outside the state, (2) new [appliances] products manufactured outside the state and sold at wholesale inside the state for final retail sale and installation outside the state, (3) [appliances] products installed in mobile manufactured homes at the time of construction, or (4) [appliances] products designed expressly for installation and use in recreational vehicles.

(d) (1) Not later than July 1, [1988] 2005, the [secretary] department, in consultation with the [commissioner] secretary, shall adopt regulations, in accordance with the provisions of chapter 54, [establishing] to implement the provisions of this section and to establish minimum energy efficiency standards for the types of new [appliances] products set forth in subsection (b) of this section. [The regulations may provide such efficiency standards for various categories and types of such new appliances as the secretary shall determine and may establish new or increased efficiency standards to become effective on and after January 1, 1990.] The regulations shall provide for the following minimum energy efficiency standards: (A) Commercial clothes washers shall meet the requirements shown in Table P-3 of section 1605.3 of the California Code of Regulations, Title 20: Division 2, Chapter 4, Article 4; (B) commercial refrigerators and freezers shall meet the August 1, 2004, requirements shown in Table A-6 of said California regulation; (C) illuminated exit signs shall meet the version 2.0 product specification of the "Energy Star Program Requirements for Exit Signs" developed by the United States Environmental Protection Agency; (D) large packaged air-conditioning equipment having not more than 760,000 BTUs per hour of capacity shall meet a minimum energy efficiency ratio of 10.0 for units using both electric heat and air conditioning or units solely using electric air conditioning, and 9.8 for units using both natural gas heat and electric air conditioning; (E) large packaged air-conditioning equipment having not less than 761,000 BTUs per hour of capacity shall meet a minimum energy efficiency ratio of 9.7 for units using both electric heat and air conditioning or units solely using electric air conditioning, and 9.5 for units using both natural gas heat and electric air conditioning; (F) low voltage dry-type distribution transformers shall meet or exceed the energy efficiency values shown in Table 4-2 of the National Electrical Manufacturers Association Standard TP-1-2002; (G) torchiere lighting fixtures shall not consume more than 190 watts and shall not be capable of operating with lamps that total more than 190 watts; (H) traffic signal modules shall meet the product specification of the "Energy Star Program Requirements for Traffic Signals" developed by the United States Environmental Protection Agency that took effect in February, 2001, except where the department, in consultation with the Commissioner of Transportation, determines that such specification would compromise safe signal operation; (I) unit heaters shall not have pilot lights and shall have either power venting or an automatic flue damper.

(2) Such efficiency standards, where in conflict with the State Building Code, shall take precedence over the standards contained in the Building Code. [After July 1, 1988] Not later than July 1, 2007, and biennially thereafter, the [secretary] department, in consultation with the [commissioner, may] secretary, shall review and increase the level of such efficiency standards by adopting regulations in accordance with the provisions of chapter 54 upon a determination that increased efficiency standards would serve to promote energy conservation in the state and would be cost-effective for consumers who purchase and use such new [appliances] products, provided no such increased efficiency standards shall become effective within one year following the adoption of any amended regulations providing for such increased efficiency standards. [The secretary, in consultation with the commissioner, may adopt such further regulations as necessary to implement the provisions of this section.]

(3) The department, in consultation with the secretary, shall adopt regulations, in accordance with the provisions of chapter 54, to designate additional products to be subject to the provisions of this section and to establish efficiency standards for such

products upon a determination that such efficiency standards (A) would serve to promote energy conservation in the state, (B) would be cost-effective for consumers who purchase and use such new products, and (C) that multiple products are available which meet such standards, provided no such efficiency standards shall become effective within one year following their adoption pursuant to this subdivision.

(e) On or after July 1, [1988] 2006, except for commercial clothes washers, for which the date shall be July 1, 2007, commercial refrigerators and freezers, for which the date shall be July 1, 2008, and large packaged air-conditioning equipment, for which the date shall be July 1, 2009, no new [appliance] product of a type set forth in subsection (b) of this section or designated by the department may be sold, offered for sale, or installed in the state unless the energy efficiency of the new [appliance] product meets or exceeds the efficiency standards set forth in such regulations adopted pursuant to subsection (d) of this section.

(f) The [commissioner] department, in consultation with the secretary, shall adopt procedures for testing the energy efficiency of the new [appliances covered by] products set forth in subsection (b) of this section or designated by the department if such procedures are not provided for in the State Building Code. The [commissioner] department shall use United States Department of Energy approved test methods, or in the absence of such test methods, other appropriate nationally recognized test methods. The manufacturers of such [appliances] products shall cause samples of such [appliances] products to be tested in accordance with the test procedures adopted pursuant to this subsection or those specified in the State Building Code.

(g) Manufacturers of new [appliances covered by] products set forth in subsection (b) of this section or designated by the department shall certify to the [commissioner] secretary that such [appliances] products are in compliance with the provisions of this section. The [commissioner] department, in consultation with the secretary, shall promulgate regulations governing the certification of such [appliances] products. [and] The secretary shall publish an annual list of such [appliances] products.

[(h) The commissioner shall cause periodic inspections to be made of distributors or retailers of new appliances covered by subsection (b) of this section in order to determine compliance with the provisions of this section. The commissioner shall cause investigations to be made of complaints received concerning violations of this section and shall report the results of such investigations to the Attorney General.]

(h) The Attorney General may institute proceedings to enforce the provisions of this section. Any person who violates any provision of this section shall be subject to a civil penalty of not more than two hundred fifty dollars. Each violation of this section shall constitute a separate offense, and each day that such violation continues shall constitute a separate offense.

Approved May 10, 2004

APPENDIX 5

Substitute Senate Bill No. 595

Public Act No. 04-252

AN ACT CONCERNING CLIMATE CHANGE.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Section 1. (NEW) (*Effective October 1, 2004*) As used in sections 1 to 4, inclusive, of this act:

(1) "Direct emissions" means emissions from sources that are owned or operated, in whole or in part, by an entity or facility, including, but not limited to, emissions from factory stacks, manufacturing processes and vents, and company owned or leased motor vehicles;

(2) "Entity" means a person, as defined in section 22a-2 of the general statutes, that owns or operates, in whole or in part, a source of greenhouse gas emissions from a generator of electricity or a commercial or industrial site, which source may include, but not be limited to, a transportation fleet;

(3) "Facility" means a building, structure or installation located on any one or more contiguous or adjacent properties of an entity;

(4) "Greenhouse gas" means any chemical or physical substance that is emitted into the air and that the Commissioner of Environmental Protection may reasonably anticipate to cause or contribute to climate change, including, but not limited to, carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride;

(5) "Indirect emissions" means emissions associated with the consumption of purchased electricity, steam and heating or cooling by an entity or facility.

Sec. 2. (NEW) (*Effective October 1, 2004*) (a) It shall be the goal of the state to reduce emissions of greenhouse gas in order to make an appropriate contribution to achieving the regional goals of reducing emissions of greenhouse gas to those levels emitted in 1990, which reduction to occur not later than January 1, 2010, and to levels ten per cent below the 1990 levels not later than January 1, 2020. The Commissioner of Environmental Protection shall consult with the Conference of New England Governors and Eastern Canadian Premiers to establish a date for the long-term regional goal of reducing the emissions of greenhouse gas by seventy-five to eighty-five per cent below 2001 levels. If the Conference of New England Governors and Eastern Canadian Premiers has not established a date for such long-term regional goal by January 1, 2007, the date for reaching such goal shall be 2050.

(b) Not later than January 1, 2005, the Governor's Steering Committee on Climate Change, established in November 2002, shall develop a multisector, comprehensive climate change action plan, with the opportunity for public comment, which plan shall contain the policies and programs necessary to achieve the state's goals for the reduction of greenhouse gas emissions by 2010 and 2020. The steering committee shall notify each member of the General Assembly of the development of such plan and of such opportunity for public comment. Not later than January 1, 2005, the steering committee shall submit, in accordance with section 11-4a of the general statutes, such plan to the joint standing committee of the General Assembly having cognizance of matters relating to the environment, energy, transportation and commerce. Not later than January 15, 2005, such committees shall convene a joint informational public hearing for the purpose of reviewing such plan. Not later than February 1, 2005, such committees shall meet for the purpose of consideration of endorsement of such plan. Not later than February 15, 2005, the steering committee shall submit a final plan to such committees.

(c) Not later than January 1, 2008, the steering committee shall develop an amended climate change action plan, with the opportunity for public comment, for achieving the state's contribution towards reaching the long-term regional goal established pursuant to subsection (a) of this section. The steering committee shall submit, in accordance with section 11-4a of the general statutes, such plan to the joint standing committee of the General Assembly having cognizance of matters relating to the environment.

(d) Not later than December 1, 2005, and annually thereafter, the Commissioner of Environmental Protection, in collaboration with the commissioners of other state agencies and the steering committee, shall submit a report to the joint standing committee of the General Assembly having cognizance of matters relating to the environment on the progress made in achieving the goals established in subsection (a) of this section and to evaluate the appropriateness of the climate change action plans developed pursuant to subsections (b) and (c) of this section in achieving such goals.

Sec. 3. (NEW) (*Effective October 1, 2004*) (a) The Commissioner of Environmental Protection shall work to establish a regional greenhouse gas registry for greenhouse gas emissions and a regional reporting system in conjunction with other states or a regional consortium.

(b) Not later than April 15, 2006, and annually thereafter, the owner or operator of any facility that is required to report air emissions data to the Department of Environmental Protection pursuant to Title V of the federal Clean Air Act and that has stationary emissions sources that emit greenhouse gases shall report to the regional registry direct stack emissions of greenhouse gases from such sources. The owner or operator shall report all greenhouse gas emissions in a type and format that the regional registry can accommodate.

(c) The commissioner shall consider, on an annual basis, requiring the expansion of reporting to the regional greenhouse gas registry to include, but not be limited to, other facilities or sectors, greenhouse gases, or direct and indirect emissions. A decision for or against an expansion of reporting and an explanation of such decision shall be included in the annual report required pursuant to subsection (d) of section 2 of this act.

(d) Not later than July 1, 2006, the commissioner shall provide for the voluntary reporting of emissions of greenhouse gas to the regional greenhouse gas registry by entities and facilities that are not required to submit information pursuant to subsections (b) and (c) of this section but which do so on a voluntary basis. The greenhouse gas emissions reported shall be of a type and format that the regional greenhouse gas registry can accommodate.

(e) If a regional greenhouse gas registry is not developed and implemented by April 15, 2007, the commissioner shall evaluate the feasibility of establishing and administering a state-wide greenhouse gas registry for the collection of emissions data pursuant to subsections (b) and (c) of this section. If a regional greenhouse gas registry is developed after the commissioner establishes a state-wide greenhouse gas registry, then the reporting requirements in subsections (b) and (c) of this section shall revert back to the regional greenhouse gas registry in accordance with said subsections (b) and (c).

(f) Not later than July 1, 2006, and triennially thereafter, the commissioner shall publish a state greenhouse gas emissions inventory that includes comprehensive estimates of the quantity of greenhouse gas emissions in the state for the last three years in which data is available.

(g) The commissioner may adopt regulations, in accordance with the provisions of chapter 54 of the general statutes, to implement the provisions of this section. Nothing in this act shall limit a state agency from adopting any regulation within its authority in accordance with the provisions of chapter 54 of the general statutes.

Sec. 4. Section 4a-67h of the general statutes, as amended by section 9 of public act 03-19, is repealed and the following is substituted in lieu thereof (*Effective October 1, 2004*):

(a) As used in this section, "environmentally preferable" means, with regard to products, services or practices, that such products, services or practices have a lesser or reduced negative effect on human health and the environment when compared to competing products, services or practices that serve the same function. "Environmentally preferable products" includes both recycled and recyclable products.

(b) Within available appropriations, the Department of Administrative Services shall establish procedures that promote, to the greatest extent feasible, the procurement and use of recycled products and environmentally preferable products, [and] services, and practices by state agencies. The department shall: (1) Designate environmentally preferable products, taking into consideration the raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance or disposal aspects of such products, and establish minimum standards and specifications for their procurement and use; (2) when feasible, include the use of environmentally preferable products and services as a criteria in a multiple criteria bid or an evaluation factor in requests for proposals; and (3) consider the use of environmentally preferable business practices when reviewing the overall performance of a bidder or proposer's business operation. Such procedures shall not be considered regulations, as defined in section 4-166.

(c) [Within available appropriations] Not later than January 1, 2005, and annually thereafter, the department shall: (1) Develop and maintain information about environmentally preferable products, [and] services and practices procured through the department, including, but not limited to, products, services and practices that minimize global warming impact and recycled products; (2) provide assistance with the implementation of the procedures developed pursuant to subsection (b) of this section and provide information to agencies about the use of environmentally preferable products and services; and (3) monitor the use of environmentally preferable products, [and] services and practices and recycled products by state agencies. Such information compiled pursuant to subsection (c) of this section and this subsection shall designate those products, services or practices that cost the same or less than other similar products, services or practices.

Approved on June 14, 2004

APPENDIX 6

Substitute Senate Bill No. 589

Public Act No. 04-222

AN ACT CONCERNING THE PRESERVATION OF THE FAMILY FARM AND LONG ISLAND SOUND.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Section 1. Section 8-37u of the general statutes is amended by adding subsection (f) as follows (*Effective July 1, 2004*):

(NEW) (f) The Commissioner of Economic and Community Development shall consult with the Commissioner of Agriculture and Consumer Protection with regard to the policies, activities, plans and programs specified in this section and the impact on and degree of protection provided to agricultural land by such policies, activities, plans and programs.

Sec. 2. Section 4a-51 of the general statutes is repealed and the following is substituted in lieu thereof (*Effective July 1, 2004*):

(a) The Commissioner of Administrative Services shall: (1) Purchase, lease or contract for all supplies, materials, equipment and contractual services required by any state agency, except as provided in sections 4-98 and 4a-57; (2) enforce standard specifications established in accordance with section 4a-56; (3) establish store rooms and warehouses for the storage of the state's property in such locations as may best serve the requirements of the state agencies; (4) operate such trucks and garages as are necessary to deliver supplies, materials and equipment from such central store rooms and warehouses to any state agency; (5) establish and operate a central duplicating and mailing room for state agencies located in the city of Hartford and such other places as he deems practical, provided the State Library photostat and offset printing department and the duplicating facilities of the Department of Public Health shall remain as constituted; and (6) establish and operate or have supervisory control over central or regional bakeries, meat cutting establishments, laundries and other central supply services in such locations as may best serve the requirements of the state agencies.

(b) The Commissioner of Administrative Services, when purchasing or contracting for the purchase of dairy products, poultry, eggs, fruits or vegetables pursuant to subsection (a) of this section, shall give preference to dairy products, poultry, eggs, fruits or vegetables grown or produced in this state, when such products, poultry, eggs, fruits or vegetables are comparable in cost to other dairy products, poultry, eggs, fruits or vegetables being considered for purchase by the commissioner that have not been grown or produced in this state.

Sec. 3. (NEW) (*Effective from passage*) (a) For the purposes of this section, "grocery or food store" means a business that employs ten or more persons and is engaged in the retail sale of produce, such as fruits and vegetables, meats, poultry, seafood, nuts, dairy products, bakery products or eggs.

(b) No grocery or food store shall be eligible for any state grant, financial assistance, state loan or other state-funded incentive under title 32 of the general statutes, unless such store is certified as a "Connecticut Farm Fresh Market" by the Commissioner of Agriculture pursuant to subsection (c) of this section.

(c) The Commissioner of Agriculture shall establish and administer a program, within available resources, to certify grocery and food stores as "Connecticut Farm Fresh Markets". A grocery or food store may be certified by the commissioner as a Connecticut Farm Fresh Market if proof is submitted, to the satisfaction of the commissioner, that such store continuously stocks fifteen per cent or more of its shelf space for retail produce and dairy with farm products grown or produced in this state. Such products include, but are not limited to, dairy products, meat, poultry, seafood, nuts, eggs, fruits and vegetables. A grocery or food store certified as a Connecticut Farm Fresh Market may use the words "Connecticut Farm Fresh Market" for promotional and marketing activities. No store other than a store certified as a Connecticut Farm Fresh Market may use such words for promotional and marketing activities.

(d) The Commissioner of Agriculture shall establish and administer a program, within available resources, to promote restaurants in the state that serve farm products grown or produced in the state. The commissioner shall, upon receiving proof satisfactory to said commissioner that at least twenty per cent of food served by a restaurant consists of farm products grown and produced in the state, certify the restaurant to use the words "Connecticut Farm Fresh Restaurant" for promotional and marketing activities. No restaurant other than one certified as a Connecticut Farm Fresh Restaurant may use such words for promotional and marketing activities.

(e) The Commissioner of Agriculture shall establish and administer a program, within available resources, to promote schools in the state that serve farm products grown or produced in the state. The commissioner shall, upon receiving proof satisfactory to said commissioner that at least twenty per cent of food served by a school consists of farm products grown and produced in the state, certify the school to use the words "Connecticut Farm Fresh School" in any promotional materials or description of such school. No school other than one certified as a Connecticut Farm Fresh School may use such words for promotional activities. For purposes of this subsection, "school" includes any public or nonpublic school and any public or nonpublic institution of higher education.

(f) The Commissioner of Agriculture may adopt regulations, in accordance with the provisions of chapter 54 of the general statutes, to carry out the purposes of this section.

Sec. 4. (NEW) (*Effective July 1, 2004*) A municipality, town, city, borough or district, as defined in section 7-324 of the general statutes, that takes active agricultural land by eminent domain shall: (1) Purchase an agricultural conservation easement on an equivalent amount of active agricultural land of comparable or better soil quality in such municipality, town, city, borough or district, or (2) if no comparable active agricultural land is available for an agricultural conservation easement as provided in subdivision (1) of this section, pay a fee for the purchase of development rights to an equivalent amount of active agricultural land of comparable or better soil quality elsewhere in the state. Such purchase amount shall be paid to the General Fund and credited to the state program for the preservation of agricultural land established pursuant to chapter 422a of the general statutes. The municipality, town, city, borough or district shall notify the Commissioner of Agriculture and Consumer Protection of its intent to comply with the provisions of subdivision (1) or (2) of this section. The Commissioner of Agriculture and Consumer Protection shall determine the amount of the payment to be made by such municipality, town, city, borough or district for the purchase of an agricultural conservation easement or the purchase of development rights pursuant to subdivisions (1) or (2) of this section. The municipality, town, city, borough or district shall not proceed unless the Commissioner of Agriculture and Consumer Protection approves the purchase of agricultural conservation easements pursuant to subdivision (1) of this subsection. Such agricultural conservation easements shall be jointly and severally held by the municipality, town, city, borough or district and the state.

Sec. 5. Section 25-157 of the general statutes, as amended by section 6 of public act 03-123 and section 1 of public act 03-148, is repealed and the following is substituted in lieu thereof (*Effective from passage*):

Notwithstanding any other provision of the general statutes, no state agency, including, but not limited to, the Department of Environmental Protection and the Connecticut Siting Council, shall consider or render a final decision for any applications relating to electric power line crossings, gas pipeline crossings or telecommunications crossings of Long Island Sound that has required or will require a certificate issued pursuant to section 16-50k, as amended, or approval by the Federal Energy Regulatory Commission including, but not limited to, electrical power line, gas pipeline or telecommunications applications that are pending or received after June 3, 2002, for a period of [two] three years after June 3, 2002. Such moratorium shall not apply to applications relating solely to the maintenance, repair or replacement necessary for repair of electrical power lines, gas pipelines or telecommunications facilities currently used to provide service to customers located on islands or peninsulas off the Connecticut coast or harbors, embayments, tidal rivers, streams or creeks. An applicant may seek a waiver of such moratorium by submitting a petition to the following: The chairpersons and ranking members of the joint standing committees of the General Assembly having cognizance of matters relating to energy and the environment, the chairman of the Connecticut Siting Council, the chairperson of the Public Utilities Control Authority, the Commissioner of Environmental Protection, and any other state agency head with jurisdiction over the subject of the petition. Such persons may grant a petition for a waiver by unanimous consent. Nothing in section 16-244j, this section or sections 25-157a to 25-157c, inclusive, as amended, shall be construed to affect the project in the corridor across Long Island Sound, from Norwalk to Northport, New York, to replace the existing electric cables that cross the sound.

