**The New Hampshire Climate Change Policy Task Force**

# New Hampshire Climate Action Plan

***A Plan for New Hampshire's Energy, Environmental and Economic Development Future***

# Appendix 5: Actions for Future Consideration

**Prepared by the**
**NH Department of Environmental Services**
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**EG Action 1.2 – Energy Efficiency Procurement**

Summary

A combination of statutory limits on investment levels and the manner in which utilities recover energy efficiency costs currently restrict the size of investments by electricity and natural gas distribution companies in energy efficiency. This proposal – also known as Least-Cost Procurement, or LCP – would improve the way New Hampshire utilities invest in efficiency programs that cost a fraction of the price of energy supply. Utilities would be required by the PUC to purchase cost-effective "demand-side" resources like energy efficiency and demand response which are less expensive than the price of energy supply. A new Energy Efficiency Advisory Council composed of consumer, environmental, and state agency representatives would work with the utilities on identifying all cost-effective investments in energy efficiency and in the planning and design of such programs. The Council will increase utility accountability while leaving responsibility for final regulatory approval with the PUC.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): Each electric and natural gas distribution company would be required to increase investments over a reasonable period of time for any qualifying investment in energy efficiency and demand reduction programs with the goal of capturing all cost-effective investments (i.e., those available at lower cost than supply) that are reliable and feasible on behalf of all customers. Every two or three years, each utility would develop an Efficiency Investment Plan that identifies the efficiency programs and annual budget amounts required to expand its procurement of demand-side resources to meet the all cost-effective standard. The utilities would first seek input on the plan from a new Energy Efficiency Advisory Council representing residential customers, business consumers, environmental interests, and state agencies. The utility would then develop its plan, taking into account the input received from the Energy Efficiency Advisory Council; and the plan would be submitted to the PUC for review and approval. The efficiency programs would continue to be implemented by the utilities and their contractors. The Efficiency Investment Plan would identify existing funding sources such as the System Benefits Charge (SBC) and other funding sources and program investment needs.

2. Implementation Plan (*i.e., how to implement the specific policy or program*)
    a. *Method of Establishment (e.g., legislation, executive order):* PUC Order.
    *b.* *Resources Required:* Efficiency resources would be procured with funds from the existing System Benefits Charge (which would be considered a minimum funding level at $1.8 mills per kWh), the forward capacity market, emissions allowances, or other funding sources, with any additional program investment needs recovered through delivery charges. Distribution companies would recover their costs, as incurred from year to year, in implementing these expanded energy efficiency programs; and customers would realize almost all of the savings.
    c. *Barriers to Address (especially for medium-to-low feasibility actions):* Electric and gas distribution companies currently recover most fixed distribution costs through volumetric (kWh or ccf) charges that create an incentive for the utility to maximize sales and thus under-invest in cost saving demand resources. To remove this disincentive for investments in energy efficiency and distributed generation, regular true-ups in rates should be established to ensure that any fixed-costs recovered through volumetric charges are not dependent on sales volumes (see EG Action 1.1 – Revenue Decoupling). The PUC should also conduct a proceeding to establish a performance-based incentive plan for implementation of efficiency programs tied to success in implementing programs that maximize cost-effective energy savings for customers.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*)
    a. *Parties Responsible for Implementation*: The PUC and utilities serving New Hampshire customers.
    b. *Parties Paying for Implementation*: All customers.
    c. *Parties Benefiting from Implementation*: All customers; companies that design, install, and service energy efficiency measures.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*)
    a. New Hampshire CORE programs funded by the Systems Benefits Charge
    b. Energy Efficiency and Sustainable Energy Advisory Board, created by HB1561.

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*)
    a. *Existing*
    b. *Proposed*
        i. EG Action 2.2 – Regional Greenhouse Gas Initiative (RGGI): Emission reductions from LCP would be a portion of the reductions attributable to RGGI and should not be double counted; but LCP could make RGGI compliance easier, such that a more stringent post-2018 phase of RGGI could be created.
        ii. EG Action 1.1 – Revenue Decoupling.

6. Timeframe for Implementation: Building on legislation established in other Northeast States, a bill for energy efficiency procurement could be introduced in the next legislative session.

7. Anticipated Timeframe of Outcome: 2010 and thereafter.

<u>Program Evaluation</u>

1. Estimated $CO_2$ Emission Reductions ($MMTCO_2e$/year):

| **Reduction in NH Energy Consumption by 2020** | **$CO_2$ Emission Reductions** | | |
|---|---|---|---|
| | **2012** | **2025** | **2050** |
| 5% | 0.08 | 0.29 | 0.38 |
| 10% | 0.17 | 0.59 | 0.76 |
| 15% | 0.25 | 0.88 | 1.14 |
| 20% | 0.33 | 1.17 | 1.52 |
| 24% | 0.40 | 1.41 | 1.83 |

2. Economic Effects
    a. Costs
        i. Implementation Cost:

| **Reduction in NH Energy Consumption by 2020** | **Relative Cost** |
|---|---|
| 5% | Moderate ($25 million to $125 million) |
| 10% | Moderate ($25 million to $125 million) |
| 15% | Moderately high ($125 million to $500 million) |

| | |
|---|---|
| 20% | Moderately high ($125 million to $500 million) |
| 24% | Moderately high ($125 million to $500 million) |

ii. Timing: Immediate / higher initial costs
iii. Impacts: Evenly distributed

b. Savings

i. Potential Economic Benefits:

| Reduction in NH Energy Consumption by 2020 | Relative Benefit |
|---|---|
| 5% | Moderately high ($125 million to $500 million) |
| 10% | High ($500 million to $1 billion) |
| 15% | High ($500 million to $1 billion) |
| 20% | Very high (Greater than $1 billion) |
| 24% | Very high (Greater than $1 billion) |

ii. Timing: Low short-term / mostly long-term
iii. Impacts: Evenly distributed

3. Other Benefits/Impacts

a. *Environmental*: Improvements in energy efficiency will reduce emissions of carbon dioxide and other greenhouse gases and primary air pollutants that contribute to climate change and damage our ecosystems. Emission reductions will directly improve air and water quality while indirectly benefitting the fish, wildlife, and ecosystems that depend on clean air and water.

b. *Health*: Particulate matter and ozone precursors such as VOCs and NOx contribute to cardiac and respiratory ailments in humans and adversely affect the health of other living organisms. In particular, ozone formation increases dramatically during hot weather. Therefore, measures that mitigate climate warming by reducing harmful emissions will also be beneficial to the health of human populations and ecosystems in general.

c. *Social*: Programs that promote environmental sustainability by conserving natural resources and reducing emissions have immediate and long-term benefits to society. Increased public awareness arising from such programs will help to alleviate climate change. Programs involving energy conservation and some alternative generation technologies have relatively short payback periods. These programs bolster the local economy in a number of ways: they produce "green" jobs, free up money that can be reallocated to other purposes, and result in greater economic security overall.

d. *Other*: Energy efficiency and emission reductions will reduce the load on our aging infrastructure and will create demand for alternative technologies in the U.S. marketplace.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*)

a. *Technical*: There is high potential for energy efficiency procurement because cost-effective energy efficiency measures and technology are available but have not been fully deployed in New Hampshire to date.

b. *Economic*: There is high potential because the current costs of readily identifiable energy efficiency resources are about one-fourth the costs of energy supply.