Sec. 6. Section 26-194 of the general statutes, as amended by section 2 of public act 03-263 and section 146 of public act 03-6 of the June 30 special session, is repealed and the following is substituted in lieu thereof (*Effective July 1, 2004*):

(a) The Commissioner of Agriculture and Consumer Protection may lease in the name of the state, under such regulations as he may prescribe and for a period not longer than ten years, all shellfish areas that have been conveyed to the state or placed under state jurisdiction by the town of West Haven and any undesignated grounds, within the exclusive jurisdiction of the state, for the purpose of planting and cultivating shellfish. The authority herein conferred shall include the Cormell Reef, Portchester, Great Captain's Island, Field Point and Greenwich Point natural beds as located and described in section 3295 of the general statutes, revision of 1918. Any person desiring to lease grounds for such purpose shall make application in writing to the commissioner and all grounds leased by authority of the provisions of this section shall be leased to the highest responsible bidder, for a minimum fee of two dollars per acre. Such lease or lease renewal shall require the lessee to make a good faith effort to cultivate and harvest shellfish from the leased area. Such lease or lease renewal shall prohibit the lessee from entering a contract whereby the lessee agrees not to cultivate and harvest shellfish for any period of time. No lessee may enter an agreement with a third party that will prevent the lessee from carrying out the lessee's obligations under the lease unless the Department of Agriculture and Consumer Protection and the Attorney General have approved such agreement. The form of such application and lease shall be approved by the Attorney General, and all such leases shall be recorded in the records of the commissioner. No lease shall be granted to a resident of a state which does not lease shellfish grounds to residents of this state, except that any nonresident who was granted a lease on or before October 1, 1985, may, upon the expiration of such lease, apply for a renewal or further lease as provided in this section. The commissioner shall grant any such lease to nonresidents upon the same terms and conditions as to residents of this state. Any lessee or holder of oyster ground, on the expiration of any lease thereof which has been or which may be granted, shall, upon application to the commissioner, have the preference in the reletting of such ground for a like term to that granted in the original lease, unless such applicant, at the time for granting such application, is in arrears for rent on the original lease of such ground. Such application for such renewal or further lease shall be granted without notice or advertisement of the pendency thereof; provided no renewal or further lease of such ground shall be granted when the commissioner, for cause, ceases to lease such ground for oyster culture. All assignments or transfers of leases shall be subject to the approval of the commissioner and shall be recorded in his records. Any person who interferes with, annoys or molests another in the enjoyment of any lease authorized by the provisions of this section shall be subject to the penalties provided in section 26-237. The provisions of sections 26-212, as amended, 26-215, as amended, and 26-232, as amended, shall not apply to any shellfish grounds leased pursuant to the provisions of this section.

(b) Notwithstanding the provisions of subsection (a) of this section, any owner of a utility line or public use structure that impacts on a leased area shall pay to the lessee the costs of removing or relocating any shellfish. Nothing in this subsection shall be construed to prohibit the state or any lessee from recovering damages incurred by the state or the lessee caused by the installation, construction or presence of such utility line or public use structure.

(c) The Commissioner of Agriculture and Consumer Protection shall assess the owner of any facility that requires a certificate issued pursuant to section 16-50k, as amended, or that requires approval by the Federal Energy Regulatory Commission and that crosses any grounds of Long Island Sound within the jurisdiction of the state, including, but not limited to, any shellfish area or leased, designated or granted grounds, an annual host payment fee of forty cents per linear foot for the length of such facility within the jurisdiction of the state. The Commissioner of Agriculture and Consumer Protection shall deposit seventy-five per cent of the proceeds of such fee into the expand and grow Connecticut agriculture account established pursuant to section 8 of this act and shall transfer the remaining twenty-five per cent to the Commissioner of Environmental Protection for deposit into the Environment Quality Fund established pursuant to section 22a-27g, as amended by this act.

[(c)] (d) The [commissioner] Commissioner of Agriculture and Consumer Protection may designate an agent within the department to exercise the authority of said commissioner under this section.

Sec. 7. Subsection (b) of section 22a-27g of the general statutes is repealed and the following is substituted in lieu thereof (*Effective July 1, 2004*):

(b) Notwithstanding any provision of the general statutes, [to the contrary,] on and after July 1, 1990, the amount of any fee received by the Department of Environmental Protection which is attributable to the provisions of sections 22a-6, as amended, 22a-6d, 22a-27i, 22a-134e, as amended, 22a-135, as amended, 22a-148, as amended, 22a-150, as amended, 22a-174, as amended, 22a-174a, as amended, 22a-208a, 22a-342, as amended, 22a-363c, as amended, 22a-372, as amended, 22a-379, as amended, 22a-409, as amended, 22a-430, as amended, 22a-449, as amended, 22a-454 to 22a-454c, inclusive, as amended, [and] 22a-361, as amended, and section 26-194, as amended by this act, or any regulation adopted or amended pursuant to section 22a-6, as amended, or pursuant to any other provision of this title, shall be deposited directly into the Environmental Quality Fund established by subsection (a) of this section and credited to the environmental quality account. The Commissioner of Environmental Protection shall annually certify to the Treasurer, with respect to each such fee received on and after July 1, 1990, the amount of such fee which shall be credited to the General Fund.

Sec. 8. (NEW) (*Effective July 1, 2004*) There shall be an expand and grow Connecticut agriculture account, which shall be a separate, nonlapsing account within the General Fund. Funds received pursuant to section 26-194, as amended by this act, shall be deposited into said account. The Commissioner of Agriculture and Consumer Protection may make payments from said account to fund the programs established in section 3 of this act.

Approved on June 8, 2004

STATE OF CONNECTICUT

BY HIS EXCELLENCY

JOHN G. ROWLAND

GOVERNOR

EXECUTIVE ORDER NO. 32

WHEREAS, in 2000, the Conference of New England Governors and Eastern Canadian Premiers ("NEG/ECP") adopted Resolution 25-9 concerning global warming and its environmental impacts;

WHEREAS, the resolution directed the existing Northeast International Committee on Energy ("NICE") to, among other things, hold a climate change workshop;

WHEREAS, in March of 2001, this Governor co-chaired a climate change workshop from which policy and strategic recommendations were formed that subsequently provided the framework for a regional climate change action plan;

WHEREAS, in August of 2001, the NEG/ECP formally adopted a regional Climate Change Action Plan ("Action Plan") designed to reduce greenhouse gas emissions to a level that stabilizes the earth's climate and eliminates the negative impacts of climate change;

WHEREAS, five committees were established by the Climate Change Action Plan, those being Inventory/Registry, Lead by Example, Energy, Transportation and Adaptation, and those committees set to work developing specific recommendations aimed at reducing greenhouse gas emissions;

WHEREAS, in early 2002, in an effort to coordinate Connecticut's actions on climate change, this Governor established a Steering Committee comprised of the chairmen of the Connecticut Clean Energy Fund and the Connecticut Department of Public Utility Control, the commissioners of the Connecticut Department of Environmental Protection, the Connecticut Department of Administrative Services and the Connecticut Department of Transportation, and an Undersecretary of the Connecticut Office of Policy and Management;

WHEREAS, in August of 2002, the NEG/ECP adopted Resolution 27-7, which recognized the progress made to date on the Action Plan and accepted the Climate Change Report prepared by the five committees established under the Action Plan;

WHEREAS, in October of 2002, the Governor's Steering Committee convened a Climate Change Action Plan Summit that featured presentations and discussions about climate change and how Connecticut could most effectively address this issue--it was at this summit that a framework for Connecticut's plan was formed;

WHEREAS, included within Connecticut's plan was the need for stakeholder inclusion and input into efforts to reduce greenhouse gas emissions;

WHEREAS, beginning in April of 2003, Connecticut stakeholders were engaged to assist in developing a variety of greenhouse gas mitigation measures, covering sectors such as transportation, electricity, residential, commercial, industrial, agriculture, forestry and waste, for consideration by the State of Connecticut;

WHEREAS, in September of 2003, the NEG/ECP adopted Resolution 28-7, in which they commended the successful efforts of the Climate Change Steering Committee and encouraged them to continue in their efforts to develop energy efficient and economically beneficial strategies to reduce greenhouse gas emissions;

WHEREAS, the stakeholders presented their recommendations to the Governor's Steering Committee in January of 2004, which include administrative and legislative actions, voluntary and mandatory measures and state and regional actions;

WHEREAS, the Governor's Steering Committee has reviewed the stakeholders' recommendations, of which two may be implemented by Executive Order—Shared Savings Program for Government Agencies and Government Green Power Purchase;

WHEREAS, the stakeholders have recommended and the Governor's Steering Committee has approved of implementation of a Shared Savings Program for Government Agencies and Government Green Power Purchase;

WHEREAS, a Shared Savings Program would allow a state agency to keep a portion of the energy savings realized when it makes energy efficiency improvements to a building;

WHEREAS, the Connecticut stakeholders anticipate a direct and indirect reduction of greenhouse gases as a result of the implementation of a Shared Savings Program for Government Agencies;

WHEREAS, under a Government Green Power Purchase Plan, state government and universities would be required to increase the state's purchase of Class I renewables to 20 percent in 2010, 50 percent in 2020 and 100 percent in 2050;

NOW, THEREFORE, I, John G. Rowland, Governor of the State of Connecticut, acting by virtue of the authority vested in me by the Constitution and by the statutes of this state, do hereby **ORDER** and **DIRECT** that:

(a) the state revise the program referenced in section 16a-37c of the Connecticut General Statutes so that savings are claimed under more controlled terms and the program is workable within the budget of the Office of Policy and Management;

(b) state agencies use the Shared Savings Program, and a portion of such savings shall go toward the purchase of green power for state agencies;

(c) state government and universities replace an increasing share of electricity with renewable energy, toward the goal of Class I renewable purchases to 20 percent by 2010, 50 percent in 2020 and 100 percent in 2050.

This order shall be effective upon signing.

Dated at Hartford, Connecticut, this 22nd day of April, 2004.

John G. Rowland

JOHN G. ROWLAND
Governor

By His Excellency's Command:

Susan Bysiewicz
Secretary of the State

APPENDIX 8

REMI

Regional Economic Models, Inc.

Economic Impact of Enacting a Feebates Program in Connecticut

Prepared for

U.S. Environmental Protection Agency
and the
State of Connecticut

By

Regional Economic Models, Inc.

Using

REMI Policy Insight
Single-Region State Model of Connecticut

November 11, 2004

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Executive Summary

The Environment Protection Agency (EPA) contracted Regional Economic Models, Inc. (REMI) to perform an economic assessment of a feebates program in the State of Connecticut. The focus of the program was to promote the purchase of more fuel-efficient cars by placing a feebate (surcharge) on high-fuel-consumption vehicles and a rebate on fuel-efficient cars.

The feebate program is intended to be self-sustaining; the monetary amount of rebates given to fuel-efficient vehicle purchasers would equal the amount of feebates received from high-fuel-consumption vehicle purchasers. Included in the feebates would be the cost for the State of Connecticut to implement the program. Consequently, there will not be any government spending to stimulate the economy. All economic stimulation is the result of a decrease in the demand for gasoline. As sales of fuel-efficient vehicles increase, the demand for gasoline decreases. The increase in consumer spending on other goods is the result of consumers having more money from purchasing less gasoline. This will cause a loss in revenue for gasoline stations and consequentially the State of Connecticut will lose the revenue from tax on gasoline.

EPA asked REMI to model the total economic and demographic impacts in Connecticut due to the implementation of the feebate program over a 15-year time horizon from 2005 to 2020. To quantify the indirect and induced effects of the policies, REMI captured all direct effects of the policies, including:

- *The increase on consumer spending on other goods*
- *A loss in revenue for gasoline stations*
- *A loss in tax revenue for the State of Connecticut*

REMI examined the above scenarios using a 53-industry-sector, single-region model for the State of Connecticut. Using this model REMI developed an underlying baseline forecast and an alternative forecast of the economic impacts of the feebates program.

Data for the analysis was provided by the Northeast States for Coordinated Air Use Management (NESCAUM), who provided REMI with projections of total costs and benefits of the feebates program. Data for this analysis was also provided by: Environment Northeast, Environmental Defense, Connecticut Fund for the Environment, Connecticut Department of Environmental Protection, and the Connecticut Department of Revenue Services.

Major Findings

Table 1 shows the economic growth on the State of Connecticut is shown due to the feebates program. Table 1 shows the cumulative growth of Connecticut over the 14-year time period.

Table 1. Economic Growth Due the Feebates Program in Connecticut (Cumulative 2006-2020)

	Feebates Program
Employment (Avg Annual Increase)*	22
Output (Mil 96$)	44.815
GSP (Mil 96$)	13.108
Population	44
Real Disp Pers Inc (Mil 96$)	10.742
State Revenues (Mil 96$)	-29.523

*Employment is the average annual increase from the baseline. Employment is not cumulative and is based on output growth.

Enacting a feebates program in the State of Connecticut would stimulate positive growth on the economy. It would create roughly 22 new jobs in the economy mainly in the service retail trade industries and population would increase by roughly 44 people. By 2020, total Output in the State of Connecticut would grow by $44.815 *million, and Gross State Product would grow by $13.108 million. However, there will also be some negative effects on the State of Connecticut. The State of Connecticut will lose $29.523 million in tax revenue by 2020, roughly $2.1 million per year, resulting in a loss in government employment, roughly 27 jobs.*

Table 2 and Table 3 show the annual increase for two specific years, 2010 and 2020. These graphs are not an accumulation of preceding years, but instead show how much growth Connecticut would experience that single year. Both years follow a similar trend; growth in Employment, Output, GSP, Population, and Real Disposable Income; and a loss in State Revenues. Between 2006, 2010, 2020, there is a linear increase (in the case of state revenues, a decrease) for all economic variables. For a detailed description of each variable please see section 2.

Table 2. Economic Growth Due to Conservation Policies in Connecticut, 2010

	Feebates Program
Employment (Avg Annual Increase)*	18
Output (Mil 96$)	2.151
GSP (Mil 96$)	0.687
Population	9
Real Disp Pers Inc (Mil 96$)	0.473
State Revenues (Mil 96$)	-1.191

Table 3. Economic Growth Due to Conservation Policies in Connecticut, 2020

	Feebates Program
Employment (Avg Annual Increase)*	33
Output (Mil 96$)	4.913
GSP (Mil 96$)	1.328
Population	44
Real Disp Pers Inc (Mil 96$)	1.373
State Revenues (Mil 96$)	-3.682

1 Methodology & Assumptions

1-1 REMI Policy Insight

REMI Policy Insight® is the leading regional economic-forecasting and policy-analysis model. For this study, REMI developed Policy Insight for the State of Connecticut. REMI built this model using the REMI model building system, which consists of hundreds of programs developed over the last two decades. The system assembled the State of Connecticut model using data from the Bureau of Economic Analysis, the Bureau of Labor Statistics, the Department of Energy, the Bureau of Census, and other public sources.

REMI Policy Insight is a structural model, meaning that it clearly includes cause-and-effect relationships. The model is based on two key underlying assumptions from mainstream economic theory: households maximize utility and producers maximize profits. Since these assumptions make sense to most people, lay people as well as trained economists can understand the model.

In the model, businesses produce goods to sell to other firms, consumers, investors, governments and purchasers outside the region. The output is produced using labor, capital, fuel, and intermediate inputs. The demand for labor, capital and fuel per unit of output depends on their relative costs, since an increase in the price of any one of these inputs leads to substitution away from that input to other inputs. The supply of labor in the model depends on the number of people in the population and the proportion of those people who participate in the labor force. Economic migration affects the population size. People will move into an area if the real after-tax wage rates or the likelihood of being employed increases in a region.

Supply and demand for labor in the model determines the wage rates. These wage rates, along with other prices and productivity, determine the cost of doing business for every industry in the model. An increase in the cost of doing business causes either an increase in prices or a cut in profits, depending on the market for the product. In either case, an increase in costs would decrease the share of the local and U.S. market supplied by local firms. This market share combined with the demand described above determines the amount of local output. Of course, the model has many other feedbacks. For example, changes in wages and employment impact income and consumption, while economic expansion changes investment and population growth impacts government spending.

Figure 1-1 is a pictorial representation of REMI Policy Insight. The Output block shows a business that sells to all the sectors of final demand as well as to other industries. The Labor and Capital Demand block shows how labor and capital requirements depend both on output and their relative costs. Population and Labor Supply contribute to demand and to wage determination. Economic migrants in turn respond to wages and other labor market conditions. Supply and demand interact in the Wage, Price and Profit block. Prices and profits determine market shares. Output depends on market shares and the components of demand.

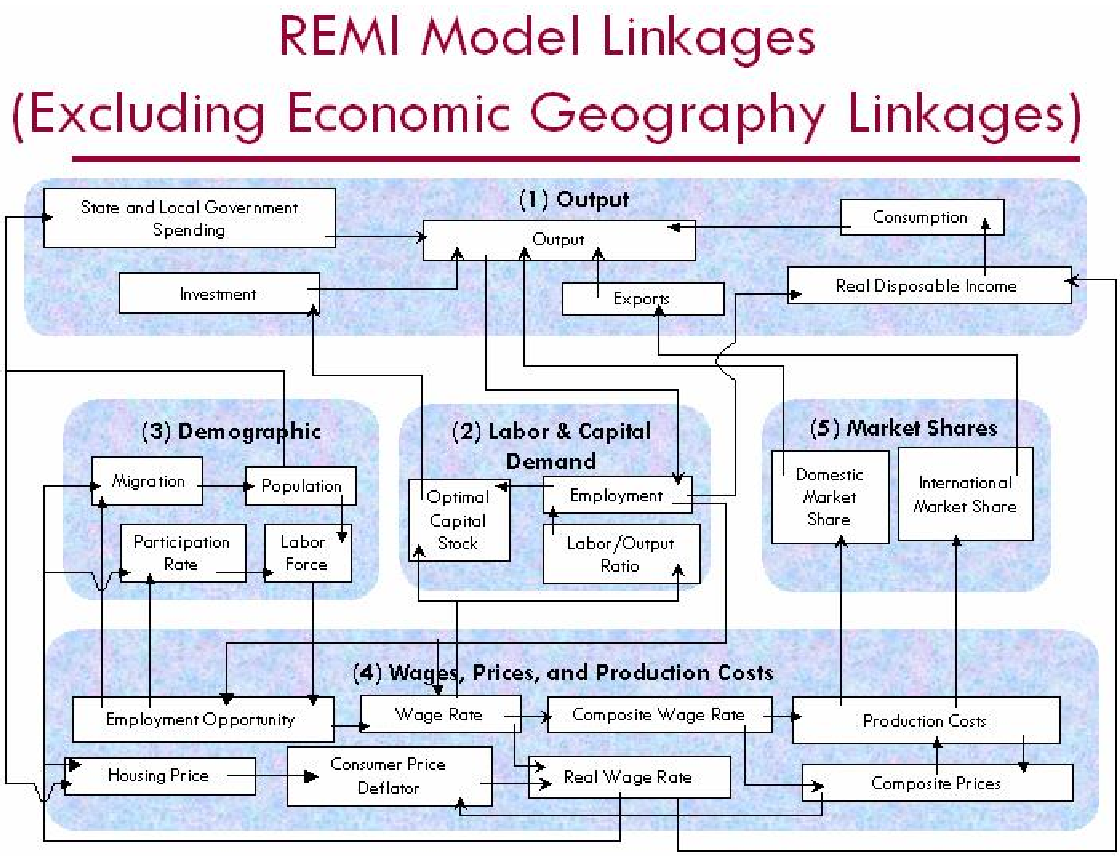

Figure 1-1 REMI Policy Insight overview

The REMI model brings together all of the above elements to determine the value of each of the variables in the model for each year in the baseline forecast. The model includes all the inter-industry interactions that are included in input-output models in the Output block, but goes well beyond an input-output model by including the linkages among all of the other blocks shown in Figure 1-1.

In order to broaden the model in this way, it was necessary to estimate key relationships. This was accomplished by using extensive data sets covering all areas in the country. These large data sets and two decades of research effort have enabled REMI to simultaneously maintain a theoretically sound model structure and build a model based on all the relevant data available.

The model has strong dynamic properties, which means that it forecasts not only what will happen but also when it will happen. This results in long-term predictions that have general equilibrium properties. This means that the long-term properties of general equilibrium models are preserved while maintaining accurate year-by-year predictions and estimating key equations using primary data sources.

Figure 1-2 shows the policy simulation process for a scenario called Policy X. The effects of a scenario are determined by comparing the baseline REMI forecast with an alternative forecast that incorporates the assumptions for the scenario. The baseline REMI forecast uses recent data and thousands of equations to generate projected economic activity for a particular region. The policy variables in the model are set equal to their baseline value (typically zero for additive variables and *one for multiplicative variables) when solving for the baseline forecast. To show the effects of a given scenario, these policy variables are given values that represent the direct effects of the scenario. The alternative forecast is generated using these policy variable inputs. Figure 1-2 shows how this process would work for a policy change called Policy X.*

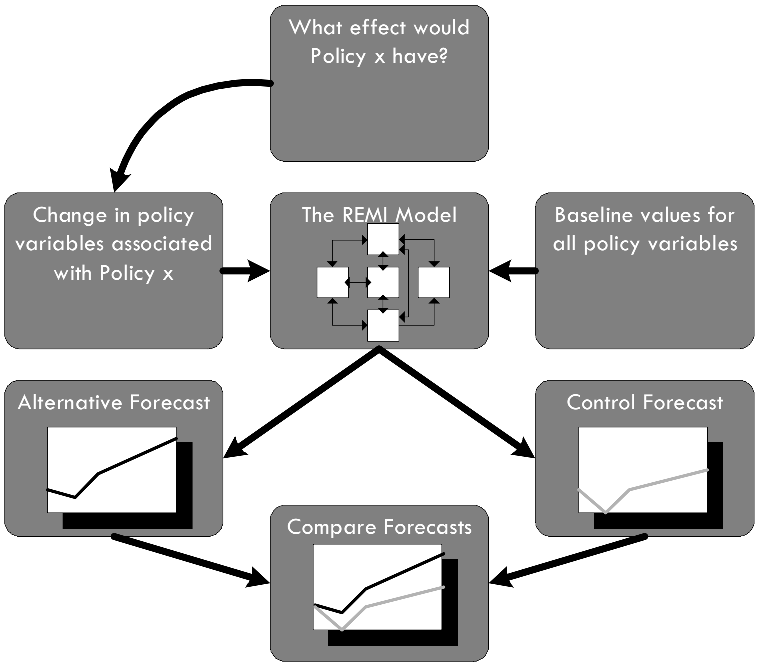

Figure 1-2 Policy X scenario

1-2 Assumptions

For this project, REMI examined the economic effects of oil and natural gas conservation policies in the State of Connecticut. REMI made the following assumptions:

1. *As fuel-efficient vehicles become more prevalent, there is a decrease in the amount of gas purchased.*
2. *Any drop in consumer spending saved due to buying less gasoline is reallocated onto other goods.*
3. *Given the self-sustaining nature of the feebates program, the number of high-fuel consumption vehicles sold equals the number of fuel-efficient vehicles sold.*
4. *High-fuel consumption vehicles are equal in cost to fuel-efficient vehicles*
5. *There is a negligible loss on car dealerships. (based on assumptions 2 and 3)*
6. *All high-fuel-consumption vehicles sold in Connecticut are manufactured outside of Connecticut. Consequently, any loss in motor vehicles sales will not reduce revenue for Connecticut's motor vehicle industry.*
7. *The feebates program is self-sufficient; the feebates collected for high-fuel-consumption vehicles will equal the rebates given for fuel-efficient vehicles, plus the cost of program implementation.*

1-3 Simulation Inputs

For simulation inputs please see Table 1-1.

Consumer Spending

As the ratio of fuel-efficient vehicles to high-fuel-consumption vehicles increases, the total quantity of gasoline demanded by consumers decreases. REMI captured the decrease in demand by decreasing consumer spending for gasoline. Approximately 40% of the loss in consumer spending will affect the petroleum industry directly. This includes gasoline filling stations, distributors, etc.. Shown in 'Consumer Spending on Gasoline' on Table 1-1.

Consumption Reallocation

Consumption reallocation transfers the money saved from purchasing less gas to purchasing other goods. The input is based on the assumption that all money saved from gas purchases will be spent on other goods. Shown in 'Consumption Reallocation' on Table 1-1.

Government Spending

The feebates program is intended to be self-sufficient. There will not be any change in government spending due to the implementation of the program, feebate collection, or rebate distribution. However, there will be a loss in government spending due to a loss in state tax revenue on gas collections. The government-spending variable does assume the government will offset the loss in state tax revenue by decreasing the amount of government employees. (See section 2-3)

Gasoline Sales

The loss in demand for vehicle gasoline would directly affect the petroleum industry in Connecticut. This includes gasoline distributors, filling stations, etc. This is entered into REMI Policy Insight as a loss in exogenous final demand. To account for the loss in revenue for the petroleum industry calculated in the consumer-spending variable, REMI subtracted the sales already calculated in Policy Insight from the projected decrease in sales of the petroleum industry.

Feebates Simulation Inputs

Table 1-1 Data Inputs for Feebates (96 Mil $)

	2006	2007	2008	2009	2010	2011
Consumer Spending on Gasoline	-11.450	-23.251	-35.622	-47.914	-60.411	-73.599
Consumption Reallocation	11.450	23.251	35.622	47.914	60.411	73.599
Government Spending	-2.451	-4.968	-7.548	-10.181	-12.857	-15.550
Final Demand for Gasoline	-3.046	-6.199	-9.595	-12.862	-16.184	-19.896

	2012	2013	2014	2015	2016	2017
Consumer Spending on Gasoline	-85.686	-98.549	-111.416	-124.507	-137.353	-149.637
Consumption Reallocation	85.686	98.549	111.416	124.507	137.353	149.637
Government Spending	-18.261	-20.978	-23.689	-26.383	-29.003	-31.574
Final Demand for Gasoline	-22.916	-26.396	-29.886	-33.538	-37.157	-40.515

	2018	2019	2020	Total
Consumer Spending on Gasoline	-161.609	-173.272	-184.396	-1,478.673
Consumption Reallocation	161.609	173.272	184.396	1,478.673
Government Spending	-34.082	-36.514	-38.854	-312.895
Final Demand for Gasoline	-43.785	-46.989	-50.012	-398.976

2 Results & Analysis

As shown in Table 2-1 enacting feebates policies in the State of Connecticut would stimulate positive growth in the economy. It is important to note, however, that not all economic sectors would benefit. There would be a loss in the government sector, roughly 27 jobs, and the petroleum products sector, roughly $16.5 million in Output by 2020.

Table 2-1 Major Economic Growth in Connecticut Due to the Feebates program, Annual

	2006	2007	2008	2009	2010	2011
Employment	2	6	10	13	18	21
Output (Mil 96$)	0.320	0.687	1.221	1.648	2.151	2.594
GSP (Mil 96$)	0.076	0.214	0.336	0.488	0.687	0.870
Population	0	2	3	6	9	12
Real Disp Inc (Mil 96$)	0.046	0.130	0.252	0.282	0.473	0.618
State Revenues (Mil 01$)	-0.256	-0.503	-0.745	-0.978	-1.191	-1.442

	2012	2013	2014	2015	2016	2017
Employment	22	25	26	28	29	31
Output (Mil 96$)	2.869	3.235	3.479	3.815	4.120	4.333
GSP (Mil 96$)	0.885	1.038	0.992	1.114	1.221	1.236
Population	16	21	24	27	30	35
Real Disp Inc (Mil 96$)	0.656	0.732	0.824	0.839	0.977	1.114
State Revenues (Mil 01$)	-1.690	-1.948	-2.208	-2.483	-2.737	-2.976

	2018	2019	2020	Total
Employment	32	32	33	22
Output (Mil 96$)	4.639	4.791	4.913	44.815
GSP (Mil 96$)	1.312	1.312	1.328	13.108
Population	38	41	44	21
Real Disp Pers (Mil 96$)	1.190	1.236	1.373	10.742
State Revenues (Mil 01$)	-3.221	-3.462	-3.682	-29.523

2-1 Output

The Output of an economy is the amount of production in dollars, including all intermediate goods purchased as well as value-added (labor, capital, and fuel investments and profit). We can also think of output as sales for both final goods and intermediate goods. Output is dependent upon consumption in the area, state government spending, investment, and exports of the industries in the region.

Due to the feebates program, Output would steadily grow during the projected timeframe. Starting in 2006, Output in the State of Connecticut would increase by $320 thousand. By 2020, Output would increase $4.013 million with a cumulative total of $44.815 million. The industry sectors that would experience the majority of the growth are the service sector, with a cumulative total of $27 million, the finance sector, with $17 million, and the retail trade sector, with $13 million. The industry sectors that would experience losses are the petroleum industry, with a cumulative lose of $16.5 million, and the wholesale sector, with $12 million.

Figure 2-1 Increase in Output (Mil 96 $)

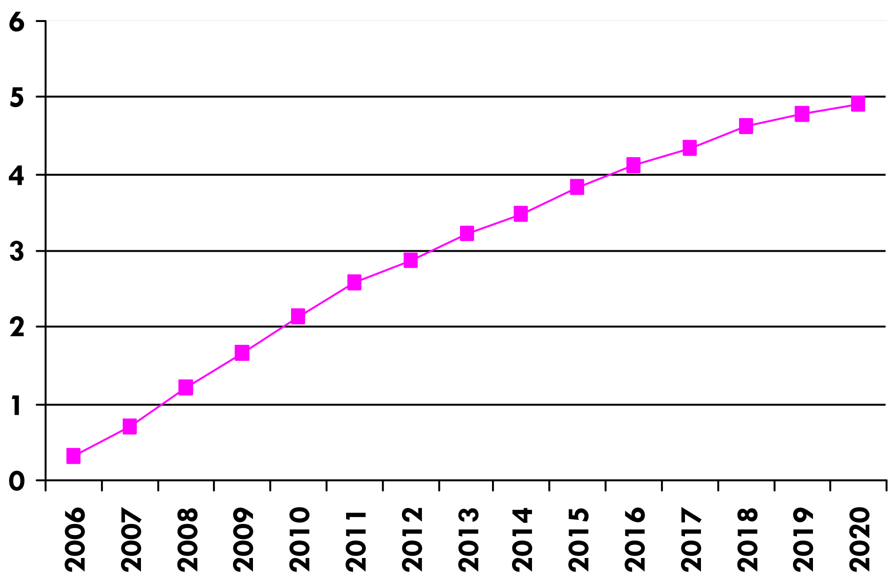

Table 2-2 Annual increase in Output (Mil 96 $)

	2006	2007	2008	2009	2010	2011	2012	2013
Feebates	0.320	0.687	1.221	1.648	2.151	2.594	2.869	3.235

	2014	2015	2016	2017	2018	2019	2020	Total
Feebates	3.479	3.815	4.120	4.333	4.639	4.791	4.913	44.815

2-2 Gross State Product

Gross State Product (GSP) as a value added concept is analogous to the national concept of Gross Domestic Product. It is equal to Output, excluding intermediate inputs. The value-add concept is equal to compensation and profits.

GSP has a lower growth rate then Output due to the structure of GSP. GSP is calculated as the total sales of all final goods sold in Connecticut. Gasoline is considered a final good product, and, therefore, the demand loss for gasoline impacted GSP more than Output.

In 2006, GSP increases by $76 thousand. In 2020, GSP increases by $1.38 million with a cumulative total of $13.108 million.

Figure 2-2 Annual increase in Gross State Product (Mil 96 $)

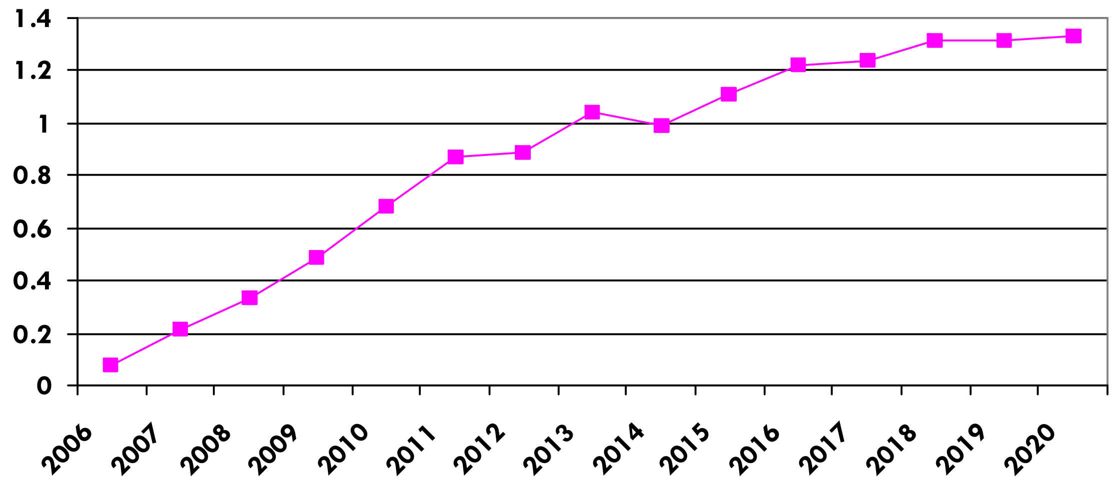

Table 2-3 Annual increase in Gross State Product (Mil 96 $)

	2006	2007	2008	2009	2010	2011	2012	2013
Feebates	0.076	0.214	0.336	0.488	0.687	0.870	0.885	1.038

	2014	2015	2016	2017	2018	2019	2020	Total
Feebates	0.992	1.114	1.221	1.236	1.312	1.312	1.328	13.108

2-3 Employment

The Employment variable in REMI Policy Insight uses historical data from the Bureau of Economic Analysis (BEA) and is based upon place of work, including part-time and full-time employees. The employment figures projected below are the difference from baseline and should not be cumulated.

There is a very slight increase in employment due to the feebates program. The majority of growth occurs in the service and retail sectors. A slight decrease in employment occurs in the government sector (roughly 27 jobs) due to the loss in tax revenue. Although there is a decrease in Output for the petroleum industry, employment loss is very small and considered negligible.

In 2006, Employment increases by 2 workers. By 2020, Employment increases by 33 net new workers.

Figure 2-3 Increase in Employment from baseline, annual

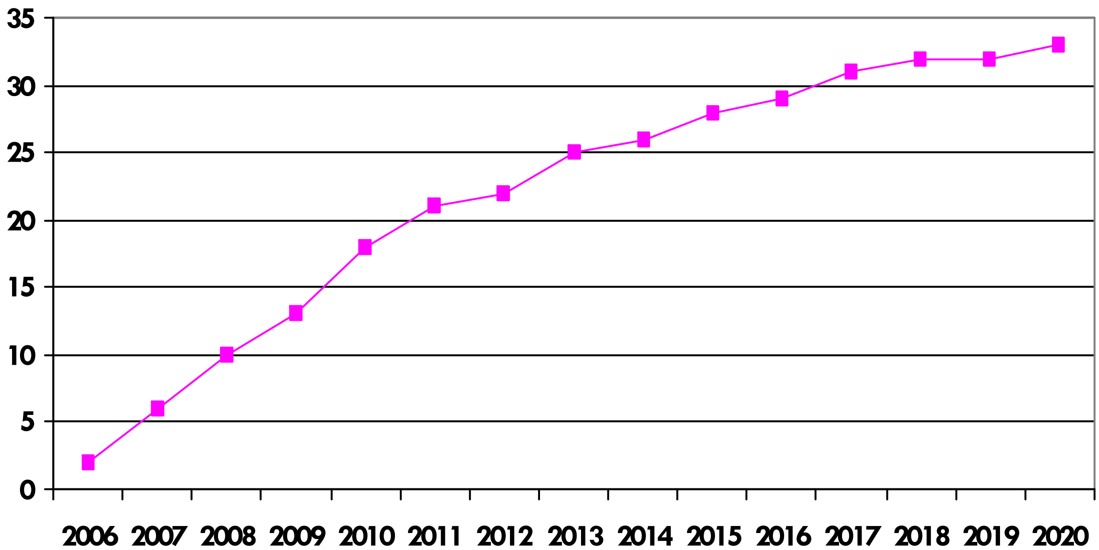

Table 2-4 Increase in Employment from baseline, annual

	2006	2007	2008	2009	2010	2011	2012	2013
Feebates	2	6	10	13	18	21	22	25

	2014	2015	2016	2017	2018	2019	2020
Feebates	26	28	29	31	32	32	33

2-4 Population

Population is a key variable in REMI Policy Insight that affects the potential labor force, government spending, consumption spending, and housing prices. The changes in population are due to changes in migration, the result of either economic growth or loss.

All changes in population are cumulative. Each year shows the difference from baseline, but includes the previous year. The increase in Population occurs largely due to economic migration and families moving with the migrants. Population does not start increasing till 2007, due to the lag time and the fact that the initial employment increase was so small. In 2007, Population increases by 2 people. By 2020, the Population of the State of Connecticut will have increased by 44 people.

Figure 2-4 Increase in Population from baseline, cumulative

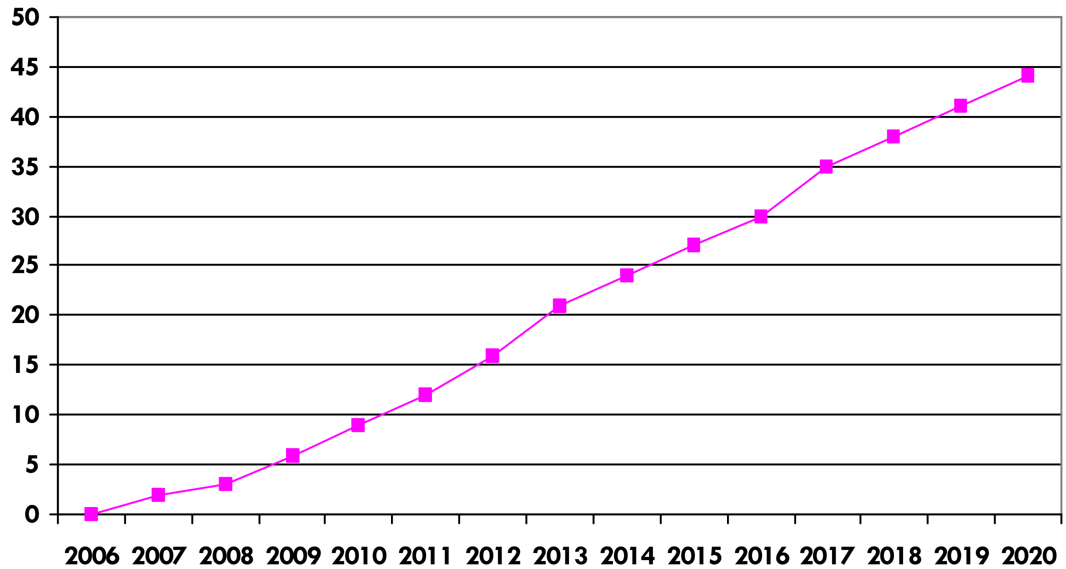

Table 2-5 Increase in Population from baseline, cumulative

	2006	2007	2008	2009	2010	2011	2012	2013
Feebates	0	2	3	6	9	12	16	21

	2014	2015	2016	2017	2018	2019	2020
Feebates	24	27	30	35	38	41	44

2-5 Real Disposable Income

Real Disposable Income is the inflation-adjusted income that is available for consumers to spend. It is personal income minus taxes and social contributions plus dividends, rents, and transfer payments. The numbers of employees in the area, their wage rate, and the consumer prices all affect real Disposable Income. An increase in employment or wage, or a decrease in consumers' prices increases a region's Real Disposable Income. Consequently, the opposite decreases Real Disposable Income.