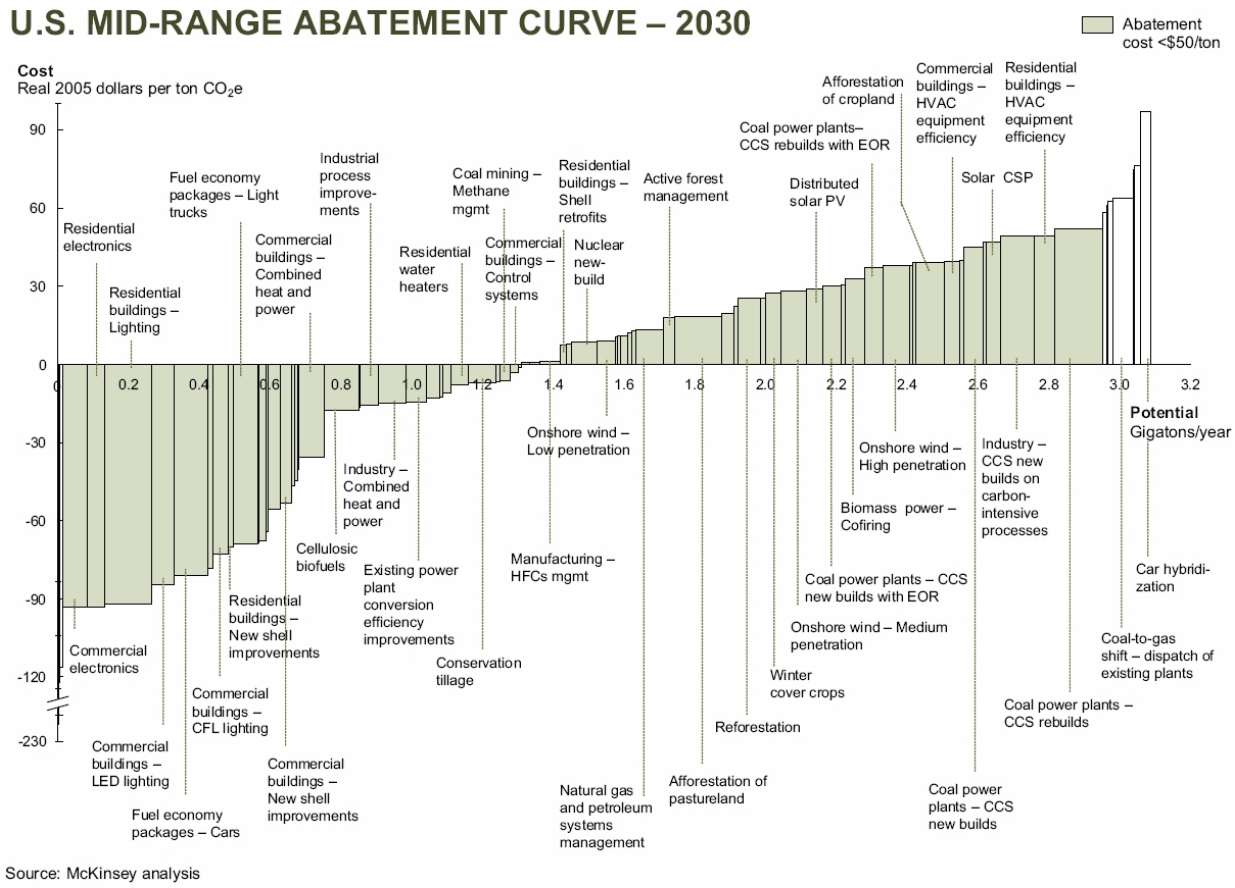
c. *Statutory/Regulatory*: There is high potential because other states have led the way in this area.

d. *Social:* Increased energy efficiency provides a variety of societal benefits, including cleaner air and lower energy costs. The effectiveness of energy efficiency programs, and the degree to which the public embraces them, will depend on the details of their design and implementation.

5. Other Factors of Note:

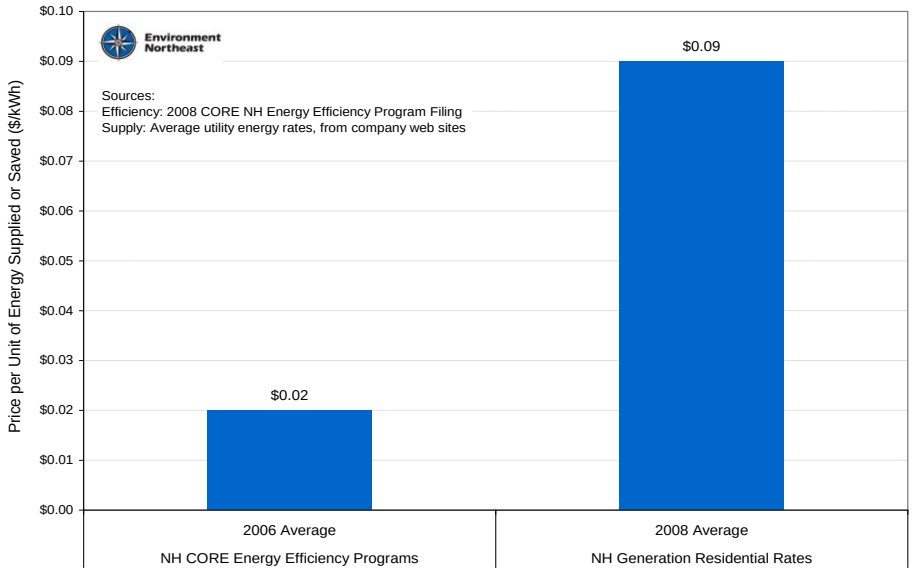
a. Based on previous experience in New Hampshire and other Northeast States, efficiency programs save about four dollars for every dollar invested. Energy savings to consumers from these programs replace expenditures on fossil fuels, and those savings become available to other parts of the economy. The benefits have a compounding effect: Local energy service jobs are created, power plant emissions are reduced, demand for new generating facilities is relieved, and carbon cap-and-trade programs are able to be implemented at lower cost.

b. *Energy Efficiency Investments Save Money While Reducing Emissions:* The following recent graphical analysis from McKinsey illustrates which technology options are available to reduce emissions at what cost. Most energy efficiency investments save money while supply investments cost money.



Source: McKinsey analysis

c. *Generation vs. Efficiency Prices:* This chart from Environment Northeast compares the average price of New Hampshire CORE electric energy efficiency programs with the average residential price of electric supply.




6. Level of Group Interest:

7. References:


- Northeast Energy Efficiency Partnership**, Economically** *Achievable* **Energy Efficiency** *Potential in New England*, http://www.neep.org/files/Updated_Achievable_Potential_2005.pdf
- McKinsey & Company, *Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?*, http://www.mckinsey.com/clientservice/ccsi/greenhousegas.asp
- ACEEE, *Energy Efficiency: The First Fuel for a Clean Energy Future*, http://aceee.org/pubs/e082.htm.
- Maryland legislation HB 374, http://mlis.state.md.us/2008rs/billfile/HB0374.htm.

**EG Action 2.3 – New Source Performance Standard (NSPS)**

Summary

In addition to RGGI, a New Source Performance Standard (NSPS) for $CO_2$ could be developed and applied to all ***new*** power plants in New Hampshire above a specific size threshold. The NSPS would be an output-based emission standard (emission limit) that is fuel-neutral; i.e., it would apply equally to any qualifying facility burning any type of fuel. The EG working group requested a sensitivity analysis from its consultant CSNE of potential emissions reductions and costs for two optional applicability thresholds: facilities larger than 10 MW and facilities larger than 30 MW. Similarly, the group requested analysis of a range of optional emission levels from 250 to 1,100 lb/MWh for the proposed standard. The lower value would be achievable by applying carbon capture and sequestration (CCS) to new integrated gasification combined cycle (IGCC) coal plants at an 87.5 percent control level from an assumed uncontrolled $CO_2$ emission rate of 2,000 lb/MWh. CSNE explained that the proposed applicability thresholds are essentially the same because all new fossil fuel-fired plants are likely to exceed 30 MW. CSNE also noted that $CO_2$ emission rates for new natural-gas-fired plants are typically around 800 lb/MWh and that the higher rate of 1,100 lb/MWh was already analyzed as being representative of business-as-usual. Significant avoided emissions could be achieved by implementing NSPS at emission rates between 250 and 1,100 lb/MWh.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): This policy complements RGGI by reducing $CO_2$ emissions growth from new power plants by imposing an emission performance standard for this energy sector. Accordingly, the resulting $CO_2$ emission levels would be below business-as-usual (BAU) emission levels. The New Source Performance Standard determines the maximum rate of emissions that can be emitted from individual new units. Implementation of this policy would effectively ban new near-term coal generation because there are neither cost-effective control technologies nor infrastructure currently available to achieve the proposed emission rate limits (carbon capture and sequestration would be required). Because new plants would most probably be located in states having higher population density and greater electric demand, implementation of an NSPS for $CO_2$ emissions may be more a regional or national issue than an issue for New Hampshire alone. Absent actions on a broader scale, New Hampshire will need to decide whether to be a leader by taking steps toward implementing an NSPS policy at the state level.