The increase in Real Disposable Income is an indirect effect of the new jobs in Connecticut. The summation of new wages, minus taxes, earned by workers equals the increase in Real Disposable Income. Although there would be a decrease in the amount of spending on gasoline, there would be no direct effect on Real Disposable Income; REMI assumed that any decrease in spending on gasoline would be offset by an increase in spending on other goods.

In 2005, Real Disposable Income increases by $46 thousand. By 2020, Real Disposable Income increases by $1.373 million with a cumulative total of $10.742 million.

Figure 2-5 Increase in Real Disposable Income (Mil 96 $)

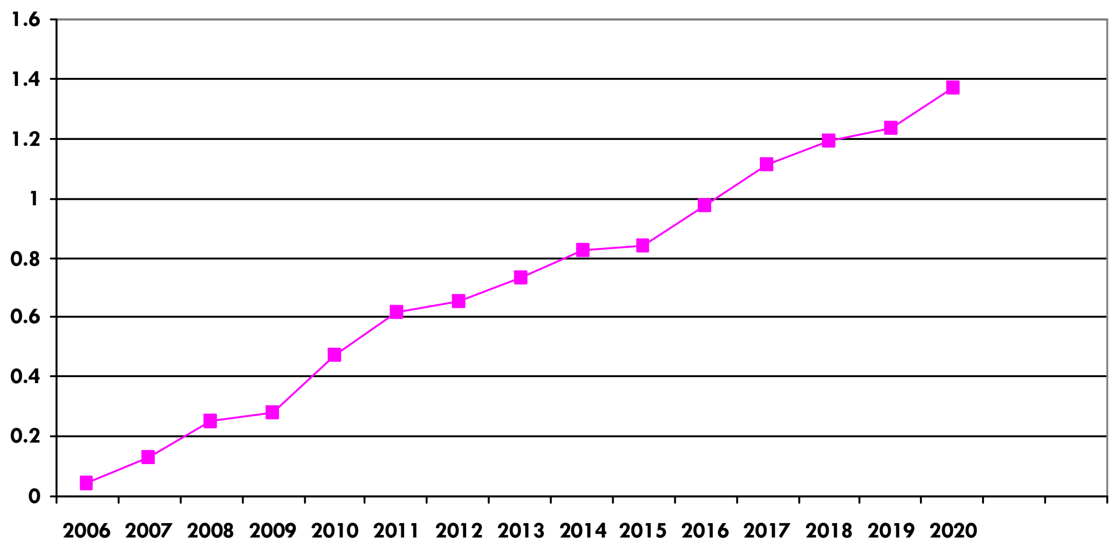

Table 2-6 Annual increase in Real Disposable Income (Mil 96 $)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Feebates	0.046	0.130	0.252	0.282	0.473	0.618	0.656	0.732	0.046

	2014	2015	2016	2017	2018	2019	2020	Total
Feebates	0.824	0.839	0.977	1.114	1.190	1.236	1.373	10.742

2-6 State Revenue

State Revenue represents the gains or losses in income for the State of Connecticut from tax revenues. These revenues include individual income tax, general sales tax, tobacco sales tax, and property tax. All changes in state revenue are indirect effects only. It does not take into account the changes in tax income from the oil and natural gas industry. All effects are the results of a change in economic activity. Real Disposable Income and Population affect State Revenues directly.

Due to the feebates program there would be a loss in State Revenue for the State of Connecticut. All revenue loss would be a direct effect of the demand loss in gasoline. Gasoline is a heavily taxed commodity so any decrease in gasoline consumption decreases the amount of tax collected on gasoline.

In 2006, the State of Connecticut loses $256 thousand in State Revenues. By 2020, the State of Connecticut would lose $3.682 million dollars for a cumulative total of $29.523 million lost.

Table 2-6 Annual increase in State Revenue (Mil 96 $)

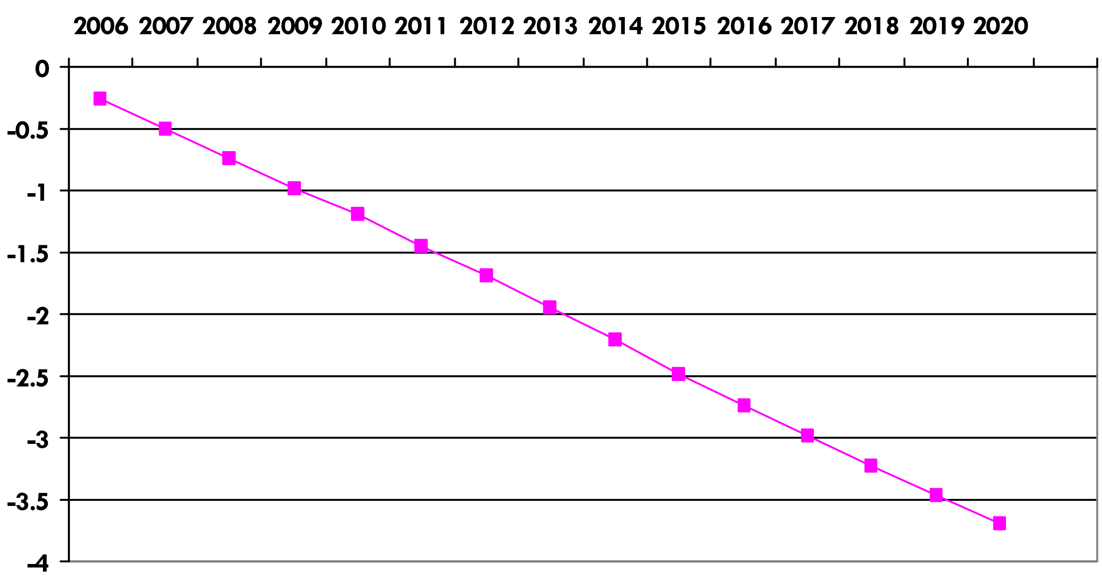

Table 2-7 Annual increase in State Revenue (Mil 96 $)

	2006	2007	2008	2009	2010	2011	2012	2013
Feebates	-0.256	-0.503	-0.745	-0.978	-1.191	-1.442	-1.690	-1.948

	2014	2015	2016	2017	2018	2019	2020	Total
Feebates	-2.208	-2.483	-2.737	-2.976	-3.221	-3.462	-3.682	-29.523

About REMI

Regional Economic Models, Inc. (REMI) is the nation's leading provider of economic forecasting and policy analysis software. The REMI Policy Insight model is used by over half of state governments, and numerous consulting firms, cities, and universities. Established in 1980, REMI has published model developments in the American Economic Review, the Review of Economics and Statistics, and other highly regarded publications.

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APPENDIX 9

REMI

Regional Economic Models, Inc.

Economic Impact of Oil and Natural Gas Conservation Policies

Prepared for

U.S. Environmental Protection Agency and the State of Connecticut

By

Regional Economic Models, Inc.

Using

REMI Policy Insight
Single-Region State Model of Connecticut

November 9, 2004

TABLE OF CONTENTS

Executive Summary

The Environment Protection Agency (EPA) contracted Regional Economic Models, Inc. (REMI) to perform an economic assessment of oil and natural gas conservation programs in the State of Connecticut. The focus of the study was on increasing efficiency of oil and natural gas for residential, commercial, and industrial users. The efficiency increase is the result of research and consumer education, and the implementation of energy-efficient equipment by users. Funding for the program is derived from a 3% natural gas-use and oil-use surcharge on residential, commercial, and industrial users.

EPA asked REMI to model the total economic and demographic impacts in Connecticut due to the implementation of conservation policies over a 15-year time horizon from 2005 to 2020. To quantify the indirect and induced effects of the policies, REMI captured all direct effects of the policies, including:

- *The oil and natural gas costs increases for residential, commercial, and industrial users resulting from the surcharge on oil and natural gas.*
- *Savings to residential, commercial, and industrial users due to reduced consumption of natural gas and oil.*
- *Consumption reallocation of other consumer goods due to an increase in personal income.*
- *Loss in sales to natural gas and oil firms due to reduced consumption*
- *Investment in new equipment, construction, research, and other sectors.*

REMI examined the above scenarios using a 53-industry-sector, single-region model for the State of Connecticut. Using this model REMI developed an underlying baseline forecast and three alternative forecasts. Two forecasts modeled oil and natural gas as separate policies and the third forecast modeled oil and natural gas in combination. By analyzing the two policies separately and then together, the underlying effects of the individual policies can be seen.

Data for the analysis was provided by: Northeast States for Coordinated Air Use Management (NESCAUM), who provided REMI with projections of total costs and benefits to residential, commercial and industrial users for both oil and natural gas. Data for this analysis was also provided by: Environment Northeast, Institute for Sustainable Energy, Connecticut Department of Public Utility Control, Connecticut Department of Environmental Protection, and the Connecticut Clean Energy Fund, and United Technology Corporation.

Major Findings

Table 1 summarizes the economic growth on the State of Connecticut due to the oil and natural gas conservation policies. This table shows the cumulative growth of Connecticut over the 15-year time period for all three alternative forecasts: oil, natural gas, and the combination of the two[1].

Table 1. Economic Growth Due to Conservation Policies in Connecticut (Cumulative 2005-2020)

	Oil & Natural Gas	Oil	Natural Gas
Employment (Avg Annual Increase)*	2,092	430	1,668
Output (Mil 96$)	3,094.90	82.80	3,020.64
GSP (Mil 96$)	2,033.01	266.21	1,773.82
Population	3,604	717	2,894
Real Disp Pers Inc (Mil 96$)	1,749.42	294.81	1,459.35
State Revenues (Mil 01$)	382.13	66.75	314.97

*Employment is the average annual increase from the baseline. Employment is not cumulative and is based on output growth.

Enacting conservation policies in Connecticut would stimulate positive growth on the economy. It would create roughly 2,092 net new jobs in the Connecticut economy, mostly in the retail and service sectors; and the population would increase by 3,604 people, mostly due to economic migration. By 2020, total Output in Connecticut would grow by $3.10 billion, total GSP would grow by $2.03 billion, and the State of Connecticut would collect approximately $382 million more in State Revenues.

All sectors of the economy will experience strong growth during the time frame, with the exception to the surprisingly small growth in Output. This effect occurs due to a high loss in demand and sales for the petroleum industry in Connecticut (see section 2-1). The strong growth in employment, largely in the service and retail sector, results from the decrease in fuel costs and the increase in Real Disposable Income (the increase in Real Disposable Income directly affects the increase in consumption). Please see section 2 for a detailed description of the results.

As shown in Table 1, the majority of the growth in the Connecticut economy occurs due to the natural-gas conservation policy. The natural-gas conservation policy accounts for roughly 80% of the growth in employment, 98% of the growth in output, 87% of the growth in GSP, 80% of the growth in population, 83% of the growth in Real Disposable Personal Income, and 82% of the growth in State Revenues. The disproportionate ratio between the oil and natural gas policies is due to the higher loss in demand for petroleum than for natural gas. As shown in section 1-3 the loss in demand of oil is almost 6 times higher than the loss in demand for natural gas.

Table 2 and Table 3 show the annual increases in economic growth for two specific years: 2010 and 2020. These graphs are not an accumulation of preceding years, but instead show how much growth Connecticut would experience that year. In the majority of the economic variables; employment,

[1] Please note: the results for the third forecast (oil and natural gas) are from the combination of oil and natural gas **inputs** into REMI Policy Insight, not the combined **outputs** of forecasts 1(oil) and 2(natural gas). Consequently, the results of the third forecast may not be the exact summation of outputs from he first and second forecast.

GSP, population, etc., there is a growth in the annual increase. The one exception is annual Output growth in the oil policy scenario. Between 2010 and 2020 there is a decrease in annual Output growth of $3.91 million. In 2020 there is a decrease in Output from the baseline of that year. However, as shown in section 2-1, only two years in the oil policy scenario experience a decline. The decline in Output for those years is relatively small and is made up in the natural gas scenario.

Table 2. Economic Growth Due to Conservation Policies in Connecticut, 2010

	Oil & Natural Gas	Oil	Natural Gas
Employment	2,076	367	1,708
Output (Mil 96$)	176.10	3.357	172.7
GSP (Mil 96$)	116.90	14.54	102.3
Population	1,604	263.2	1341
Real Disp Pers Inc (Mil 96$)	101.00	15.18	85.82
State Revenues (Mil 01$)	22.52	3.511	19.00

Table 3. Economic Growth Due to Conservation Policies in Connecticut, 2020

	Oil & Natural Gas	Oil	Natural Gas
Employment	2,478	563.7	1913
Output (Mil 96$)	262.80	-0.5493	263.2
GSP (Mil 96$)	170.90	18.62	152.2
Population	3,617	717	2894
Real Disp Pers Inc (Mil 96$)	153.20	27.39	125.9
State Revenues (Mil 01$)	31.62	5.841	25.78

1 Methodology & Assumptions

1-1 REMI Policy Insight

REMI Policy Insight® is the leading regional economic-forecasting and policy-analysis model. For this study, REMI developed Policy Insight for the State of Connecticut. REMI built this model using the REMI model building system, which consists of hundreds of programs developed over the last two decades. The system assembled the State of Connecticut model using data from the Bureau of Economic Analysis, the Bureau of Labor Statistics, the Department of Energy, the Bureau of Census, and other public sources.

REMI Policy Insight is a structural model, meaning that it clearly includes cause-and-effect relationships. The model is based on two key underlying assumptions from mainstream economic theory: households maximize utility and producers maximize profits. Since these assumptions make sense to most people, lay people as well as trained economists can understand the model.

In the model, businesses produce goods to sell to other firms, consumers, investors, governments and purchasers outside the region. The output is produced using labor, capital, fuel, and intermediate inputs. The demand for labor, capital and fuel per unit of output depends on their relative costs, since an increase in the price of any one of these inputs leads to substitution away from that input to other inputs. The supply of labor in the model depends on the number of people in the population and the proportion of those people who participate in the labor force. Economic migration affects the population size. People will move into an area if the real after-tax wage rates or the likelihood of being employed increases in a region.

Supply and demand for labor in the model determines the wage rates. These wage rates, along with other prices and productivity, determine the cost of doing business for every industry in the model. An increase in the cost of doing business causes either an increase in prices or a cut in profits, depending on the market for the product. In either case, an increase in costs would decrease the share of the local and U.S. market supplied by local firms. This market share combined with the demand described above determines the amount of local output. Of course, the model has many other feedbacks. For example, changes in wages and employment impact income and consumption, while economic expansion changes investment and population growth impacts government spending.

Figure 1-1 is a pictorial representation of REMI Policy Insight. The Output block shows a business that sells to all the sectors of final demand as well as to other industries. The Labor and Capital Demand block shows how labor and capital requirements depend both on output and their relative costs. Population and Labor Supply contribute to demand and to wage determination. Economic migrants in turn respond to wages and other labor market conditions. Supply and demand interact in the Wage, Price and Profit block. Prices and profits determine market shares. Output depends on market shares and the components of demand.

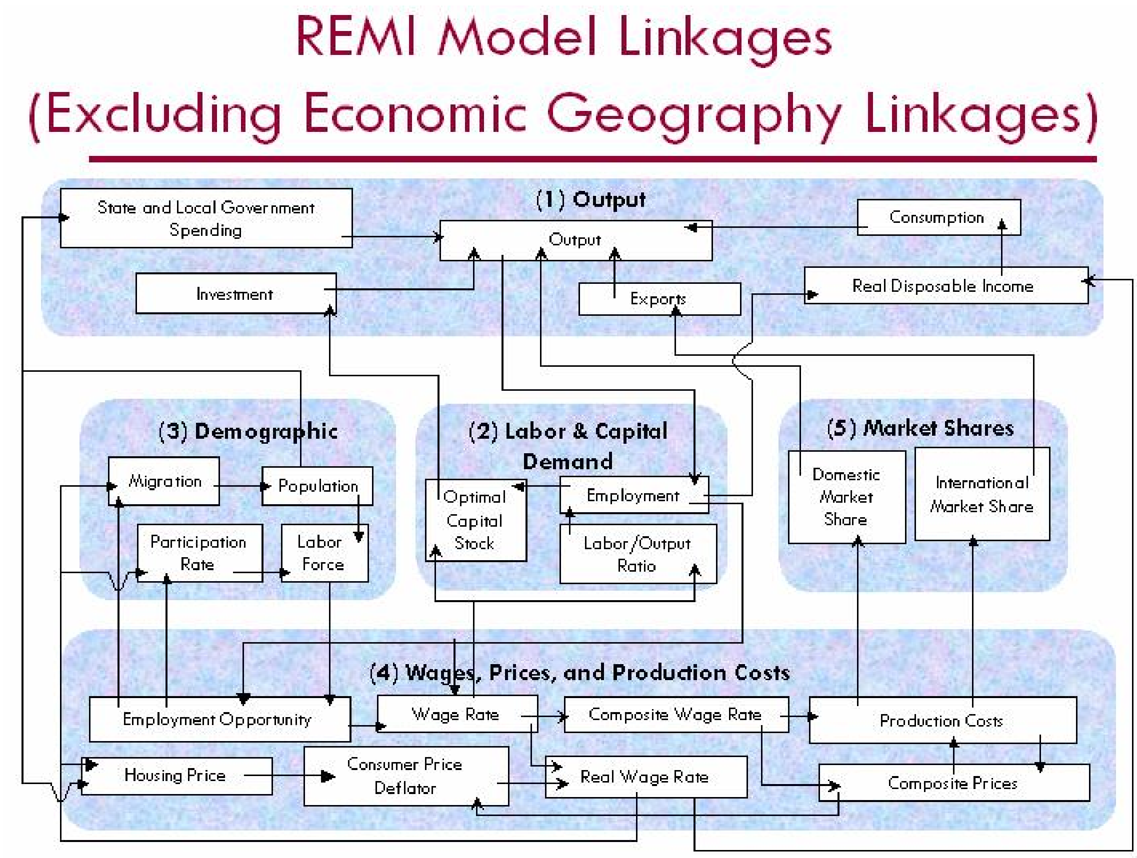

Figure 1-1 REMI Policy Insight overview

The REMI model brings together all of the above elements to determine the value of each of the variables in the model for each year in the baseline forecast. The model includes all the inter-industry interactions that are included in input-output models in the Output block, but goes well beyond an input-output model by including the linkages among all of the other blocks shown in Figure 1-1.

In order to broaden the model in this way, it was necessary to estimate key relationships. This was accomplished by using extensive data sets covering all areas in the country. These large data sets and two decades of research effort have enabled REMI to simultaneously maintain a theoretically sound model structure and build a model based on all the relevant data available.

The model has strong dynamic properties, which means that it forecasts not only what will happen but also when it will happen. This results in long-term predictions that have general equilibrium properties. This means that the long-term properties of general equilibrium models are preserved while maintaining accurate year-by-year predictions and estimating key equations using primary data sources.

Figure 1-2 shows the policy simulation process for a scenario called Policy X. The effects of a scenario are determined by comparing the baseline REMI forecast with an alternative forecast that incorporates the assumptions for the scenario. The baseline REMI forecast uses recent data and thousands of equations to generate projected economic activity for a particular region. The policy variables in the model are set equal to their baseline value (typically zero for additive variables and *one for multiplicative variables) when solving for the baseline forecast. To show the effects of a given scenario, these policy variables are given values that represent the direct effects of the scenario. The alternative forecast is generated using these policy variable inputs. Figure 1-2 shows how this process would work for a policy change called Policy X.*

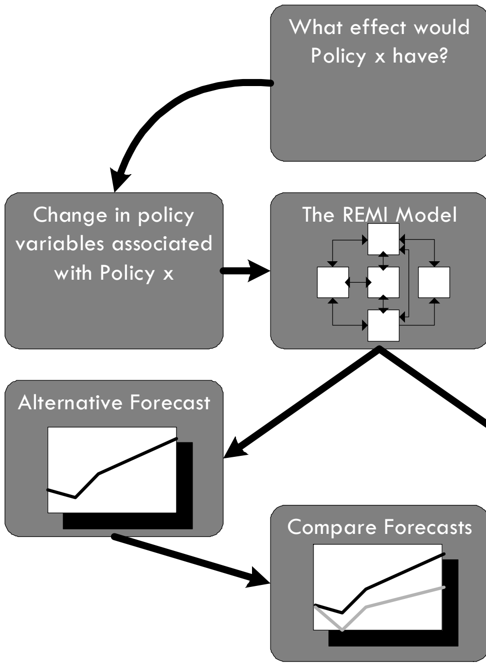

Figure 1-2 Policy X scenario

1-2 Assumptions

For this project, REMI examined the economic effects of oil and natural gas conservation policies in the State of Connecticut. REMI made the following assumptions:

1. *The conservation costs and benefits begin in 2005.*
2. *Increasing the surcharge for both oil and natural gas decreases consumer spending for other consumer goods.*
3. *When efficiency increases, consumers and commercial and industrial firms require less oil and natural gas.*
4. *Any drop in consumer spending on oil and natural gas is reallocated to increased spending on other goods.*
5. *Decreasing costs for both commercial and industrial firms reduces production costs.*
6. *All output sold by oil and natural gas industries is considered intermediate goods.*
7. *The benefits of enacting the oil and natural gas policies are seen in the first year (no time lag).*

1-3 Simulation Inputs

For simulation inputs please see Tables 1-1 and 1-2. The first two forecasts modeled oil and natural gas as separate policies. The third forecast combined Tables 1-1 and 1-2 to model the economic effects of both policies on Connecticut.

Consumer Spending

For both energy types, oil and natural gas, there was both a decrease and increase in consumer spending. The increase in consumer spending is due to the surcharge on oil and natural gas. The surcharge boosts the cost of a relatively inelastic good, which forces consumers to purchase less of other goods to pay for the increase in energy prices. They save money, however, as a result of the efficiency improvements they are able to implement due to the program. The decrease in consumer spending is the benefit that residential users will receive from requiring less energy to fuel their homes. Shown in 'Consumer Spending' Tables 1-1 and 1-2

Consumption Reallocation

Consumption reallocation transfers the money saved on energy to purchasing other goods. The input is based on the assumption that all money saved from energy efficient improvements will be spent on other goods. Shown in 'Consumption Reallocation' on Tables 1-1 and Tables 1-2.

Energy Costs

All of REMI's forecasts indicate that energy costs increase for industrial and commercial users due to the surcharge, but decrease due to more efficient energy usage. Oil and Natural Gas are modeled similarly. In both forecasts fuel costs for firms rise due to the surcharge, but the firms also save money as a results of the improvements they implement due to the program. Shown in 'Oil Cost for Commercial Firms' and 'Oil Cost for Industrial Firms' in Table 1-1 for oil, and as shown in 'NG cost for Commercial Firms' and 'NG Cost for Industrial Firms' in Table 1-2 for natural gas.

Intermediate Demand

Both the oil and natural gas industry sectors experience a loss in revenue due to the decrease in demand spurred by conservation policies. This loss is entered into REMI Policy Insight as a loss of intermediate demand for the particular industry. The intermediate demand variable in REMI Policy Insight does take into account that local firms will not absorb 100% of the loss in demand. How much demand loss is 'transferred' to firms outside the region depends on the Regional Purchase Coefficient (RPC). Each industry in REMI Policy Insight has a specific RPC. The RPC is the ratio of consumer goods bought from local firm versus non-local firms. Please note that the loss in intermediate demand is much greater on the oil industry than on the natural gas industry. Shown in 'Intermediate Demand' on Tables 1-1 and 1-2.

Investment

REMI modeled significant investment in electrical equipment and other sectors through increased industry demand. Since there are no estimated investment values, we approximate the investment in different sectors using REMI Policy Insight forecast data. Doing so yields total output by industry, which, when multiplied by the ratio of electricity to total output in the I-O table, gives an estimation of the total annual spending on electricity. Dividing by the adjusted REMI baseline prices (as given by the IPM run), we get an estimate of annual MWh consumption. Now we can multiply by the surcharge of $3/MWh, which gives us an estimate of the total funds generated for investment in energy efficiency. This investment is allocated to several different sectors using percentages determined from 2001, 2002, and 2003 ECMB budget figures, as shown:

49%	*Electrical Equipment*	*(2907: Industry Sales (amount) Electrical Equipment),*
13%	*Construction*	*(2923: Industry Sales (amount) Construction),*
13%	*Professional Services*	*(2946: Industry Sales (amount) Miscellaneous Professional Services),*
7%	*Business Services*	*(2942: Industry Sales (amount) Miscellaneous Business Services)*
6%	*Government Spending*	*(181: Government Spending (amount) State),*
5%	*Education*	*(2947: Industry Sales (amount) Education),*
5%	*Public Utilities*	*(1830: Capital Costs (amount) Public Utilities),*

For the purpose of fitting the table into the report all investment was combined in 'Investment Spending' on Tables 1-1 and 1-2. The investment categories were not combined in REMI Policy Insight, but broken down by the above percentages.

Oil Simulation Inputs

Table 1-1 Data Inputs for Oil (96 Mil $)

	2005	2006	2007	2008	2009	2010
Consumer Spending on Oil	-9.51	-18.53	-27.17	-35.85	-44.24	-51.93
Consumer Spending on Oil	34.03	33.16	32.18	31.66	30.82	29.85
Consumption Reallocation	9.51	18.53	27.17	35.85	44.24	51.93
Consumption Reallocation	-34.03	-33.16	-32.18	-31.66	-30.82	-29.85
Oil Cost for Commercial Firms	-2.22	-8.51	-12.33	-15.39	-17.79	-19.30
Oil Cost for Commercial Firms	6.38	6.12	5.85	5.66	5.48	5.28
Oil Cost for Industrial Firms	-0.31	-1.20	-1.72	-2.02	-2.23	-2.37
Oil Cost for Industrial Firms	0.70	0.66	0.62	0.59	0.57	0.56
Intermediate Demand for Oil	-25.48	-98.92	-123.33	-133.79	-137.39	-138.51
Investment Spending	40.30	39.14	37.88	37.16	36.14	34.98

	2011	2012	2013	2014	2015	2016
Consumer Spending on Oil	-60.02	-68.05	-76.60	-84.75	-91.45	-97.27
Consumer Spending on Oil	29.29	28.83	28.39	27.88	27.40	27.12
Consumption Reallocation	60.02	68.05	76.60	84.75	91.45	97.27
Consumption Reallocation	-29.29	-28.83	-28.39	-27.88	-27.40	-27.12
Oil Cost for Commercial Firms	-20.73	-22.06	-23.51	-24.74	-25.94	-27.15
Oil Cost for Commercial Firms	5.21	5.17	5.17	5.14	5.13	5.12
Oil Cost for Industrial Firms	-2.54	-2.69	-2.87	-3.02	-3.17	-3.32
Oil Cost for Industrial Firms	0.56	0.56	0.57	0.58	0.58	0.58
Intermediate Demand for Oil	-142.09	-144.76	-150.98	-154.55	-152.60	-157.56
Investment Spending	34.36	33.87	33.45	32.92	32.45	32.17

	2017	2018	2019	2020	Total
Consumer Spending on Oil	-101.87	-107.51	-111.91	-115.99	-1102.65
Consumer Spending on Oil	26.63	26.51	26.20	26.01	465.95
Consumption Reallocation	101.87	107.51	111.91	115.99	1102.65
Consumption Reallocation	-26.63	-26.51	-26.20	-26.01	-465.95
Oil Cost for Commercial Firms	-28.18	-29.54	-30.61	-31.67	-339.67
Oil Cost for Commercial Firms	5.09	5.12	5.11	5.10	86.13
Oil Cost for Industrial Firms	-3.44	-3.61	-3.74	-3.88	-42.12
Oil Cost for Industrial Firms	0.59	0.59	0.59	0.60	9.53
Intermediate Demand for Oil	-160.47	-162.85	-166.41	-171.89	-2221.57
Investment Spending	31.67	31.58	31.26	31.07	550.37

Natural Gas Simulation Inputs

Table 1-2 Data Inputs for Oil (96 Mil $)

	2005	2006	2007	2008	2009	2010
Consumer Spending on NG	-32.60	-63.33	-78.85	-85.39	-87.90	-89.05
Consumer Spending on NG	27.76	25.71	23.88	22.13	20.63	19.43
Consumption Reallocation	32.60	63.33	78.85	85.39	87.90	89.05
Consumption Reallocation	-27.76	-25.71	-23.88	-22.13	-20.63	-19.43
NG Cost for Commercial Firms	-18.09	-70.29	-87.51	-94.77	-97.55	-98.83
NG Cost for Commercial Firms	30.81	28.54	26.50	24.56	22.90	21.56
NG Cost for Industrial Firms	-7.39	-28.62	-35.82	-39.02	-39.84	-39.69
NG Cost for Industrial Firms	13.03	11.96	11.19	10.29	9.44	8.80
Intermediate Demand for NG	-2.53	-9.71	-14.05	-17.41	-20.02	-21.67
Investment Spending	70.18	64.88	60.34	55.84	51.91	48.80

	2011	2012	2013	2014	2015	2016
Consumer Spending on NG	-91.63	-93.63	-97.56	-99.95	-99.24	-102.34
Consumer Spending on NG	18.84	18.25	18.11	17.77	16.97	16.95
Consumption Reallocation	91.63	93.63	97.56	99.95	99.24	102.34
Consumption Reallocation	-18.84	-18.25	-18.11	-17.77	-16.97	-16.95
NG Cost for Commercial Firms	-101.69	-103.92	-108.28	-110.93	-110.14	-113.58
NG Cost for Commercial Firms	20.91	20.26	20.10	19.72	18.84	18.82
NG Cost for Industrial Firms	-40.40	-40.84	-42.70	-43.62	-42.45	-43.99
NG Cost for Industrial Firms	8.52	8.17	8.18	8.01	7.51	7.58
Intermediate Demand for NG	-23.26	-24.75	-26.38	-27.75	-29.11	-30.47
Investment Spending	47.30	45.75	45.47	44.59	42.45	42.48

	2017	2018	2019	2020	Total
Consumer Spending on NG	-104.28	-105.96	-108.31	-111.71	-1451.73
Consumer Spending on NG	16.81	16.69	16.71	16.91	313.58
Consumption Reallocation	104.28	105.96	108.31	111.71	1451.73
Consumption Reallocation	-16.81	-16.69	-16.71	-16.91	-313.58
NG Cost for Commercial Firms	-115.73	-117.60	-120.20	-123.98	-1593.10
NG Cost for Commercial Firms	18.66	18.52	18.55	18.77	348.02
NG Cost for Industrial Firms	-44.73	-45.25	-46.21	-47.91	-628.48
NG Cost for Industrial Firms	7.56	7.52	7.56	7.71	143.02
Intermediate Demand for NG	-31.63	-33.15	-34.35	-35.55	-381.79
Investment Spending	42.17	41.87	41.97	42.52	788.52

2 Results & Analysis

As shown in Table 2-1, enacting conservation policies in Connecticut will stimulate positive growth on the economy. All sectors of the economy will experience strong growth during the time frame, with the exception of surprisingly small growth in Output. This effect occurs due to a loss in demand and sales for the petroleum industry in Connecticut (see section 2-1). Connecticut does experience strong growth in employment, largely in the service and retail sector, resulting from the decrease in fuel costs and increase in Real Disposable Income (the increase in Real Disposable Income directly affects the increase in consumption).

Table 2-1 Major Economic Growth in Connecticut Due to Conservation Policies, Annual

	2005	2006	2007	2008	2009	2010
Employment	1,073	1,441	1,674	1,848	1,975	2,076
Output (Mil 96$)	107.10	116.20	130.30	146.60	161.70	176.10
GSP (Mil 96$)	64.96	76.84	87.65	98.45	108.00	116.90
Population	161	426	722	1,023	1,320	1,604
Real Disp Inc (Mil 96$)	29.17	57.75	73.29	84.86	93.59	101.00
State Revenues (Mil 01$)	8.37	13.79	16.87	19.22	20.99	22.52

	2011	2012	2013	2014	2015	2016
Employment	2,156	2,215	2,296	2,346	2,343	2,385
Output (Mil 96$)	187.60	197.20	208.10	216.90	222.70	231.20
GSP (Mil 96$)	124.40	130.50	137.60	143.10	146.40	151.80
Population	1,875	2,129	2,373	2,602	2,805	2,996
Real Disp Inc (Mil 96$)	107.60	113.30	120.40	126.10	128.80	134.40
State Revenues (Mil 01$)	23.79	24.84	26.19	27.20	27.62	28.58

	2017	2018	2019	2020
Employment	2,406	2,427	2,446	2,478
Output (Mil 96$)	239.00	246.60	254.20	262.80
GSP (Mil 96$)	156.60	161.10	165.60	170.90
Population	3,171	3,332	3,479	3,617
Real Disp Pers (Mil 96$)	138.90	143.20	147.80	153.20
State Revenues (Mil 01$)	29.32	30.01	30.73	31.62

2-1 Output

The Output of an economy is the amount of production in dollars, including all intermediate goods purchased as well as value-added (labor, capital, and fuel investments and profit). We can also think of output as sales for both final goods and intermediate goods. Output is dependent upon consumption in the area, state government spending, investment, and exports of the industries in the region.

In both of these scenarios state government spending, investment, and industry sales remain relatively equal between the two scenarios. The difference in output is based on the decrease in consumption that results from higher costs for consumers.

When looking at Output growth in the oil and natural gas policy scenarios separately, we see that the majority of growth results from the natural gas. Very little growth in output for Connecticut occurs due to the oil policy. In fact, a loss of Output from the baseline occurs in 2014 and 2020. The significant difference in Output growth is due to a loss in demand for oil (please refer to Table 1-1; Intermediate Demand for Oil). By 2020, the oil industry will receive a total loss of demand of $2.221 billion, compared to the natural gas industry which will experience of loss in demand of $340 million. The REMI simulation does take into account economic leakage, that is, the loss of demand does not fully occur in the State of Connecticut.

In the first forecast (oil as a single policy) the petroleum-products industry receives a cumulative loss of $451 million over the forecast period. In the second forecast (natural gas as a single policy) the natural gas industry has a cumulative loss of $10.5 million over the forecast period. Again, this is due the higher loss in intermediate demand for the oil industry.

The projected increase in output in 2005 is $107.1 million when looking at the oil and natural gas policies combined. By 2020 the Output growth of both policies is $262 million dollars with a cumulative total of $3.1 billion.

Figure 2-1 Increase in Output (Mil 96 $)

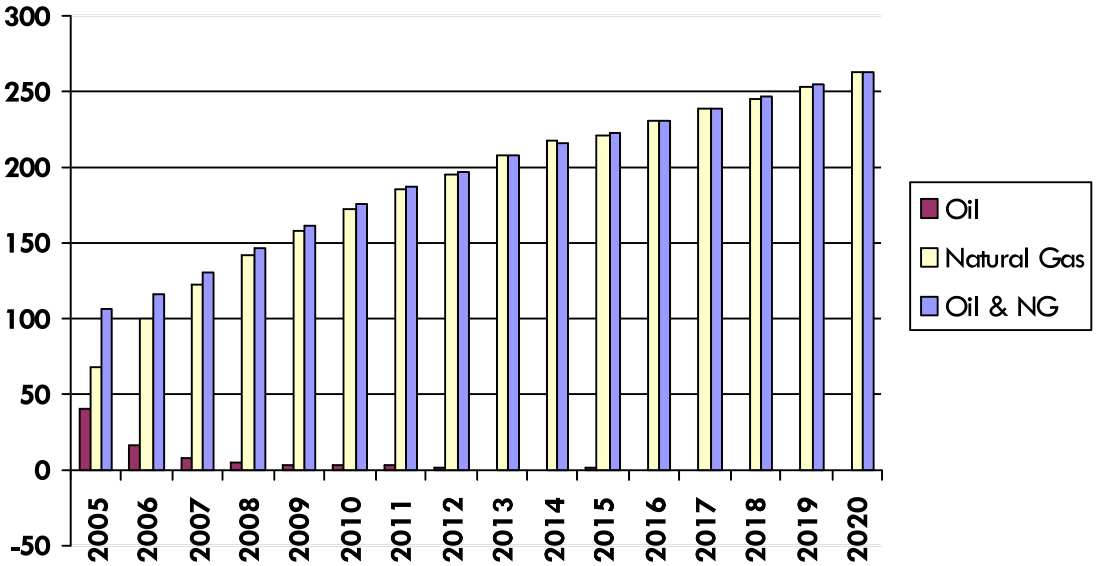

Table 2-2 Annual increase in Output (Mil 96 $)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Oil	39.93	16.62	7.904	4.654	3.494	3.357	2.472	2.106	0.6104
Natural Gas	67.09	99.55	122.4	142	158.2	172.7	185.2	195.1	207.5
Oil & NG	107.10	116.20	130.30	146.60	161.70	176.10	187.60	197.20	208.10

	2014	2015	2016	2017	2018	2019	2020	Total
Oil	-0.4578	1.099	0.3967	0.1831	0.6409	0.3357	-0.5493	82.7957
Natural Gas	217.2	221.5	230.8	238.7	245.8	253.7	263.2	3,020.64
Oil & NG	216.90	222.70	231.20	239.00	246.60	254.20	262.80	3,104.30

2-2 Gross State Product

Gross State Product (GSP) as a value added concept is analogous to the national concept of Gross Domestic Product. It is equal to Output, excluding intermediate inputs. The value-add concept is equal to compensation and profits.

Similar to Output, GSP growth in the oil-policy scenario is significantly lower than natural gas. However, in the oil-policy scenario, GSP does not experience any of the loss that Output does due to the definition of GSP. The Output of an economy is the sales of all goods, including intermediate and final goods. GSP does not include sales of intermediate goods, and all demand loss for oil by firms is intermediate. As seen in Figure 2-3, in the natural-gas-policy scenario GSP increases dramatically over the 15-year time horizon, while there is only a slight increase in GSP in the oil-policy scenario.

The projected increase in GSP in 2005 is $64.96 million. By 2020 the annual increase for GSP is $170.90 million with a cumulative increase of $2,040.80 million.

Figure 2-2 Annual increase in Gross State Product (Mil 96 $)

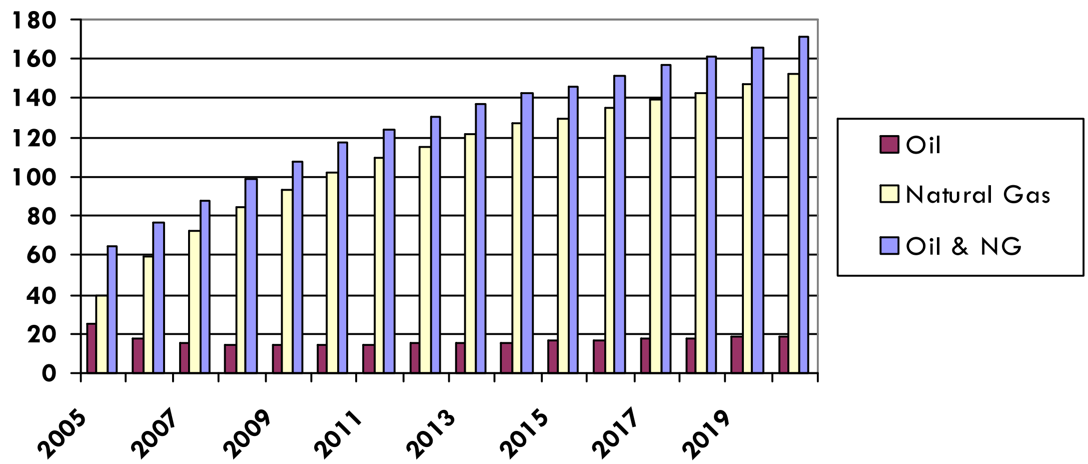

Table 2-3 Annual increase in Gross State Product (Mil 96 $)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Oil	24.95	17.62	14.94	14.24	14.25	14.54	14.79	15.17	15.27
Natural Gas	39.98	59.2	72.71	84.2	93.73	102.3	109.6	115.3	122.3
Oil & NG	64.96	76.84	87.65	98.45	108.00	116.90	124.40	130.50	137.60

	2014	2015	2016	2017	2018	2019	2020	Total
Oil	15.35	16.31	16.69	17.17	17.96	18.34	18.62	266.21
Natural Gas	127.7	130	135	139.3	143.1	147.2	152.2	1773.82
Oil & NG	143.10	146.40	151.80	156.60	161.10	165.60	170.90	2,040.80

2-3 Employment

The Employment variable in REMI Policy Insight uses historical data from the Bureau of Economic Analysis (BEA) and is based upon place of work, including part-time and full-time employees. The employment figures projected below are the difference from baseline and should not be cumulated.