2. Implementation Plan (*i.e., how to implement the specific policy or program*)
    a. *Method of Establishment (e.g., legislation, executive order)*: Legislation, followed by rulemaking.
    b. *Resources Required*:
    c. *Barriers to Address (especially for medium to low feasibility actions)*: There may be technological barriers and excessively high costs that prevent attainment of the lowest desirable $CO_2$ emission rate for new power plants.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*)
    a. *Parties Responsible for Implementation*: NH Legislature, NHDES
    b. *Parties Paying for Implementation*: New generation facility owners.
    c. *Parties Benefiting from Implementation*: The entire state and neighboring states.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*)

a. *Existing*:

b. *Proposed*: Action 2.2 – Regional Greenhouse Gas Initiative (RGGI).

6. Timeframe for Implementation: 2010+

7. Anticipated Timeframe of Outcome: 2010+

Program Evaluation

1. Estimated $CO_2$ Emission Reductions ($MMTCO_2e$/year):

| NSPS | $CO_2$ Emission Reductions | | |
|---|---|---|---|
| | 2012 | 2025 | 2050 |
| 250 lbsCO2/MWh | 0.28 | 1.44 | 3.68 |
| 300 lbsCO2/MWh | 0.26 | 1.33 | 3.39 |
| 400 lbsCO2/MWh | 0.21 | 1.10 | 2.80 |
| 500 lbsCO2/MWh | 0.17 | 0.87 | 2.22 |
| 600 lbsCO2/MWh | 0.12 | 0.64 | 1.63 |
| 700 lbsCO2/MWh | 0.08 | 0.41 | 1.04 |
| 800 lbsCO2/MWh | 0.03 | 0.18 | 0.46 |

2. Economic Effects

a. Costs

i. Implementation Cost: Moderately high ($125 million to $500 million) for all scenarios
ii. Timing: Low short-term / mostly long-term for all scenarios
iii. Impacts: Evenly distributed for all scenarios

b. Savings

i. Potential Economic Benefits: Low (0-$2.5 million) for all scenarios
ii. Timing: Low short-term / mostly long-term for all scenarios
iii. Impacts:

3. Other Benefits/Impacts

a. *Environmental*: The proposed action will reduce emissions of carbon dioxide and other greenhouse gases and primary air pollutants that contribute to climate change and damage our ecosystems. Emission reductions will directly improve air and water quality while indirectly benefitting the fish, wildlife, and ecosystems that depend on clean air and water.

b. *Health*: Particulate matter and ozone precursors such as VOCs and NOx contribute to cardiac and respiratory ailments in humans and adversely affect the health of other living organisms. In particular, ozone formation increases dramatically during hot weather. Therefore, measures that mitigate climate warming by reducing harmful emissions will also be beneficial to the health of human populations and ecosystems in general.

c. *Social*: Programs that promote environmental sustainability by conserving natural resources and reducing emissions have immediate and long-term benefits to society. Increased public awareness arising from such programs will help to alleviate climate change. Programs involving energy conservation and some alternative generation technologies have relatively short payback periods.

These programs bolster the local economy in a number of ways: they produce "green" jobs, free up money that can be reallocated to other purposes, and result in greater economic security overall.

d. *Other*: Energy efficiency and emission reductions will reduce the load on our aging infrastructure and will create demand for alternative technologies in the U.S. marketplace.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*): High
    a. *Technical*: Technology is currently in the demonstration stage for carbon capture and sequestration, which may be necessary in order for higher carbon fuels to be utilized with a NSPS.
    b. *Economic*: The implementation costs will rise as the NSPS limit is reduced.
    c. *Statutory/Regulatory*: A legislative process would be required, followed by a rule making process in order to implement a NSPS. This could be implemented as a complementary mechanism to the Regional Greenhouse Gas Initiative (RGGI) as means to expand generation while staying under the emissions cap.
    d. *Social*: While there may be economic barriers to short-term implementation, over the long-term carbon capture and sequestration technology could enable the country to utilize its coal reserves and increase energy security.
5. Level of Group Interest:
6. Other Factors of Note:
7. References:
    - Pew Center papers:
        - State Options for Low-Carbon Coal Policy, Coal Initiative Reports - White Paper Series, Pew Center on Global Climate Change (www.pewclimate.org) p. 61.
        - A Program to Accelerate the Deployment of $CO_2$ Capture and Storage (CCS): Rationale, Objectives, and Costs**,** Coal Initiative Reports - White Paper Series, Pew Center on Global Climate Change (www.pewclimate.org) p. 54.
    - Federal bills:
        - S.1201, "A bill to amend the Clean Air Act to reduce emissions from electric powerplants, and for other purposes," Sec. 712, Low-Carbon Generation Requirement.
    - Washington State Chapter 80.80 RCW, *Greenhouse gases emissions – baseload electric generation performance standard,* http://apps.leg.wa.gov/RCW/default.aspx?cite=80.80&full=true

**EG Action 2.5 – Nuclear Power Capacity**

Summary

Nuclear power generation accounts for 20 percent of the total electricity generated in the United States and 45 percent of the total electricity generated in New Hampshire. FPL Energy Seabrook Station is New England's largest single-unit power plant and generates enough power to serve more than a million homes and businesses in the region. Seabrook Station's current operating license expires in 2030, and the company plans to file for a 20-year license renewal. *Continued operation of Seabrook Station was assumed by CSNE in the business-as-usual baseline scenario.*

There are current plans to build more than 30 new nuclear plants in the United States, but most will be located in the South. Under the constraints of permitting and construction timelines, the first unit is not expected to go on line until 2015. Many believe that the Northeast is an unlikely spot for siting new nuclear plants because of the history of opposition to such plans.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): No company has announced plans to build a new nuclear power plant in New Hampshire. Opponents contend that nuclear generation should be measured against renewable generation or energy efficiency in terms of costs, environmental impacts, and life-cycle emissions; they reason that greater emissions reductions could be achieved with renewable generation and energy efficiency instead of new nuclear capacity. Proponents point out that the magnitude of renewable generation and energy efficiency that would be needed to achieve $CO_2$ emission reduction targets may be unrealistic. (For comparison, Seabrook Station has a capacity of 1,200-MW, while PSNH's Northern Wood Power Project is rated at 50 MW.) Because the federal Nuclear Regulatory Commission has jurisdiction over re-licensing, there is no state-level action item associated with maintaining existing nuclear generation.