As expected, the increase in employment is largely due to the natural gas policy. However, there is also an employment increase due to the oil policy, roughly 33% of the total in 2005 and 20% of the total employment increase in 2020. The employment increase in both scenarios is due largely to increases in consumption (an increase in consumption is the result of an increase in consumer spending). Consequently, roughly 66% percent (1,650 jobs) of new employment is in the retail trade and service sectors in 2020. The two industries that suffer a loss in employment are the petroleum products industry (16 workers by 2020) and the natural gas industry (4 workers by 2020). Fortunately the employment losses are so small that they can be considered negligible. There is also some indirect job loss in the oil-policy scenario due to oil firms purchasing slightly less capital from the decrease in demand. Again, the employment loss is relatively small, only 10 jobs in 2020, and the loss is made up in the employment gains from consumption.

The initial total employment increase in 2005 is 1,073 net new workers. The initial growth rate is high, roughly 34%, but slows considerably over the next 14 years, to 1% in 2020. The decreasing growth rate flattens the growth in employment as the economy adjusts. By 2020 the total net new employment is 2,478 new workers.

Figure 2-3 Increase in Employment from baseline, annual

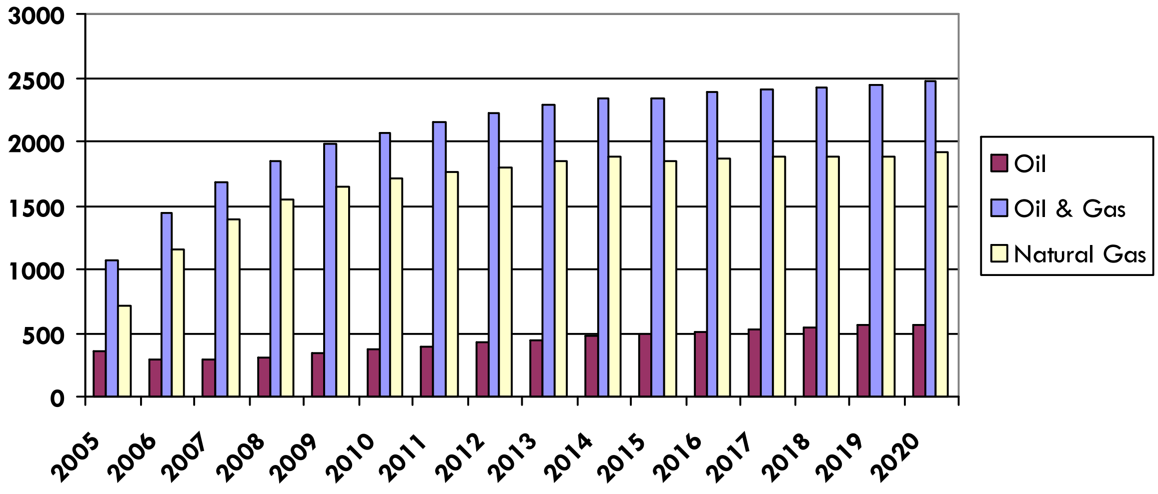

Table 2-4 Increase in Employment from baseline, annual

	2005	2006	2007	2008	2009	2010	2011	2012
Oil	356	293	287	309	338	367	393	421
Natural Gas	716	1,149	1,386	1,539	1,637	1,708	1,762	1,793
Oil & NG	1,073	1,441	1,674	1,848	1,975	2,076	2,156	2,215

	2013	2014	2015	2016	2017	2018	2019	2020
Oil	447	470	497	513	526	545	556	564
Natural Gas	1,849	1,875	1,845	1,870	1,878	1,880	1,889	1,913
Oil & NG	2,296	2,346	2,343	2,385	2,406	2,427	2,446	2,478

2-4 Population

Population is a key variable in REMI Policy Insight that affects the potential labor force, government spending, consumption spending, and housing prices. The changes in population are due to changes in migration, the result of either economic growth or loss.

All changes in population are cumulative. Each year is difference from baseline, but includes the previous year. The large increase in population is due to the natural gas investment. In 2005 the population of the State of Connecticut increases by 161 people with a linear increase cumulating to 3,617 net new people in Connecticut in 2020. The in migration is due largely to economic migration and the family members of the economic migrants.

Figure 2-4 Increase in Population from baseline, cumulative

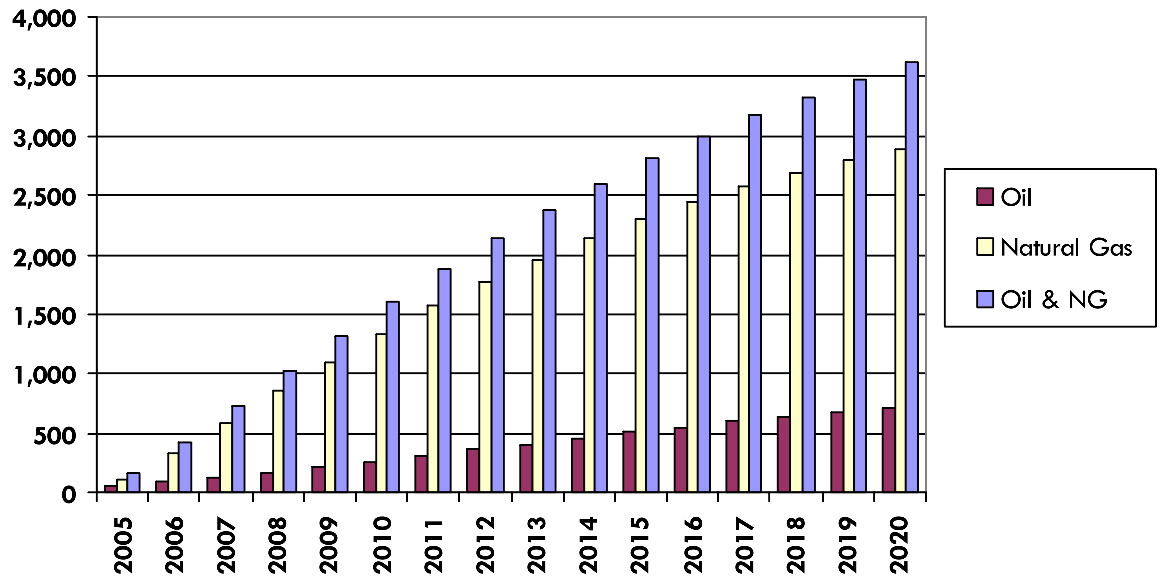

Table 2-5 Increase in Population from baseline, cumulative

	2005	2006	2007	2008	2009	2010	2011	2012
Oil	53	92	131	173	217	263	310	358
Natural Gas	108	334	590	851	1,102	1,341	1,563	1,768
Oil & NG	161	426	722	1,023	1,320	1,604	1,875	2,129

	2013	2014	2015	2016	2017	2018	2019	2020
Oil	407	455	503	550	595	638	680	717
Natural Gas	1,963	2,143	2,296	2,440	2,572	2,688	2,794	2,894
Oil & NG	2,373	2,602	2,805	2,996	3,171	3,332	3,479	3,617

2-5 Real Disposable Income

Real Disposable Income is the inflation-adjusted income that is available for consumers to spend. It is personal income minus taxes and social contributions plus dividends, rents, and transfer payments. The numbers of employees in the area, their wage rate, and the consumer prices all affect real Disposable Income. An increase in employment or wage, or a decrease in consumers' prices increases a region's Real Disposable Income. Consequently, the opposite decreases Real Disposable Income.

The increase in Real Disposable Income is an indirect effect from the new jobs in Connecticut. The summation of new wages, minus taxes, earned by workers equals the increase in Real Disposable Income. Although there was a decrease in the amount of spending on natural gas and oil, there was no direct effect on Real Disposable Income as it was assumed any decrease in spending on natural gas and oil would be spent on other goods.

The projected increase in Real Disposable Income is $29.17 million in 2005. By 2020, Real Disposable Income increases to $153.20 million for a cumulative increase of $1753.36 million.

Figure 2-5 Increase in Real Disposable Income (Mil 96 $)

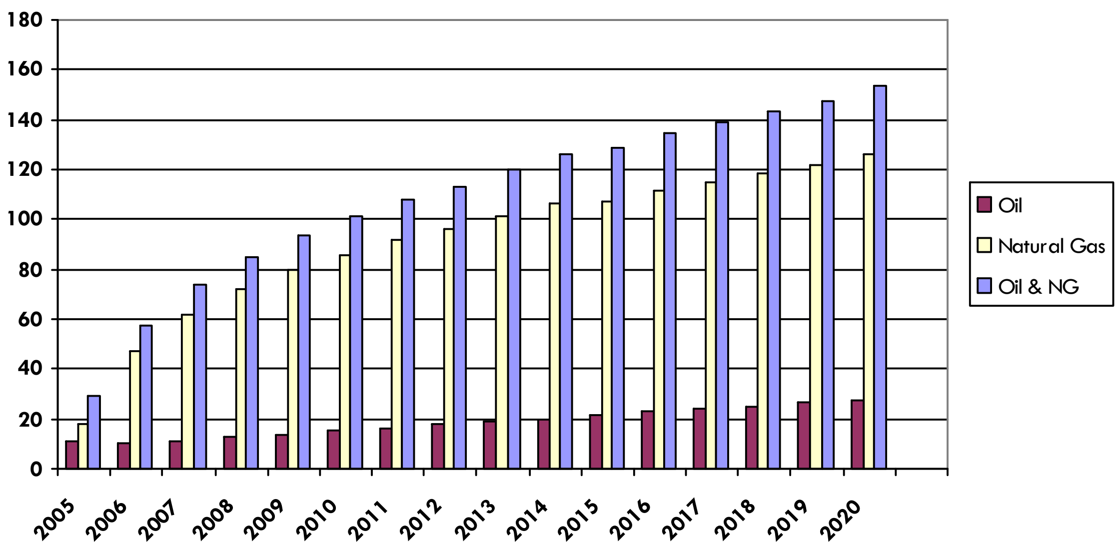

Table 2-6 Annual increase in Real Disposable Income (Mil 96 $)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Oil	11.3	10.53	11.18	12.49	13.85	15.18	16.37	17.64	18.91
Natural Gas	17.87	47.22	62.13	72.4	79.74	85.82	91.38	95.69	101.5
Oil & NG	29.17	57.75	73.29	84.86	93.59	101.00	107.60	113.30	120.40

	2014	2015	2016	2017	2018	2019	2020	Total
Oil	20.08	21.59	22.78	23.9	25.27	26.35	27.39	294.81
Natural Gas	105.9	107.3	111.8	115.2	118.1	121.4	125.9	1459.35
Oil & NG	126.10	128.80	134.40	138.90	143.20	147.80	153.20	1,753.36

2-6 State Revenue

State Revenue represents the gains or losses in income for the State of Connecticut from tax revenues. These revenues include individual income tax, general sales tax, tobacco sales tax, and property tax. All changes in state revenue are indirect effects only. It does not take into account the changes in tax income from the oil and natural gas industry. All effects are the results of a change in economic activity. Real Disposable Income and Population affect State Revenues directly.

As seen in section 2-5 the large increase in Real Disposable Income is the due to the natural gas policy. As Population and Real Disposable Income increases, so do the State Revenues that Connecticut collects. Beginning in 2005 the State of Connecticut will collect $8.37 million additional revenue due to the conservation policies. In 2020, the State of Connecticut will collect $31.62 million cumulating to a total of $381.66 million collected over the 15 year time period.

Table 2-6 Annual increase in State Revenue (Mil 01 $)

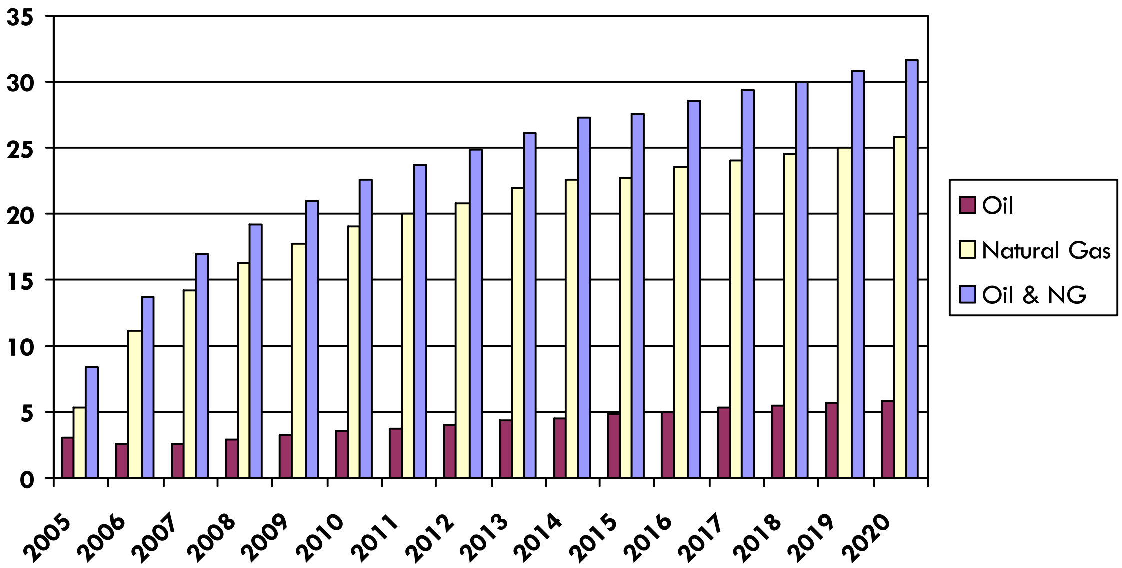

Table 2-7 Annual increase in State Revenue (Mil 01 $)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Oil	3.01	2.61	2.66	2.91	3.21	3.51	3.77	4.04	4.30
Natural Gas	5.36	11.18	14.22	16.31	17.78	19.00	20.04	20.80	21.89
Oil & NG	8.37	13.79	16.87	19.22	20.99	22.52	23.79	24.84	26.19

	2014	2015	2016	2017	2018	2019	2020	Total
Oil	4.54	4.85	5.06	5.26	5.51	5.69	5.84	66.75
Natural Gas	22.65	22.78	23.53	24.08	24.52	25.05	25.78	314.97
Oil & NG	27.20	27.62	28.58	29.32	30.01	30.73	31.62	381.66

Appendix: Economic Impact of Health Benefits using COBRA

Using additional data provided by EPA, REMI ran two additional forecast scenarios modeling the economic effect of the increase in health benefits due to the conservation programs. The health benefits result from the indirect effects of the conservation policies on reducing air pollution. To estimate the overall economic impact of the reduction in air pollution, REMI used outputs from EPA's Co-benefits Risk Assessment (COBRA) model. COBRA provides a monetary value of the changes in health benefits due to changes in air pollution.

COBRA

The COBRA model calculates the monetary impact of changes in air pollution via a three-step process. First, the model uses an air-quality model to quantify the associated change in air particles. Second, COBRA uses concentration response (C-R) functions that link changes in particles to health incidences, such as a decrease in respiratory illnesses due to less harmful particulate matter in the air. Finally, COBRA estimates the monetary impact of each health incidence based on direct medical costs, value of statistical life, willingness-to-pay, and cost-of-illness values. The final outputs of the COBRA model used by REMI Policy Insight are: mortality changes, health incidence improvements such as decreases in respiratory illnesses, fewer missed work days, and the value of all health incidences on the medical and insurance industries.

The output of the COBRA model is provided statically in two separate years, 2010 and 2020. REMI linearly interpolated the output to format into REMI Policy Insight.

Methodology

REMI modeled two alternative forecasts using the outputs from the COBRA model. The first forecast modeled the economic effects of the mortality changes, fewer missed workdays (modeled as an increase in labor productivity), and the loss in revenue on the medical and insurance industries. The second forecast modeled the same economic effects, but also included the increased value individuals place upon Connecticut due to higher air quality. To model the value individuals place on an increase in air quality, REMI uses the economic concept of compensating differential.

Compensating differential within REMI Policy Insight accounts for the regional differences in the net economic migration between regions. The model calculates that regions with higher economic migration have a higher quality of life. A high economic migration increases the labor force of an area, reducing the wage rate. The consequent assumption is regions with a high quality-of-life have can pay lower wage rates to keep or attract new employees. Inversely, regions with a low quality-of-life compensate employees with higher wages. As the air quality in Connecticut increases, the quality-of-life in Connecticut increases, individuals will migrate into the region, the labor force will increase, and employees require less compensation.

Model Inputs

Mortality Change

To simulate the mortality change, the number of deaths decreased from the COBRA model was used to change the survival rate in the simulation. The 2010 and 2020 COBRA snapshots provided two points of the actual numbers of deaths avoided if the policy was implemented. The years between 2005-2009 and 2009-2020 were interpolated linearly from those two points.

Labor Productivity

COBRA calculates the decrease in days off taken by workers due to illness. Based on the data provided, REMI assumed that gains in workdays would increase productivity. REMI increased productivity proportionally to the increase in hours worked over total hours worked in Connecticut.

Medical and Insurance Impacts

The final values the COBRA model provided were the loss of business activity for the medical and insurance industries. Due to healthier Connecticut residents from the policy impact, there would be a decrease in demand in the Connecticut medical and health insurance sectors. The value used was the same as the total dollar value of the health improvements. The assumption used to estimate loss in revenue due to fewer health incidences put 50% of loss in the medical industry and 50% in the insurance industry. The policy variables used in Policy Insight were decreases in demand for both these industries.

Health Incidence Improvements

The total dollar value of the health improvements from the COBRA model was used to change the compensating differential within the simulation. The lowered compensating differential decreases the wage amount needed to keep or attract new employees into the region due to better air quality.

Results

Table 4 summarizes the economic growth in the State of Connecticut due to the increase in the health benefits resulting from the oil and natural gas conservation policies. This table shows the cumulative growth of Connecticut over the 15-year time period for three alternative forecasts. The first forecast simulates the economic impact of the health benefits without using REMI Policy Insight's Compensating Differential Variable (See Inputs). The second forecast simulates the economic impact of the health benefits using REMI Policy Insight's Compensating Differential variable. The final forecast included all inputs of the oil and natural gas policies and the inputs calculated from COBRA.

Table 4. Economic Growth Due to the Health Benefits of the Conservation Policies in Connecticut (Cumulative 2005-2020)

	Health Benefits without Comp Diff	Health Benefits with Comp Diff	Oil & Natural Gas with COBRA
Employment (Avg Annual Increase)*	-15	-9	1,670
Output (Mil 96$)	-22.57	-11.00	3,094.00
GSP (Mil 96$)	-12.36	-3.98	2,037.14
Population	2	41	1,724
Real Disp Pers Inc (Mil 96$)	-5.75	3.30	1,758.13
State Revenues (Mil 01$)	-1.26	0.81	382.74

Using EPA's COBRA model, REMI was able to model the economic impacts of the increase in air quality in Connecticut due to the energy conservation projects. The results of the REMI model show a small negative effect upon the economy. The negative effect is due to the loss in revenue for the medical and insurance industry. Even though Connecticut benefits economically from an increase in labor productivity and the compensating differential, the benefits do not outweigh the loss in revenue for the medical and insurance industry[2].

In the first forecast shows a decrease in 15 jobs in the economy, a loss of $22.57 million in Output and $12.36 million in GSP by 2020. Real Disposable Income decreases by $5.75 million and the State of Connecticut losses $1.26 million in State Revenue. The only positive increase in the first forecast is Population by 2 people.

The inclusion of the compensating differential variable in the second forecast slightly dampens the negative impacts. The second forecast shows a loss in employment of 9 jobs, a loss of $11 million in Output and $3.98 million in GSP. By using the compensating differential variable there are slightly positive impacts for Population, Real Disposable Income, and State Revenues. As stated in the inputs section, compensating differential increases the attractiveness of Connecticut. As Connecticut becomes more attractive, migration into the area increases. The influx of people into the state

[2] Due to the large medical and insurance industry in Connecticut, the multiplier effects of a loss or gain may be larger than other regions.

increases the total amount Real Disposable Income. State Revenue is dependent on the amount of Real Disposable Income, and therefore increases as well. Population increases by 41 people, increasing the amount of Real Disposable Incomes by $3.3 million and the amount of revenue collected by the State of Connecticut by $810 thousand.

The final forecast combines the COBRA simulations with the final oil and natural gas simulation. It is important to note that the negative impact due to the loss in revenue in the medical and insurance industry is relatively small when weighed against the positive impact of enacting the oil and natural gas conservation policies. The total economic impact the oil and natural gas policies have on the State of Connecticut is positive. The benefits of the policies would increase employment roughly by 1,670 jobs by 2020. Output would increase by $3.094 billion and Gross State Product would increase by $2.03 billion by 2020. Population would increase by 1,724 people, Real Disposable Income would increase by $1.758 billion dollars and State Revenues collected by Connecticut would increase by $382 million dollars.

Table 4 and Table 5 show the annual economic effects for two specific years: 2010 and 2020. These graphs are not an accumulation of preceding years, but instead show the economic effects on Connecticut is for the specific year. As with the accumulated totals of each forecast shown in Table 4, the increase in health benefits will have a negative impact on Connecticut.

Table 5. Economic Growth Due to Health Benefits of the Conservation Policies in Connecticut, 2010

	Health Benefits without Comp Diff	Health Benefits with Comp Diff	Oil & Natural Gas with COBRA
Employment (Avg Annual Increase)*	-19	-16	2061
Output (Mil 96$)	-1.57	-1.30	174.90
GSP (Mil 96$)	-0.87	-0.66	116.30
Population	-2	25	1,630
Real Disp Pers Inc (Mil 96$)	-0.50	-0.21	100.90
State Revenues (Mil 01$)	-0.10	-0.03	22.51

Table 6. Economic Growth Due to Conservation Policies in Connecticut, 2020

	Health Benefits without Comp Diff	Health Benefits with Comp Diff	Oil & Natural Gas with COBRA
Employment (Avg Annual Increase)*	-22	-6	2,472
Output (Mil 96$)	-1.37	0.58	263.3
GSP (Mil 96$)	-0.70	0.66	171.50
Population	14	125	3,747
Real Disp Pers Inc (Mil 96$)	0.03	1.41	154.60
State Revenues (Mil 01$)	-0.04	0.27	31.89

About REMI

Regional Economic Models, Inc. (REMI) is the nation's leading provider of economic forecasting and policy analysis software. The REMI Policy Insight model is used by over half of state governments, and numerous consulting firms, cities, and universities. Established in 1980, REMI has published model developments in the American Economic Review, the Review of Economics and Statistics, and other highly regarded publications.

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Connecticut Climate Change

APPENDIX 10

Summary of Public Comments on Climate Change Action Plan 2005 (Draft) and Responses from the Governor's Steering Committee

(includes comments received through December 15, 2004)

To see the complete text of comments submitted on the draft plan, go to http://www.ctclimatechange.com/Appendices.html

RCI = Residential, Commercial, Industrial Energy Use
AFW = Agriculture, Forestry, Waste Emissions
Transp/LU = Transportation and Land Use

Sector	Commenter	Brief Summary of Comments	GSC Response
RCI	Jason Rupaka, Plainville resident	Promote air cleaner or catalytic converter retrofit for the standard furnace/boiler to reduce greenhouses gases	DEP 2005 legislative proposal to reduce the sulfur content in home heating oil from 3000 ppm to 500 ppm starting in 2007. This is >75% reduction in SO2. Furnaces will run much cleaner as a result. The oil and gas conservation funds would also provide incentives for installation and use of cleaner, more efficient technology.
RCI	Joel Gordes, Environmental Energy Solutions	RA12 – heat pump water heater not yet commercially available	This item is being coordinated through the ECMB, of which the DEP is a member. The DPUC will take these comments into consideration as it determines the manner in which it will implement this action item.
General		See 9/28/04 ECMB reply to DPUC recommendations from stakeholder plan	This item is also being coordinated through the ECMB.
		Include short-term goals that will occur within current terms of office	See "Suggested Next Steps for Implementation" section of each recommendation – short-term goals incorporated where possible
Transp/LU		Public transit ridership is down and fares have increased	The Plan's recommendations are designed to increase investment and reverse this trend.
Transp/LU	Charles J. Rothenberger	State should progress forward in implementing GHG Tailpipe Standards as an essential part of the recently adopted California LEV II Standards.	DEP is required to amend its regulations in order to keep them consistent with CA. These amendments must be completed by the end of 2005 in order to be in effect for the 2009 model year.

Sector	Commenter	Brief Summary of Comments	GSC Response
		State should implement a feebate program. Suggest an approach that ties financial incentives into current sales tax structure.	CT is working with MA, RI and ME to assess the environmental and economic benefits and impacts of a regional approach. Initial technical analysis is expected to be completed in January 2005. Based on that, we will work with stakeholders in CT to determine the best implementation approach.
		Acknowledges state efforts to perform congestion pricing study and pilot program. VMT increases are a major concern.	Thank you. The Plan's recommendations for both smart growth and transit expansion should slow down VMT growth.
		Clean diesel and black carbon efforts currently by the DEP, DOT and City of New Haven are acknowledged as positive first steps. Stress need to build onto these programs	The DEP's diesel initiative is a comprehensive statewide plan that will be part of our efforts to attain the fine particulate standard. Reductions are expected from both mobile and stationary source sectors.
Transp/LU	Virginia Walton, Storrs resident	Support smart growth, incentives for urban renewal and redevelopment, support mixed use	We recognize that the State C&D plan does not include implementation requirements for most entities. We anticipate that legislation will be introduced to broaden the range of entities that will be required to implement smart growth initiatives.
AFW		Fund DEP recycling program thru a surcharge on waste disposed at incinerators and bulky waste landfills – strengthen enforcement and education	DEP will address recycling implementation issues in Solid Waste Mgmt Plan (DEP has issued RFP to develop plan)
		Preserve farmland thru surcharge on farmland converted for development, support farmers	Will forward recommendation to Department of Agriculture and work more closely with them on land preservation strategies
General	Sean Casten, Turbosteam Corp. MA	Create self-sustaining revenue neutral revolving fund to subsidize GHG actions ($X/ton reduced) for CT tax paying entities. Would be esp useful to encourage CHP	We would be interested in hearing more about how this idea would work. A "white paper" or equivalent would be welcomed. Then, we can determine the best implementation mechanisms.
General	Rina Bakalar, City of Bridgeport (sent via Brian Keane)	Bridgeport is preparing a "green plan" which will include some of the goals in the action plan.	Great!
AFW	Steven Yates, CRRA	Increase waste to energy capacity in CT– would reduce GHG from transporting waste to out of state landfills. Recommend to Governor that DEP "moratorium" on additional WTE capacity be lifted and that CRRA be charged with study and development of the most cost-effective means of increasing capacity.	DEP will address disposal capacity issues in Solid Waste Mgmt Plan (DEP has issued RFP to develop plan). There is no current "moratorium" on WTE capacity in CT. CGS Section 22a-208d requires a written determination of need from DEP that the facility is necessary to meet the solid waste disposal needs of the state.
General	Chandra Prasad, Hamden resident	"I am grateful and delighted that Connecticut is addressing climate change and ways to ameliorate it. I fully support this initiative... It's about time we as a state stepped up our efforts."	Thanks for the support!

General	Roger Smith, Clean Water Action – supported by over 60 organizations and individuals listed	Support all recommendations in stakeholder report, but need timeline and implementation strategy for each action, based on an objective of meeting 2010 and 2020 goals.	See "Suggested Next Steps for Implementation" section of each recommendation
Electricity		CCEF solar PV program ($5/watt) should be made permanent.	The CCEF has funded, or committed funding, nearly all of its prior budgetary appropriations for solar PV programs. A proposal from CCEF staff to the board will request additional funding to support the continued efforts of the program.
		Revise RPS to require 20% renewables by 2020	Additional analyses will need to be conducted following a multi-year evaluation of the current RPS through 2010.
		Set CT standards for cap & trade: 25% reductions from electric sector by 2020; no clean energy credit for nukes; allocate credits for public purposes (clean energy, efficiency); no C offsets initially	These issues are currently integral to the work of the regional greenhouse gas initiative (RGGI). Once the RGGI model rule is completed in April 2005, each state will undertake its own rulemaking processes. We will consider these comments again at that time.
AFW		Voluntary C offsets – do not include in cap & trade until reductions made, allow in-state only	Same response as for above comment.
		Expand bottle bill, use uncollected deposits to fund muni recycling programs	DEP will address in Solid Waste Mgmt Plan (DEP has issued RFP to develop plan).
RCI		Increase systems bene charge from 2 – 5 mills to result in 650 GWh per year by 2010 and 1,500 GWh per year by 2020.	The current funding level for the systems benefits charge is set by state statute- any funding increase will require a legislative change. The DPUC will take these comments into consideration to the extent such an increase is proposed.
		Set oil and gas funds at $0.35 per million BTU	The development of both conservation funds will likely require legislative action. To date, various funding levels have been contemplated and the benefits of a suggested funding level for both funds was examined in the studies which the GSC recently performed.
Transp/LU		Support for clean diesel/black C action – fund thru feebate revenues	Thank you for your support of the DEP clean diesel initiative. We will work with stakeholders on ways to increase penetration and effectiveness and would welcome any further details on this proposal.
		improve passenger rail service	The Plan's recommendations would fund improved services for bus and rail.
		support for pay as you drive insurance	GSC will evaluate this suggestion.
		require sale of low-rolling resistance tires to result in reduced fleet emissions of 1.6% by 2010 and 2.3% by 2020	GSC will evaluate this suggestion.

		expand existing trip reduction programs and increase education	The Plan's recommendations will be examining and implementing a menu of options which will include trip-reduction strategies from carpooling, vanpooling and transit, to telecommuting, compressed work weeks and flexible work hours.
		encourage location efficient mortgages	This item is part of our recommended actions.
Education		Create climate change challenge grant program	Will ask Climate Change Education Committee to address this
		Create business leader program	Will ask Climate Change Education Committee to address this
		Work with Treasurer to reach insurance sector	DEP will continue to work with Treasury Dept on this
		Educate DPH and local health boards on adaptation strategies	Will ask Climate Change Education Committee to address this
Electricity/ RCI	Richard Perkins, Waterford resident	Encourage geo-thermal heating/cooling through subsidies, tax incentives, or low interest loans	Many of these items may be eligible through the Conservation and Load Management Fund. The ECMB holds at least two public information meetings each year to solicit program ideas that can be included in each of the electric distribution company's plans. We would encourage you to participate in this process. Future dates can be obtained through the ECMB web site.
Electricity/ AFW	Maria Zannes, Integrated Waste Services Assoc.	Encourage continued use and expansion of CT waste to energy (WTE) facilities; reaffirm commitment to WTE in solid waste mgmt plan; provide WTE the benefits and incentives available to other clean energy sources. Provides figures on national GHG savings from WTE and results from analysis of GHG savings from Saugus WTE facility (1500 tons/day of municipal solid waste, 38 MW of power, resulting in net reduction of 73,000 MTCE per year).	DEP will address WTE capacity issues in Solid Waste Mgmt Plan (DEP has issued RFP to develop plan). WTE is a Class II renewable energy source in CT and thus can be incorporated into RPS as Class II source.
General	Eric Brown, CBIA	Draft plan does not meet the 2010 and 2020 goals as required by PA 04-252, "a Plan which fails to fully acknowledge the difficult actions that will be required to meet the statutory goals does a disservice to the State and is contrary to the requirements of subsection 2(b) of the Act." If GSC concludes goals can't be met, then: • fully acknowledge that actions in plan will not meet 2010/2020 goals; • acknowledge that unless significant technology advances are made, state must consider expanding nuke capacity, increasing regulation of residential/ consumer activity, and siting energy infrastructure • GSC should commit to a new deadline of 1/1/06 for a plan that meets goals	The draft 2005 plan being submitted to the legislature does meet or exceeds 2010 goals and 2020 goals.

Transp/LU	Sandy Fry, CRCOG	Must expand transit service (bus and rail) to meet 3% VMT reduction goal in plan – strategies in draft plan will not meet this goal. Capital investment and expansion of service are both needed; reverse current pattern of increasing fares while cutting service.	The VMT management strategies included in the Plan, and all the calculation of emissions reductions, was premised on such an investment in and expansion of transit.
		Smart growth will require more than adoption of State Plan of C&D. Other actions needed: build out analysis; statewide policies and legislation to support smart growth (open space, bike/ped options, property tax reform, targeted growth area funding, integrate regional/muni plans of C&D).	We recognize that the State C&D plan does not include implementation requirements for most entities. We anticipate that legislation will be introduced to broaden the range of entities that will be required to implement smart growth initiatives.
		Adopt US DOT Policy on Integrating Biking and Walking into the Transportation Infrastructure	Since much of the funding for service and system expansions will come from US DOT, these policies should be integrated into the planning and design processes.
		Adopt smart growth recognition program similar to MA	OPM is looking at the Massachusetts program for consideration.
General/ process	Derek Murrow, Environment Northeast	Because full draft is not posted on website, extend public comment period or have 2nd comment period thru 1/15/05	Entire draft will be posted on website following submission of the draft plan by the GSC to the General Assembly in early 2005 and the GSC public comment period will be extended until the time of the legislative informational public hearing.
		Website contains recommended action section only; plan needs other sections: exec summary, background info, plan summary and next steps	Entire draft will be posted on website following submission of the draft plan by the GSC to the General Assembly in early 2005.
		Concerned about double counting (e.g., energy efficiency actions referred to ECMB, but $ must be restored /expanded for additional reductions)	We are also concerned about double counting and "green washing". The DEP plans to amend its NOx budget program to provide set-asides for qualifying energy efficiency and renewable projects. This will help to better capture the benefits of these actions.
		Suggest the following as high priority actions: • Create gas and oil conservation funds • Develop cap & trade • Reduce diesel emissions • Restore funding to CLM fund • Restore funding to CCEF	We appreciate the input and support for these actions.
Electricity	Andy Bauer, Portland resident, member of CT Climate Coalition	Supports renewable energy strategy and aggressive promotion of RPS action	We appreciate the input and support for these actions.
		Supports cap & trade that excludes nukes	We appreciate the input and support for these actions.
RCI		Supports restoration of CLM fund	We appreciate the input and support for these actions.
Education		Support for education initiatives	We appreciate the input and support for these actions.

General	Henry Link, Hartford resident	Devote more staff to implementing climate change actions	We appreciate the input and support for these actions.
		Following actions should be high priority: energy efficient mortgages, restore ECL program, high-performance buildings (private), CHP, restore CLM fund, create oil fund, create gas fund, renewable energy strategy, RPS, restore CEF, energy efficiency/CHP, EPP, buy local produce, recycling	We appreciate the input and support for these actions.
Transp/LU		Extend sales tax exemption to all fuel type vehicles above 40 mpg	DRS would support extending 12-412(115) to include all vehicles that obtain over 40mpg.
RCI		Publicize appliance swap program	Will forward comment to ECMB and Climate Change Education Committee.
RCI		Upgrade industrial building codes also	The 2003 International Energy Conservation Code was adopted by reference on 9/1/04. It addresses commercial facilities, which includes industrial buildings.

Connecticut Climate Change

APPENDIX 11

Governor's Steering Committee
CT Climate Change Action Plan 2005 (Draft)

GHG Reductions, Cost, Implementation of Recommended Actions

38 Short List Action Items

Recommended Action	GHG Reductions MMTCO2e 2010/2020	Cost 2010/2020	Total Cost 2010/2020	Lead Agency	Implementation Status/Needs	Co-Benefits
RA 1. LEV II	0.04/ 0.47	Stage 1 ('03-'05) $3,300 Stage 2 ('06-'08) $1,500 Stage 3 ('09-'11) $700		DEP	Implemented. Regulations adopted by DEP.	
RA 3. Fleet Vehicle Incentives and Initiatives	part of RA 4: GHG tailpipe standards	Not estimated	Not estimated	DAS, DOT	Implemented	
RA 5. Public Education Initiatives (for Low GHG Vehicles)	part of RA 4: GHG tailpipe standards	Not estimated	Not estimated	DEP, DOT, DMV	In Process	
RA 7. Transit, Smart Growth, and VMT Management Package	0.22/ 0.49	$602/MTCO2e in 2020 [marginal cost in 2020 is $280/MTCO2e]	$137 million/year (accounts for avoided costs)	OPM, DOT, DEP	In Process/Action Pending	
RA 8. Multi-State Intermodal Freight Initiative	0.00/ 0.14	Not estimated	Not estimated	DOT	In Process	
RA 9. Clean Diesel and Black Carbon	0.80/ 2.40	$6-13/MTCO2e in 2020 (does not include avoided costs)	$13-30 million/year (does not include avoided costs)	DEP, DRS, OPM	In Process	
RA 10. Appliance Standards	0.10/ 0.21	-$89/MTCO2e		OPM, DPUC	In Process. PA 04-85 passed. Current DPUC administrative proceeding to adopt regulations.	