2. Implementation Plan (*i.e., how to implement the specific policy or program*)
    a. *Method of Establishment (e.g., legislation, executive order)*

        The state Energy Facility Site Evaluation Committee performs review for new project siting only, not re-licensing. The federal Nuclear Regulatory Commission reviews applications for both re-licensing and new facilities.

    b. *Resources Required*

        The initial high-cost capital investment to build Seabrook Station has already been made. Once built, nuclear plants like Seabrook are relatively low-cost to operate; but those operating costs do not account for the recurring long-term costs of spent fuel storage and disposal. The August 2, 2007, ISO-NE *New England Electricity Scenario Analysis* states the following assumptions:

        - Capital costs for new nuclear plant capacity range from $3,000/kW to $5,000/kW (compared to $800 to $1,000/kW for natural-gas-fired plants)
        - Annual production costs for nuclear plants are $5,502 million (compared to $6,825 million for natural-gas-fired plants)

    c. *Barriers to Address (especially for medium to low feasibility actions)*

        The lack of a long-term repository for spent fuel is a major obstacle to nuclear power development.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):

a. *Parties Responsible for Implementation*: Energy Facility Site Evaluation Committee (for new siting only, not re-licensing), federal Nuclear Regulatory Commission, PUC, ISO-NE, FEMA

b. *Parties Paying for Implementation*: When New Hampshire restructured the utility industry, Seabrook Station was sold and thus transitioned from a regulated power plant to an independent generator. The costs for producing power are borne by the shareholders and recovered from electricity customers through the regional pricing of electricity.

c. *Parties Benefiting from Implementation*: Florida Power and Light and citizens in the region who purchase electricity from the plant.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*): ISO-NE regional planning

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):

   a. *Existing*:

   b. *Proposed*: EG Action 2.2 – Regional Greenhouse Gas Initiative (RGGI): Placing a price on carbon dioxide emissions could provide an advantage to nuclear generation. If a more stringent post-2018 phase of RGGI were established, this advantage would increase.

6. Timeframe for Implementation: 2025

7. Anticipated Timeframe of Outcome: 2025 and thereafter

Program Evaluation:

Three different scenarios were evaluated in order to understand the implications of nuclear energy's potential contribution to the NH generation mix in terms of $CO_2$ reductions and cost.

- Nuclear Case 1: Replace nuclear capacity with natural gas in 2030
- Nuclear Case 2: Business as usual (renew license and maintain capacity)
- Nuclear Case 3: Replace petroleum, coal, and a portion of natural gas base generation with new 1000 MW nuclear power plant

1. Estimated $CO_2$ Emission Reductions ($MMTCO_2e$/year)

| Scenario | $CO_2$ Emission Reductions | | |
|---|---|---|---|
| | **2012** | **2025** | **2050** |
| Nuclear Case 1: Replace nuclear capacity with natural gas in 2030 | 0.00 | 0.00 | -4.05 |
| Nuclear Case 2: Replace petroleum, coal, and a portion of natural gas base generation with new 1000 MW nuclear power plant | 0.00 | 6.23 | 6.23 |
| Nuclear Case 3: Business as usual (renew license and maintain capacity) | 0.00 | 0.00 | 0.00 |

2. Economic Effects (see 2.b under Program Description, above, and references below)

   a. Costs

| Scenario | Implementation Cost | Timing | Impacts |
|---|---|---|---|
| Nuclear Case 1: Replace nuclear capacity with natural gas in 2030 | High ($500 million to $1 billion) | Low short-term / mostly long-term | Evenly distributed |
| Nuclear Case 2: Replace petroleum, coal, and a portion of natural gas base generation with new 1000 MW nuclear power plant | Very high (Greater than $1 billion) | Low short-term / mostly long-term | Evenly distributed |

   b. Savings

| Scenario | Potential Economic Benefit | Timing | Impacts |
|---|---|---|---|
| Nuclear Case 1: Replace nuclear capacity with natural gas in 2030 | Low (0-$2.5 million) | Low short-term / mostly long-term | Evenly distributed |
| Nuclear Case 2: Replace petroleum, coal and a portion of natural gas base generation with new 1000MW nuclear | Low (0-$2.5 million) | Low short-term / mostly long-term | Evenly distributed |

3. Other Impacts

   a. *Environmental*: Seabrook is on the seacoast and subject to potential flooding from long-term sea level rise. On-site spent fuel storage could potentially result in contamination if extreme flooding were to occur. On-site spent fuel storage could be significantly reduced if a national storage facility is approved. Federal action on storage could occur prior to Seabrook's re-licensing date but is not assured. Therefore, the possibility of preventive measures (e.g., seawall construction) should be considered by the Adaptation working group. In the meantime, more than half the country's nuclear power plants store their own waste on-site. It is a mature technology with a substantial safety design. Seabrook Station will begin dry fuel storage in the summer of 2008. With respect to emergency preparedness, nuclear power plants are built with reasonable assumptions regarding physical threats and natural disasters, including extreme weather events. Seabrook Station's safety-related openings are located above what is called the reachable maximum precipitation level. This level was determined by analysis of extreme storm conditions that assumed the highest water mark in a 100-year period in combination with simultaneous worst-case rain and storm surge events.

   b. *Health*: Nuclear plants have risks of radiation exposure from accidents or major catastrophes (e.g., terrorist attacks, equipment malfunctions, etc.). Seabrook Station has redundant safety measures in place intended to minimize the probability of such occurrences. These include a redundant safety system design, highly-trained employees, and a comprehensive emergency plan managed by New Hampshire and Massachusetts.

   c. *Social*: The existing facility is a major employer in the region.

   d. *Other*:

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*)

a. *Technical*: There is the potential for implementing this action at any time because nuclear power technology is fully developed and available.

b. *Economic*: Although there may be significant long-term economic advantages to avoided $CO_2$ emissions associated with ***new*** nuclear generation, this technology has high up-front capital costs and the uncertain costs of long-term nuclear waste disposal.

c. *Statutory/Regulatory*: The state has no authority over permitting nuclear facilities but may have a role in influencing federal decisions to approve or deny nuclear plant licenses.

d. *Social*: The probability of significant public opposition makes the implementation potential of new nuclear capacity low.

5. Level of Group Interest: The EG working group members generally agree that building new nuclear generation in New Hampshire is a secondary, long-term consideration that does not need to be evaluated at this time. However, most working group members agree with continued reliance on existing nuclear generation capacity for the near term or beyond. Some Task Force members have expressed an interest in evaluating the potential long-term avoided $CO_2$ emissions that could result from building new nuclear capacity. Although ***new*** nuclear generation could provide significant long-term avoided $CO_2$ emissions, many working group members have concerns about the high initial capital outlay for new nuclear generation and the ongoing issue of nuclear waste disposal.

6. Other Factors of Note:

7. References:


- Nuclear Information and Resource Service, http://www.nirs.org/.
- Fosters Daily Democrat news article, "License extension in offing for Seabrook Station," October 14, 2007, http://www.fosters.com/apps/pbcs.dll/article?AID=/20071014/GJNEWS_01/710140075&SearchID=73319232746974.
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- USEC Inc., supplier of enriched uranium fuel for commercial nuclear power plants, http://www.usec.com/.
- Photo essay on fossil fuel use in the nuclear fuel cycle, http://www.peakoil.org.au/nuclear.co2.htm.
- Jan Willem Storm van Leeuwen and Philip Smith, Nuclear power – the energy balance**,** February 2008, http://www.stormsmith.nl/.
- Arjun Makhijani, President of the Institute for Energy and Environmental Research in Takoma Park, MD, "Carbon-Free and Nuclear-Free: A Roadmap for US Energy Policy," 2007 RDR Books, Muskegon, MI (downloadable from his website, www.ieer.org ).
- Uwe R. Fritsche, Coordinator Energy & Climate Division, Öko-Institut, Darmstadt Office, "Comparison of Greenhouse-Gas Emissions and Abatement Cost of Nuclear and Alternative Energy Options from a Life-Cycle Perspective."
- Section 6.4.2 *"Premature Closure of Seabrook"* New Hampshire Energy Plan November 2002 NH OEP: "The closure of Seabrook nuclear station in 2005 would lead to some rather significant consequences for the New Hampshire and the New England regional energy system. The Seabrook shutdown is forecast to cause retail electricity prices to rise by as much as 10% relative to the Base Case. As in the hypothetical coal closure scenario, this leads to modest near-term economic impacts, with longer-term economic gains as a result of efficiency improvements. However, with the higher price impact of Seabrook closure, it takes longer (more than 10 years) for the economic impacts to turn positive. In contrast to the coal

hypothetical, the closure of Seabrook would cause a major increase in greenhouse gas emissions, as fossil fuels (largely natural gas) would likely replace the lost nuclear generation."

- American Nuclear Society position statements, http://www.ans.org/pi/matters/nextgen/.
- U.S. Dept. of Energy, http://www.ne.doe.gov/.
- Environmental Science & Technology article, "What History Can Teach Us About the Future Costs of U.S. Nuclear Power,"
  http://pubs.acs.org/subscribe/journals/esthag/41/i07/html/040107viewpoint_hultman.html.
- U.S. House Committee on Science & Technology, July 12 , 2005, Subcommittee on Energy hearing, ***Economic Aspects of Nuclear Fuel Reprocessing***
  http://gop.science.house.gov/hearings/energy05/july%2012/.
  Supplemental Materials
  University of Chicago Study: The Economic Future of Nuclear Power. (pdf )
  The Economics of Reprocessing Versus Direct Disposal of Spent Nuclear Fuel. (pdf)
  MIT Study: The Future of Nuclear Power. (pdf)
- Comments on MIT study, http://www.rmi.org/images/PDFs/Energy/E04-22_FutureNucPwr.pdf.

**EG Action 2.10 – Evaluate the Potential to Replace Existing Coal-Fired Generation**

**Summary:**

The State of New Hampshire should immediately conduct an independent evaluation of the potential alternatives to the continued operation of Merrimack Station with scrubbers as a coal-fired coal electric generation facility. The purpose of the study would be to determine whether feasible Merrimack Station replacement scenarios exist which could be deployed to reduce the $CO_2$ emissions of existing base load power generation more quickly and in a manner which maintains grid reliability and which does not lead to higher costs to consumers. Merrimack Station in Bow New Hampshire is presently the source of 20% of all man-made $CO_2$ emissions annually in New Hampshire. The Task Force feels that such a study should be done without altering the current legislative mandate to install scrubbers at the plant to reduce mercury and sulfur dioxide emissions. The cost of halting this process would be accounted for within the study.

**Overall Implementation:**

- The NH Public Utilities Commission would submit a Request for Proposals (RFP) seeking third party evaluation of the potential options (e.g., replacement with biomass and energy efficiency; importation of renewable wind and hydro from Canada)
- The PUC would direct the evaluation and manage the consultants performing the study.

**Potential Responsible Parties:**

- The Public Utilities Commission
- The Energy Efficiency and Sustainable Energy Board
- The Office of Energy and Planning
- The Department of Environmental Services

**Timeframe:**

- The RFP for the study would be released immediately as work on the scrubber installation is in process.
- A deadline for completion of the study would be set so that if feasible alternatives were to be identified they could be implemented without incurring significant additional costs by interrupting the scrubber installation process.

**Other Factors of Note:**

Although not included among the 67 recommended actions in the Climate Action Plan, the following statement has been included as requested by specific members of the Task Force.

**<u>An Additional View</u>**

Nearly 20% of New Hampshire's man-made carbon dioxide emissions come from one source, the coal burning electricity generating station located in Bow on the Merrimack River operated by Public Service Company of New Hampshire. If the State is to attain the goal of reducing CO2 emissions by 80% by 2050 as articulated in this Task Force report, clearly this 440 megawatt coal plant will not be operating as a coal plant as it is today in 2050.

In 2006 the Legislature established a statutory mandate for PSNH to install pollution abatement equipment (called "scrubbers") that will substantially reduce the volume of mercury and sulfur dioxide emitted into the atmosphere by the coal burning at Merrimack Station. The scrubbers do not reduce CO2 emissions. The cost estimate in 2006 of designing, permitting and building the scrubbers was $250 million. Once PSNH had bid all of the contracts for

this project, the total cost actually came to $457 million. The statutory mandate requires these scrubbers to be installed and operating by July 1, 2013.

A minority group of Task Force members believes this Task Force report should include a recommendation suggesting that it would be prudent for the Legislature to require the Public Utilities Commission to secure an independent analysis of alternatives that could guide the Legislature on this issue. Specifically, such an analysis would provide the Legislature guidance in determining the costs and benefits of standing by the original mandate and of changing the original mandate with the goal of replacing coal power generated at Merrimack Station sooner rather than later. We believe the Legislature should mandate the PUC to conduct this analysis without altering the existing scrubber mandate, and should only alter the existing scrubber mandate after a full review and debate of the alternatives advanced by the analysis.

| | |
|---|---|
| Will Abbott | Vice-President, Policy and Land Management, Society for the Protection of New Hampshire Forests |
| Daryl Burtnett | State Director, Nature Conservancy |
| Alice Chamberlin | Executive Director, Two Countries, One Forest |
| Jameson French | President and CEO, Northland Forest Products |
| Meredith Hatfield | Consumer Advocate, Office of the Consumer Advocate |
| Rhett Lamb | Planning Director, City Of Keene |
| Jim O'Brien | Executive Director, Granite State Conservation Voters |

**RCI Action 1.7 – Preserve Older Buildings and Neighborhoods as Components of Sustainable Communities**

Summary

State policies and programs exist that would promote the reuse, rehabilitation, and preservation of older buildings and neighborhoods. This action would collect and promote these policies and programs, promoting the conservation of embodied energy and avoiding the expenditure of new energy by first maximizing the use of rehabilitated older buildings and neighborhoods as a matter of public policy. Current urban planning policies are recognizing that increased density, as is present in older plats, reduces energy use in transportation, new infrastructure, building materials, and landscaping. Compact communities, such as New Hampshire villages and urban centers, promote a pedestrian-friendly lifestyle and may provide nodes for public transit; they also preserve open space. Many of the buildings extant in these centers are underutilized, with their upper stories no longer serving their intended business or residential uses. Full use of these spaces would provide greater density with little additional carbon impact and would preserve the original, sustainable plans of these New Hampshire communities.

Program Description

1. Mechanism *(i.e., how the policy or program achieves the desired result):* The public policy of conserving older buildings and neighborhoods as components of sustainable communities provides for the conservation of embodied energy while avoiding the expenditure of new energy. These objectives are achieved by reducing the need for demolition, replacement of structures, and expansion of infrastructure.

2. Implementation Plan *(i.e., how to implement the specific policy or program):*

    a. *Method of Establishment (e.g., legislation, executive order):* Utilize existing legislation found in Chapter 266 of the New Hampshire Session Laws of 2002 regarding the preservation and rehabilitation of historic and culturally significant buildings and structures. Develop further legislation, as appropriate to enable communities to adopt appropriate criteria for the continued use or reuse of older commercial and industrial buildings, and to ensure that matters of life safety, fire protection, structural integrity, handicapped accessibility, energy conservation, traffic, parking, and other health and safety considerations for such buildings are satisfied in a responsible but flexible manner.

    b. *Resources Required*: Training personnel and writers be employed to hold conferences and prepare training manuals envisioned by and described in Chapter 266. Energy conservation must be given augmented emphasis.

    c. *Barriers to Address (especially for medium to low feasibility actions):* Lack of staff and/or funding for the employment of qualified consultants and for the publication of the authorized handbook and/or other media.