Recommended Action	GHG Reductions MMTCO2e 2010/2020	Cost 2010/2020	Total Cost 2010/2020	Lead Agency	Implementation Status/Needs	Co-Benefits
RA 11. Appliance Swapping Program	0.02/ 0.02	-$78/MTCO2e		DPUC	In Process. Current DPUC admin proceeding on 2005 C&LM budget.	
RA 12. Heat Pump Water Heater Replacement Program	0.01/ 0.01	-$121/MMTCO2e		DPUC, DAS	In Process. Current DPUC admin proceeding on 2005 C&LM budget.	
RA 13. Bulk Purchasing of Appliances	0.02/ 0.05	-$187/MTCO2e		DPUC, DAS, OPM	In Process. Current DPUC admin proceeding on 2005 C&LM budget.	
RA 14. Mandate Upgrades to Residential and Commercial Building Energy Codes	0.06/ 0.21	-$172/MTCO2e		OPM, DPS	Implemented, effective September 2004.	
RA 17. Expand Weatherization Program	0.01/ 0.01	$241/MTCO2e		OPM, DSS	Action Pending	
RA 18. Energy Star Homes Program	0.02/ 0.04	-$3/MTCO2e		DPUC	In Process. Current DPUC admin proceeding on 2005 C&LM budget.	
RA 19. High Performance Schools and State-Funded Buildings	0.02/ 0.06	$419/MTCO2e		OPM, DPW	In Process	
RA 21. Shared Savings Program for Government Agencies	0.12/0.20	Not estimated	Not estimated	OPM, DPW	In Process	
RA 22. Training of Building Operators	0.03/ 0.03	-$140/MTOC2e		DPUC	In Process. Current DPUC admin proceeding on 2005 C&LM budget.	
RA 23. Green Campus Initiative	0.18/ 0.19	$300,000 initial costs; $1,050,000 annually		DEP, OPM, DAS, ISE@ECSU	In Process	
RA 24. Energy Benchmarking and Tracking Program for Municipal Buildings	0.12/ 0.19	$0.005/square foot; $250,000 annually		OPM, DPUC, ISE@ECSU	In Process	
RA 25. Pilot Fuel Switching Project	n/a [additional projects will generate benefits]	-$22/MTCO2e		DEP, DPW	In Process	
RA 26. Remove Current Barriers to 3rd Party Load Management Techniques	0.02/ 0.03	-$34/MTCO2e		DPUC	In Process	
RA 27. State Procurement of Environmentally Preferable Services and Products	Not estimated	Not estimated	Not estimated	DAS, DEP	Implemented	
RA 28. Review NEDRI (New England Demand Response Initiative) Recommendations	Not estimated	Not estimated	Not estimated	DPUC, DEP	Action Pending	
RA 29. Promote Voluntary Programs and Actions	Not estimated	Not estimated	Not estimated	DEP	In Process	
RA 36. Reduce Non-Farm Fertilizer Use	0/0 (0.003/ 0.003)	Not estimated	Not estimated	DEP	In Process	
RA 37. Buy Local Produce	0/0 (0.003/ 0.003)	Not estimated	Not estimated	DEP, DAg	In Process	
RA 38. Research on Forest Management and Forest Carbon Offsets	Not estimated	Not estimated	Not estimated	DEP	Action Pending	
RA 39. Urban Tree Planting Program	0/0 (0.001/ 0.002)	$9,815/MTCO2e	$500,000/year (some fed funds available)	DEP	In Process	

Recommended Action	GHG Reductions MMTCO2e 2010/2020	Cost 2010/2020	Total Cost 2010/2020	Lead Agency	Implementation Status/Needs	Co-Benefits
RA 40. Forest and Agricultural Land Preservation	0.28/ 0.28	$137/MTCO2e	$57 million/year (not all new program $, some state funds allocated in past)	DEP, DAg	In Process	
RA 41. Promote Use of Durable Wood Products Over Other Construction Materials	Not estimated	Not estimated	Not estimated	DAS, DECD	Action Pending	
RA 42. Support Economically Viable Landfill Gas to Energy Projects	Included in waste and electricity reference cases.	Not estimated	Not estimated	CCEF	In Process	
RA 43. Increase Recycling, Source Reduction to 40%	0.91/ 0.97	$4-5/MTCO2e	$4.1 million/year	DEP	Action Pending	
RA 47. Government Clean Energy Purchase	0.08/0.21	Included in RA 45	Included in RA 45	OPM	In Process	
RA 48. Production Tax Credit	Not estimated	Included in RA 45	Included in RA 45	CCEF, DRS	In Process	
RA 49. Clean Energy Option	0.43/ 0.81	$33.69/MTCO2e/ $21.92/MTCO2e	$14.49 million/ $17.76 million (voluntary market)	DPUC	In Process	
RA 50. Renewable Energy Credits	Not estimated	Not estimated	Not estimated	CCEF, DPUC	In Process	
RA 53. Regional Cap and Trade Program	0.95/ 2.26 [assumes leakage] 1.98/5.13 [w/o leakage]	To be provided thru modeling results		DEP, DPUC	In Process	
RA 54. Public Education Initiative	Not applicable	Not applicable	Not applicable	DEP	In Process	
RA 55. Emissions Inventory and Registry	Not applicable	Not applicable	Not applicable	DEP, DPUC	In Process	

17 Actions Identified for Additional Analysis

Recommended Action	GHG Reductions MMTCO2e 2010/2020	Cost 2010/2020	Total Cost 2010/2020	Lead Agency	Implementation Status/Needs	Co-Benefits
RA 2. GHG Feebate Program	0.04/0.11	-$166.70/ton CO2e / -$171.50/ton CO2e		DRS, DEP	In Process	**REMI findings:** Enacting a feebates program in the State of Connecticut would stimulate positive growth on the economy. It would create roughly 22 new jobs in the economy mainly in the service retail trade industries and population would increase by roughly 44 people. By 2020, total Output in the State of Connecticut would grow by $44.815 million, and Gross State Product would grow by $13.108 million. However, there will also be some negative effects on the State of Connecticut. The State of Connecticut will lose $29.523 million in tax revenue by 2020, roughly $2.1 million per year, resulting in a loss in government employment, roughly 27 jobs.
RA 4. Tailpipe GHG standards	0.05/2.63	-$136/ton CO2e / -$99/ton CO2e		DEP	Action Pending. DEP plans to adopt regulations in 2005.	
RA 6. Hydrogen Infrastructure	Not estimated	Not estimated		CEF	Action Pending	REMI modeling to be performed
RA 15. Promote energy efficient mortgages	0.01/0.01	-$32/MTCO2e		OPM	Action Pending	
RA 16. Revise Energy Conservation Loan Program	Not estimated	Not estimated		DECD	Action Pending	
RA 20. High performance buildings: private funding	0.02/0.05	$308/MTCO2e		OPM	In Process	
RA 30. Encourage combined heat and power	0.53/1.41	Not estimated		DEP, DPUC	Action Pending	
RA 31. Restore conservation and load management fund	0.28/0.61	-$56/MTCO2e	Funded thru electricity surcharge: $37 million 2004-2005; $27 million 2006-2020; $87 million 2011-2020 [does not include cost savings]	DPUC	Action Pending	

Recommended Action	GHG Reductions MMTCO2e 2010/2020	Cost 2010/2020	Total Cost 2010/2020	Lead Agency	Implementation Status/Needs	Co-Benefits
RA 32. Establish heating oil conservation fund	1.02/1.89	-$187/MTCO2e	Funded thru charge on oil sales: $20 million/yr 2005-2020 [does not include cost savings]	DPUC	In Process	**combined COBRA benefits for RA 32 and RA 33:** **2010:** NOx 1848 tons reduced; SO2 2554 tons; PM 137 tons; lives saved 3; value of other health benefits $1.5 million. For **2020:** NOx 3025 tons reduced; SO2 4562 tons; PM 207 tons, lives saved 7; value of other health benefits $3.4 million.
RA 33. Establish natural gas conservation fund	1.44/2.07	-$303/MTCO2e	Funded thru charge on natural gas sales: $20 million/yr 2005-2020 [does not include cost savings]	DPUC	In Process	**combined REMI benefits for RA 32 and RA 33:** Enacting conservation policies in Connecticut would stimulate positive growth on the economy. It would create roughly 2,092 net new jobs in the Connecticut economy, mostly in the retail and service sectors; and the population would increase by 3,604 people, mostly due to economic migration. By 2020, total Output in Connecticut would grow by $3.10 billion, total GSP would grow by $2.03 billion, and the State of Connecticut would collect approximately $382 million more in State Revenues.
RA 34. Identify measures to reduce high global warming potential gases	Not estimated	Not estimated		DEP	Action Pending	
RA 35. Install centralized manure digesters	0.02/0.05	$112-$126/MTCO2e		CCEF, DEP	Action Pending	
RA 44. Voluntary carbon offset program	Not estimated	Not estimated		DEP	In Process	
RA 45. Renewable energy strategy	reflected in individual RAs	$22.39/MTCO2e	Total cost thru 2020 is $253.91 million	CEF, OPM, DPUC, DRS	In Process	
RA 46. Renewable portfolio standard	1.30/3.20	Included in RA 45	Included in RA 45	DPUC, CEF	Action Pending	
RA 51. Restore clean energy fund	0.31/ 0.41	$2.05-$39.09/MTCO2e / $0.60-$29.66/MTCO2e		CEF, DPUC	Action Pending	

Recommended Action	GHG Reductions MMTCO2e 2010/2020	Cost 2010/2020	Total Cost 2010/2020	Lead Agency	Implementation Status/Needs	Co-Benefits
RA 52. Energy efficiency and combined heat and power	reflected in individual RAs	-$18.71/MTCO2e	Total cost thru 2020 is -$481.26 million	DPUC, CEF	In Process	**preliminary REMI findings:** **mid-level scenario:** Results in a decline in revenue for public utilities of 17.7% (in 2005) of electricity demand. This leads to a small decline in economic growth from 2005-2008, but produces a positive change in economic growth from 2009 forward. **optimistic scenario:** Public utilities sector suffers no loss of revenue. Benefits due to energy savings quickly outweigh costs and there is greater economic growth from 2006 forward. **conservative scenario:** public utilities loss of revenue equal to 35.5% of the decline in electricity demand. CT experiences less economic growth through 2013, but experiences stronger economic growth from 2014 forward

APPENDIX 12

Response to Questions Regarding the Draft Climate Change Action Plan as Presented to a Joint Conference of the Environment, Energy, Commerce and Transportation Committees

Submitted by DEP Commissioner Gina McCarthy
January 28, 2005

Introduction

This document has been prepared to respond to questions of individual legislators at the joint hearing of January 19, many of which reflected the questions raised by the Office of Legislative Research in their review of the draft Connecticut Climate Change Action Plan. The legislative questions, as well as those of the Office of Legislative Research (OLR), included both broad thematic and more narrowly focused questions, which informed the form of this response. Thematically, the responses address costs and action prioritization, public participation and process and regional partnering.

We want to acknowledge and recognize the substantial legislative commitment to develop an aggressive implementation plan. The leadership is to be commended for the actions taken thus far. We look forward to continuing to work collaboratively with the legislature to address this important issue.

Costs and Action Prioritization

Connecticut's draft 2005 action plan is just that, a planning document, a road map for us to follow as we move forward. We fully recognize that this is the first step of a long process. Therefore, it is premature and may be misleading to total all projected costs or benefits. Rather, we have provided the attached charts which identify as available estimated costs for full implementation of each item. The charts are separated into those 38 items, which have been given priority, and the subsequent 17, which require both additional review and action toward implementation.

Also provided in the charts:

- information on the state agency lead for each action item;
- a prioritized list of the action items, including our anticipated implementation mechanism [i.e. use existing authority, adopt regulatory amendment, new legislation expected to be needed];
- anticipated greenhouse gas (GHG) reductions in 2010 and 2020;
- the cost per ton of reductions for those action items where relevant and independent data were available;

- for selected action items, where completed, we have also provided information on additional economic and public health benefits.

Climate change is an issue that touches upon all economic and environmental sectors. We have also not yet begun to address the significant costs of not taking action, or further delaying so, and the costs needed to adapt to climate change. The cost of inaction is already high and increasing each year. We know that increased storm frequency and severity is now costing insurance companies about $40 billion last year, and rising. We also see increases in tropical insects and the need to address them, e.g. the DEP efforts to address the West Nile virus in Connecticut. We must devote resources to solve this effort over the long term. We are completely open to, and have thoughts on, how to develop funding streams that have minimal immediate impacts on the state budget.

The full action plan, available at www.ctclimatechange.com, provides citations for referenced technical work. Experience with costs in other environmental programs is also relevant here. For many of the major programs adopted pursuant to the federal Clean Air Act, costs have often been inflated. Taking lead out of gasoline was accomplished at a tenth of the costs estimated by manufacturers. The acid rain program was implemented at an average cost of $170-200 per ton of sulfur dioxide, again, about a tenth of that estimated by the utility industry. We will continue to work diligently to develop costs and benefits for those items that currently do not have associated values. Also, as additional information is obtained, such as through the stakeholder process we envision, we will review those data and incorporate revisions, as appropriate, into the action plan.

From the beginning, the state has approached this as an economic development opportunity. Tap into and further develop Connecticut's excellent brainpower to commercialize and invent the technologies and processes that will lead the way. Connecticut is known as "cellicon" valley within the fuel cell industry due to the large concentration of manufacturers here. We want to encourage their growth as these are high paying manufacturing jobs. The University of Connecticut has established a Fuel Cell Research Center. The government of the United Kingdom has visited several Connecticut fuel cell manufacturers to assess the ability of technology developed here to help the UK reduce their GHG footprint. Our energy efficiency program, administered through the Energy Conservation Management Board (ECMB), received national recognition in 2004 for its high cost-effectiveness, its broad focus and its ability to help transform markets. These are just a few of the many positive economic development opportunities that can be achieved through the implementation of items in the state's climate change action plan.

Public Participation and Process

Providing a robust public comment and input structure was important to the development of this plan. As this item was also raised by the OLR report, attached are all public comments received during the open comment period. We plan to establish and complete a stakeholder process this year to enable broad public input. This will help build upon the work already completed, help develop additional recommendations, and allow more technical assessments of the co-benefits to be completed. We will especially reach out to the public health community and the General Assembly. Representatives from public health can help assist us to further analyze the co-benefits. Ongoing coordination with representatives from the General Assembly will help assure adoption of appropriate implementation mechanisms and identification of other means to achieve the anticipated levels of reductions and their co-benefits.

During this year, we will also be engaged in implementing the 38 actions already accepted for immediate action. In particular, we will focus on:

- amending regulations to adopt the Pavley portion of our clean car standards;
- investigating opportunities to increase the use of bio-diesel in Connecticut;
- continue to work with other state agencies and stakeholders on mercury reductions, to help achieve co-benefits associated with this plan
- complete the request for proposal process that will help the state amend its solid waste plan to increase the recycling rate and address source reduction; and
- work with the legislature to craft language that will help establish oil and gas conservation funds, in a manner that is responsive to state goals and helps provide significant GHG reductions. More efficient consumption also directly benefits consumers through lower energy bills.

Each of these efforts includes its own stakeholder and public process.

Regional Partnering

Connecticut's actions [and those of our sister New England states] reflect the long record of state innovation leading the way. In clean air, New England established an association to collaborate on air policy in 1967, three years before that of EPA. We took action to address acid rain many years before EPA and Congress recognized its importance. We reduced power plant emissions through an innovative market based program that is now being emulated elsewhere in the country and the world. In the area of greenhouse gases, we are working with New England and mid-Atlantic states to develop processes for inventorying, registering and potentially establishing a cap and trade program. We continue to work with sister states in the region and use the New England Governor's Council

Power Planning Committee to coordinate on renewable portfolio standards. States have long been laboratories of innovation, providing replicable examples of how best to implement ideas. Our efforts to address climate change are consistent with our 38-year collaborative relationship with other New England and Northeastern states.

Consistent with this collaborative history, we will continue to search for and implement actions on a regional scale, within the context of this action plan. Our air shed, our transportation and electric grid infrastructures and our economies are regionally linked. All six New England states and the five eastern Canadian provinces have now completed climate change action plans. We will work through existing planning structures to assure cross-fertilization to maximize our benefits, improve market penetration and adopt measures that develop our economy. Many of the items in Connecticut's plan will also help us to achieve our ozone and fine particulate air quality objectives, as part of those mandated under the federal Clean Air Act. We have worked for the past four years within ISO-NE to promote distributed generation to improve grid reliability. This work will reduce reliance on older, less efficient power plants, reduce electricity costs [this will help to reduce the congestion charge "adder" to southwest Connecticut ratepayers, which is currently in the range of $100-300 million annually] and also reduce greenhouse gas emissions. The legislative passage during 2004 of stricter appliance standards now helps us to encourage other states to do the same, therefore increasing market penetration for more efficient appliances, reducing consumer energy costs, air pollution and greenhouse gases. Passage of the California Low Emissions Vehicle standards during 2004 and our expected adoption of the Pavley amendments during 2005 will significantly reduce exposure to air toxics and reduce concentration of pre-cursors to ozone formation. Other states are also adopting these same standards, including Massachusetts, Maine and New York. Each of the 55 action items so far recommended via the stakeholder process can be viewed with such a lens. The plan itself therefore helps to harmonize planning throughout the state in order to achieve multiple objectives.

Conclusion

We appreciate this opportunity to provide information to the legislature on this critically important issue. We hope the information helps not only to better focus on the key deliberative issues, but also to enable actions to occur in a collaborative and systematic manner. The economic opportunities to gain competitive advantage exist; the costs of doing nothing further increase each year. Working with the cognizant committees in the legislature will help us implement this plan collaboratively and efficiently. Additional stakeholder input will improve the plan and frame the issues to be included in the annual report we submit at the end of this year. We look forward to working with you and we greatly appreciate your support.

APPENDIX 13

ENVIRONMENT, TRANSPORTATION, COMMERCE, AND ENERGY & TECHNOLOGY COMMITTEE SUPPORT FOR CONNECTICUT CLIMATE CHANGE ACTION PLAN 2005

The Governor's Steering Committee, pursuant to Public Act 04-252 [Sec. 2 (b)], submitted a draft climate change action plan on January 5, 2005 to the joint standing committees of the General Assembly having cognizance of matters relating to the environment, energy, transportation, and commerce.

On January 19, 2005, Commissioners McCarthy (DEP) and Downes (DPUC) presented the draft climate change action plan to the joint standing committees. A discussion of the draft climate change action plan ensued.

Public comment was taken on the draft climate change action plan through a public meeting held by the Environment Committee on January 28, 2005.

The joint standing committees voted to support the plans according to the following meeting minutes:

Transportation Committee – Monday, January 31, 2005 at 10:00 a.m.
Rep. Guerrera asked for a motion to endorse the Draft CT Climate Change Action Plan concept, recognizing that it is a long-range planning document designed to achieve statutory green-house gas reductions, over decades. And further recognizing that the implementation of many of the specific reduction strategies outlined in the draft plan will require future legislative or regulatory enactment, including additional opportunities for further public input and participation. Sen. McDonald, seconded by Rep. Scribner, made the motion. A voice vote was taken and the motion passed.

Environment Committee – Monday, January 31, 2005 at 11:00 a.m.
Chair Sen. Stillman, A. S20, presented language for a proposed motion to endorse the draft CT Climate Change Action Plan 2005. (Committee vote on whether to endorse required under P.A. 04-252.)

Discussion on motion language and draft plan:

- Rep. Piscopo, J. 76, expressed reservations about the plan, describing it as akin "to the Kyoto Treaty," and concerns about drastic measures on something out of our control.
- Sen. McKinney, J. S28, noted that the Transportation Committee had voted to support the plan earlier in the day using Senator Stillman's suggested language.
- Rep. Chapin, C. 67, expressed appreciation for the "reasonable language" but wanted record to note that typically, he is reluctant to support a proposal that requires further analysis.

A motion was made by Sen. Stillman, A. S20, and seconded by Sen. McKinney, J. S28 , to show the Committee's support for the draft plan with the following statement:

"We move to support the draft CT Climate Change Action Plan concept, recognizing that it is a long-range planning document designed to achieve statutory greenhouse gas reductions over decades. And further recognizing that the implementation of many of the specific reduction strategies outlined in the draft plan will require future legislative or regulatory enactment, including additional opportunities for further public input and participation."

The motion carried on voice vote.

Commerce Committee – Thursday, February 3, 2005 at 1:00 p.m.
Rep. Berger asked for a motion to show the Committee's support for the draft Connecticut Climate Change Action Plan concept, with the following language:

"We move to support the draft Connecticut Climate Change Action Plan concept, recognizing that it is a long-range planning document designed to achieve statutory greenhouse gas reductions over decades. And further recognizing that the implementation of many of the specific reduction strategies outlined in the draft plan will require future legislative or regulatory enactment, including additional opportunities for further public input and participation."

Rep. Pawelkiewicz offered the motion and was seconded by Rep. Sharkey. The motion passed by voice vote.

Energy & Technology Committee – Thursday, February 10, 2005 at 1:30 p.m.
I. Senator Fonfara remarked on the Draft Version of The Governors Steering Committee on Climate Change.

Motion made by Representative Fontana, seconded by Representative Megna to support the goals and concepts expressed in the plan.

Remarking were, Representatives DelGobbo, Fontana, and Miller and Senators Fonfara and Herlihy.

The Chairman ordered a roll call vote.

9 yea, 5 nay, 3 absent and not voting. The motion carried.

Pursuant to Public Act 04-252 [Sec. 2 (b)] “An Act Concerning Climate Change,” the Governor’s Steering Committee on Climate Change submitted on February 15, 2005, the final Connecticut Climate Change Action Plan 2005 to the joint standing committees of the General Assembly having cognizance of matters relating to the environment, energy, transportation, and commerce.