3. Parties Affected by Implementation *(i.e., residents, businesses, municipalities, etc.):*

    a. *Parties Responsible for Implementation:* The New Hampshire Department of Cultural Resources, New Hampshire Department of Safety, and municipal code and safety officials, and zoning and planning boards, statewide

    b. *Parties Paying for Implementation:* Not yet identified.

    c. *Parties Benefiting from Implementation*: New Hampshire communities statewide.

4. Related Existing Policies and Programs: New Hampshire RSA 227-C:1 is committed to the conservation of older buildings and neighborhoods. New Hampshire RSA 672:1 III-e encourages the kind of residential density that might be achieved through the adaptation of underutilized space in existing buildings.

5. Complementary Policies *(i.e., those that achieve greater reductions through parallel implementation):*

    a. *Existing:* New Hampshire RSA 21-I-19-a states that "it shall be the policy of the State of New Hampshire to maximize use of economical energy efficient measures in the construction, renovation and maintenance of buildings owned or leased by the state. Further, it shall be the policy of the state to encourage municipalities to incorporate such measures into their buildings to the greatest extent possible."

    b. *Proposed*
    RCI Action 1.2 – Maximize Energy Efficiency in Existing Residential Buildings
    RCI Action 1.3 – Maximize Energy Efficiency in Existing Commercial, Industrial, and Municipal Buildings
    RCI Action 1.8 – Conserve Embodied Energy in Existing Building Stock

6. Timeframe for Implementation: Depends on the availability of funding and possibly on the reestablishment of a demonstration program that offers financial incentives.

7. Anticipated Timeframe of Outcome: The outcome of the proposed policy will depend upon the speed with which the policy may be adopted and implemented, and on the responsiveness of the private sector in investing in the retrofit of unused or underutilized space in existing communities.

<u>Program Evaluation</u>

1. Estimated $CO_2$ Emission Reductions: This action not individually quantified.

2. Economic Effects

    a. Costs

        i. Implementation Cost: Low (0-$2.5 million)
        ii. Timing: Immediate / higher initial costs
        iii. Impacts: State government

    b. Savings

        i. Potential Economic Benefit: Supporting mechanism only
        ii. Timing:
        iii. Impacts:

3. Other Benefits/Impacts

    a. *Environmental*: The health benefits cited by RSA 9-B as an outcome of the type of building use envisioned by this policy are:

        - Decreased water and air pollution
        - Clean aquifer recharge areas
        - Viable wildlife habitat

    b. *Health*: The improved environmental conditions will have direct impacts of respiratory and cardiovascular health.

    c. *Social*: The social benefits envisioned by this policy are:

        - Vibrant commercial activity within cities and towns

- Strong sense of community identity
- Adherence to traditional settlement patterns when siting municipal and public buildings and services
- Ample alternate transportation modes
- Uncongested roads
- Attractive views of the landscape
- Preservation of historic village centers

d. *Other*: This policy fulfills legislative intent as codified in RSA 9-B; RSA 21-I-19-a; RSA 227-C:1-a; RSA 672; and Chapter 266 of the New Hampshire Session Laws of 2002.

4. Potential for Implementation (i.e., including challenges, obstacles and opportunities):

   a. *Technical*: There is already sufficient theoretical knowledge to deal analytically and technically with the adaptation of older buildings for enhanced social benefit while preserving their embodied energy and thereby reducing potential $CO_2$ release.

   b. *Economic*: Funding may be required in order to induce developers to undertake such projects, thereby instilling confidence and illustrating the feasibility of rehabilitating upper floors and other underutilized portions of older buildings.

   c. *Statutory/Regulatory*: Further legislation may be required to enable communities to adopt appropriate criteria for the continued use or reuse of older commercial and industrial buildings, and to ensure that matters of life safety, fire protection, structural integrity, handicapped accessibility, energy conservation, traffic, parking, and other health and safety considerations for such buildings are satisfied in a responsible but flexible manner.

   d. *Social*: Social factors affecting the potential for implementation may include changing attitudes toward mixed building uses, residential occupancy of upper stories, reliance on public transportation as distinct from the automobile, and increased population density in village or urban districts. Current demographic studies indicate that Americans are willingly returning to cities and are readopting urban modes of living. These trends suggest that there will be a positive social response to the principles of this policy, thereby ensuring the realization of the environmental benefits that underlie the policy.

5. Other Factors of Note: This policy combines principles of smart growth and building conservation to obtain an environmental benefit affecting climate change. Many indicators suggest that New Hampshire is ready to merge several initiatives in order to obtain the multiple benefits offered by this policy, which in fact represents a return to modes of social organization and building use of the pre-automobile age.

6. Level of Group Interest: Medium

7. References:

**RCI Action 2.3 – Require Annual $CO_2$ Emissions Reporting**

Summary

Large commercial and industrial facilities should be required to report their calculated annual $CO_2$ emissions in an effort to promote awareness of greenhouse gas emissions. Because many facilities are already required to inventory and report other pollutants to NHDES on an annual basis, $CO_2$ emissions reporting could easily be added to the existing reporting structure. A facility would be able to use approved emission factors and annual fuel usage to calculate its emissions. Annual $CO_2$ emissions reporting would apply to any facility that is required to file annual emissions reports as a condition of a federal or state air permit in New Hampshire.

Program Description

1. Mechanism *(i.e., how the policy or program achieves the desired result):* Commercial and industrial facilities would include annual $CO_2$ emissions in their annual emissions reports to NHDES. A facility could use gross fuel usage and approved emission factors to calculate its annual $CO_2$ emissions. The proposed action would apply to any stationary source that is required to have an air permit under NH Code of Administrative Rules Env-A 600 *Statewide Permit System*. The current system for calculation and payment of annual emission fees would be unchanged, and no fees for $CO_2$ emissions are proposed at this time. Although not part of the proposed action, annual $CO_2$ emissions reporting might be extended at a future date to include any facility whose annual fossil fuel usage exceeded a set minimum. A program to implement the new $CO_2$ emissions reporting requirements would need to be developed.

2. Implementation Plan *(i.e., how to implement the specific policy or program):*
    a. *Method of Establishment (e.g., legislation, executive order):* Administrative rule change
    b. *Resources Required:* NHDES staff
    c. *Barriers to Address (especially for medium to low feasibility actions):* Passage of rule change, push back from affected sources, training for sources newly subject to reporting.

3. Parties Affected by Implementation *(i.e., residents, businesses, municipalities, etc.):*
    a. *Parties Responsible for Implementation:* NHDES
    b. *Parties Paying for Implementation:* Facilities, NHDES
    c. *Parties Benefiting from Implementation:* NHDES, the public

4. Related Existing Policies and Programs: NHDES Annual Emissions Reporting Program for permitted stationary sources. (See NH Administrative Rules, Env-A 907.01 General Reporting Requirements)

5. Complementary Policies *(i.e., those that achieve greater reductions through parallel implementation):*
    a. *Existing*
    b. *Proposed*

6. Timeframe for Implementation: For the industrial sector, the program to include $CO_2$ in annual emissions reporting could be implemented in 6 months to 1 year based on rule change requirements by NHDES. The commercial sector could take longer than one year because most sources are not currently subject to air emissions reporting.

7. Anticipated Timeframe of Outcome: Because the proposed action would increase awareness of $CO_2$ emissions in the industrial and commercial sectors, it is hoped that this action would act as a catalyst for proactive reductions in $CO_2$ emissions by the affected facilities.

Program Evaluation

1. Estimated $CO_2$ Emission Reductions: This action not individually quantified.

2. Economic Effects
    a. Costs:
        i. Implementation Cost: Low (0-$2.5 million)
        ii. Timing: Constant / even
        iii. Impacts: Business – evenly distributed
    b. Savings:
        i. Potential Economic Benefit: Supporting mechanism only
        ii. Timing:
        iii. Impacts:

3. Other Benefits/Impacts:
    a. *Environmental*: Increased awareness of emissions, reduced energy use would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.
    b. *Health*: This action will lead to lower emissions of all pollutants from power generation and reducing those pollutants will reduce their corresponding impact on air quality and human health. Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.
    c. *Social*: The measure will add transparency and hold facilities accountable for their own emissions.
    d. *Other*:

4. Potential for Implementation (i.e., including challenges, obstacles and opportunities): This action has a high potential for implementation.
    a. *Technical*: The technical resources and expertise required to implement this action already exist.
    b. *Economic*: Additional state funding may be required to increase staff required to oversee the process.
    c. *Statutory/Regulatory*: An administrative rule would need to be drafted and passed
    d. *Social*: Response to this action item by the public is expected to be positive.

5. Other Factors of Note:

6. Level of Group Interest: Medium

7. References: None

**RCI Action 2.4 – Develop Best-Practice Guidelines for Energy-Efficient Process Equipment**

Summary

Industry groups in New Hampshire should be encouraged to work together with utilities and environmental professionals to develop industry-specific best practices. These guidelines could include efficiency standards for industry-specific process equipment to aid in purchasing the most energy-efficient equipment. In addition, efficient operating procedures could be documented and distributed across industries. Smaller operations would benefit from shared information on best practices as they do not always have the resources to explore energy efficiency measures on their own.

Program Description

1. Mechanism *(i.e., how the policy or program achieves the desired result):* Current trade groups or industry sectors could be targeted by state government to develop (or improve on current versions of) best practices. Assistance in developing best practices could be provided by the utilities, the NH Department of Environmental Services, and other public and/or private entities. Best practices would then be shared with all members of the respective industries. Best practices should target process equipment design and operational efficiency. A potential source of funding for this program could be the Greenhouse Gas Reduction Fund (RSA 125-O:23).

2. Implementation Plan *(i.e., how to implement the specific policy or program):*
    a. *Method of Establishment (e.g., legislation, executive order):* Outreach effort, printed materials targeted toward industry sectors.
    b. *Resources Required:* Utility and government staff. Potential funding source: Greenhouse Gas Reduction Fund (RSA 125-O:23)
    c. *Barriers to Address (especially for medium to low feasibility actions):* None known.

3. Parties Affected by Implementation *(i.e., residents, businesses, municipalities, etc.):*
    a. *Parties Responsible for Implementation:* Industry, utilities, state government.
    b. *Parties Paying for Implementation:* State government/utilities, business sector.
    c. *Parties Benefiting from Implementation:* Industry.

4. Related Existing Policies and Programs: CORE programs funded by Systems Benefits Charge.

5. Complementary Policies *(i.e., those that achieve greater reductions through parallel implementation):*
    a. *Existing:* TBD
    b. *Proposed:* RCI Actions 1.3, Maximize Energy Efficiency in Existing Commercial, Industrial, and Municipal Buildings; 2.1, Create Incentive Programs to Install Higher-Efficiency Equipment, Processes, and Systems; and 2.5, Promote Net-Zero or Minimal-Emissions Industrial and Commercial Clusters

6. Timeframe for Implementation: Promotion of this action could begin immediately.

7. Anticipated Timeframe of Outcome: 2010 and later, as information is disseminated.

Program Evaluation

1. Estimated $CO_2$ Emission Reductions: This action not individually quantified.

2. Economic Effects
    a. Costs:
        i. Implementation Cost: Low (0-$2.5 million)
        ii. Timing: Constant / even
        iii. Impacts: Business – evenly distributed
    b. Savings:
        i. Potential Economic Benefit: Supporting mechanism only
        ii. Timing:
        iii. Impacts:

3. Other Benefits/Impacts:
    a. *Environmental*: Increased awareness of emissions, reduced energy use would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.
    b. *Health*: This action will lead to lower emissions of all pollutants from power generation and reducing those pollutants will reduce their corresponding impact on air quality and human health. Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.
    c. Social: Promote camaraderie within industry sectors and enable innovation through collaboration.
    d. Other:

4. Potential for Implementation *(i.e., including challenges, obstacles and opportunities):* This action has a high potential for implementation.
    a. Technical: The technical resources and expertise required to implement this action already exist.
    b. Economic: A small amount of money would be required to promote this program, but legwork would be done by existing groups and existing staff members within state government and the utilities.
    c. Statutory/Regulatory: This would not be a regulated/statutory program.
    d. Social: The action is anticipated to have high public support due to its low cost.

5. Other Factors of Note:

6. Level of Group Interest: Medium

7. References: None

**RCI Action 2.5 – Promote Net-Zero or Minimal-Emissions Industrial and Commercial Clusters**

Summary

Commercial and industrial facilities utilize over 20 percent of energy consumed in New Hampshire. A program could be instituted to promote overall energy efficiency in commercial and industrial clusters – primarily in new construction and secondarily in existing entities – by optimizing complementary uses, activities, and shared facilities such as cogeneration, waste heat utilization, and district heating and cooling. The ideal installations would emit no net $CO_2$, but those that utilize state-of-the-art energy minimization strategies would substantially reduce greenhouse gas emissions in any case. To augment this program, industry groups, DES, DRED, and OEP would provide a matrix indicating projected energy and cost savings based on utilizing up-to-date energy conservation technologies and state of the art energy sources (bio-mass, solar, wind, CHP and co-generation). These organizations also might help in "match-making" complementary business activities, e.g., a greenhouse operation that could utilize waste heat from a wood-fired electric power plant.

Program Description

1. Mechanism *(i.e., how the policy or program achieves the desired result):*

   *Step 1*. Develop a series of "beta" sites, either industrial or commercial, that would incorporate to the maximum practical extent:

   - Renewable energy resources,
   - Energy conservation measures, and
   - Complementary business activities and energy usage profiles.

   The resulting measures and energy and savings would be made available to interested parties and promoted by the appropriate entities. (A beta site is an actual operating facility that utilizes the technologies and practices that are being promoted.)

   *Step 2*. Promote widespread use of the practices developed at the "beta" sites.

2. Implementation Plan *(i.e., how to implement the specific policy or program):*

   a. *Method of Establishment (e.g., legislation, executive order):* Outreach effort to locate firms which would act as "beta" sites. Match-making and model zoning and planning provisions.

   b. *Resources Required:* Industry groups, DES, DRED, OEP, utilities, energy source suppliers, equipment suppliers.

   c. *Barriers to Address (especially for medium to low feasibility actions):* Incentives to prospective "beta" sites. Potential zoning and siting barriers.

3. Parties Affected by Implementation *(i.e., residents, businesses, municipalities, etc.):*

   a. *Parties Responsible for Implementation:* DRED, DES, OEP

   b. *Parties Paying for Implementation:* DRED, DES, OEP, commercial and industrial facilities. Some components may qualify for funding through statewide energy efficiency programs or RGGI (Regional Greenhouse Gas Initiative)

   c. *Parties Benefiting from Implementation:* Commercial and industrial facilities, the public

4. Related Existing Policies and Programs: None known, other than general smart growth principles as they relate to industrial parks and commercial centers.

5. Complementary Policies *(i.e., those that achieve greater reductions through parallel implementation):*

   a. *Existing:* Utility energy efficiency programs and various business and economic development efforts.

   b. *Proposed:*

   ADP Action 6 – Strengthen the Adaptability of New Hampshire's Economy to Climate Change
   AFW Action 2.2.1 – Maintain Infrastructure for Biomass Production and Support Regulatory and Business Efficiencies
   AFW Action 2.2.2 – Ensure Biomass Consumption is within Sustainable Limits
   AFW Action 2.2.3 – Ensure the Most Efficient Use of Energy/Biomass Stock
   EG Action 1.1 – Revenue Decoupling
   EG Action 1.2 – Energy Efficiency Procurement
   EG Action 1.3 – Combined Heat & Power Resource Standard
   EG Action 2.1 – Renewable Portfolio Standard (RPS)
   RCI Action 1.1 – Maximize Energy Efficiency in New Construction
   RCI Action 2.1 – Create Incentive Programs to Install Higher-Efficiency Equipment, Processes, and Systems
   RCI Action 3.1 – Promote Renewable Energy and Low-$CO_2$e Thermal Energy Systems
   TLU Actions 2.C.1through 2.C. 8.

6. Timeframe for Implementation: One year, ongoing.

7. Anticipated Timeframe of Outcome: 2010 and thereafter as infrastructure is completed.

Program Evaluation

1. Estimated $CO_2$ Emission Reductions: This action not individually quantified.

2. Economic Effects

   a. Costs:

      i. Implementation Cost: Moderately low ($2.5 million to $25 million)
      ii. Timing: Immediate / higher upfront
      iii. Impacted: State government

   b. Savings:

      i. Potential Economic Benefit: Supporting mechanism only
      ii. Timing:
      iii. Impacts:

3. Other Benefits/Impacts:

   a. *Environmental*: Increased awareness of emissions, reduced energy use would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.

   b. *Health*: This action will lead to lower emissions of all pollutants from power generation and reducing those pollutants will reduce their corresponding impact on air quality and human health. Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.

c. *Social*: Promote camaraderie within commercial and industrial sectors and enable innovation through collaboration.

d. *Other*: None known.

4. Potential for Implementation (i.e., including challenges, obstacles and opportunities): This action has a moderate potential for implementation.

   a. *Technical*: The technical resources and expertise required to implement this action will need to be developed.

   b. *Economic*: The initial construction costs may be high but mid- long-terms saving may offset the first costs.

   c. *Statutory/Regulatory*: To enable incentives to promote this program, a method for doing so would need to be established.

   d. *Social*: The action is anticipated to have public support because of its positive impact on communities.

5. Other Factors of Note:

6. Level of Group Interest: Medium

7. References: None

**TLU Action 1.B.2 – Implement a Carbon-Based Vehicle Registration Fee Structure**

Summary

This action would utilize the annual vehicle registration fee to create a financial incentive to purchase high-efficiency/low-greenhouse-gas-emitting vehicles and a financial disincentive to purchase high-GHG-emitting vehicles. The proposed measure would create a sliding scale of annual vehicle registration fees based on vehicle efficiency: Higher-efficiency vehicles would have lower registration fees, while lower-efficiency vehicles would have higher registration fees or surcharges. The program could be made virtually revenue-neutral by using the surcharges paid on low-efficiency vehicles to cover the reduced fees on high-efficiency vehicles, or the program could be used to create revenue to support other actions such as transit options.

The described action is similar to the feebate concept proposed in TLU Action 1.B.1 but differs in one important way: Feebates would provide one-time incentives effective for new vehicle purchases, while variable registration fees would represent recurring, annual incentives.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*):

   A carbon-based vehicle registration fee encourages faster adoption of fuel-efficient vehicles by making the annual cost of registration for inefficient vehicles more expensive. This mechanism would be designed to support the point of sale feebate (TLU Action 1.B.1) and would be implemented several years after the feebate so as not to penalize motorists for vehicles purchased prior to implementation of the system. By making the "inefficiency surcharge" an annual event rather than just a point-of-sale event (which may be effectively hidden and forgotten by rolling it into vehicle financing), the overall goal of increasing vehicle efficiency is supported.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):

   a. *Method of Establishment (e.g., legislation, executive order):* Implementing the carbon-based registration fee would require legislative action through an amendment to RSA 261 (Registration of Vehicles) and a change in the Dept. of Safety Administrative Rules (Chapter Saf-C 500) which established motor vehicle registration rates, rules, and procedures.

   b. *Resources Required:* Little new revenues would be required; however, an incremental administrative burden would be placed on DMV and /or town clerks to collect the surcharge and disburse the rebate. Additional forms and changes to accounting systems would also be required. A GHG rating system and corresponding feebate schedule would need to be developed and maintained. Administrative costs of the program could be built into the structure of the surcharge. If implemented in conjunction with a feebate program (TLU Action 1.B.1.) then the administrative costs of the program would already be mostly covered.. Resources to effectuate the necessary legislative and administrative rule changes would also be required.

   c. *Barriers to Address (especially for medium to low feasibility actions):* Because this applies to all vehicles, not just new vehicles as in the feebate program (TLU Action 1.B.1.) there are potential equity impacts resulting from relatively higher impacts on low-income drivers who are more likely to own older, less efficient vehicles and cannot afford to purchase more efficient vehicles. There may also be consumer resistance from those who either need higher GHG emitting vehicles (contractors, those with large families, etc.) or have a strong preference for them. Feebate and carbon-based fee programs have been successfully attacked in other states as "anti-SUV" or as amounting to an SUV

tax. There may be restrictions from town clerks if the burden for administering the program is placed on them without additional resources.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* Town clerks and the Deptartment of Safety, Division of Motor Vehicles. The Department of Environmental Services would most likely be responsible for developing and maintaining the vehicle GHG rating and fee schedule. If done in conjunction with a feebate program (TLU Action 1.B.1), the same vehicle rating and fee schedule would be applicable to both programs.
    b. *Parties Paying for Implementation:* Owners of high-GHG-emitting vehicles; Department of Safety, Department of Environmental Services.
    c. *Parties Benefiting from Implementation:* Owners of fuel-efficient vehicles would have lower annual registration fees, and society would gain from associated environmental and health benefits.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):
    a. *Existing:*
    b. *Proposed:* All actions that influence the cost of driving (Goal 2A) and improve transit opportunities (Goal 2B), thereby reducing vehicle miles traveled. Goal 1 includes supporting actions that would allow this action to proceed successfully.

6. Timeframe for Implementation: Several years after implementation of TLU Action 1.B.1 (feebates). This delay would allow motorists a time in which to make more efficient vehicle choices and would also allow a phased-in development of the sliding fee scale, which would be more manageable for the implementing agencies.

7. Anticipated Timeframe of Outcome: The outcome of the feebate program would begin immediately. The carbon-based registration fee program would increase the impact of the feebate program over time as fleet turnover occurs and both fees led to a greater percentage of high-fuel-economy vehicles in the fleet.

<u>Program Evaluation</u>

a. Estimated $CO_2$ Emission Reductions:

| **Action to Implement** | **$CO_2$ Emission Reductions ($MMTCO_2e$)** | | |
|---|---|---|---|
| | **2012** | **2025** | **2050** |
| New car registration fee differential of $500 per 0.01 gallon/mile (new vehicles 14% more fuel efficient) | 0.23 | 0.73 | 1.00 |

1. Economic Effects:
    a. Costs:
        i. Implementation Cost: Low (0-$2.5 million)
        ii. Timing: Constant / even
        iii. Impacts: State government
    b. Savings:

i. Potential Economic Benefit: High ($500 million to $1 billion)
ii. Timing: Low short-term/Mostly long-term
iii. Impacts: Consumer

2. Other Benefits/Impacts:

   a. *Environmental*: Many higher-fuel-economy vehicles also lower emissions of ozone pre-cursors and particulate emissions. Therefore, in addition to GHG reductions, this action would reduce harm to vegetation from ozone, and reduce pollutants contributing to regional haze. If the fee revenues were used to support expansion of public transit, then VMT and associated GHGs emissions could decrease and these benefits could be increased.

   b. *Health*: Human health benefits would be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution would reduce the incidence of cardiac and respiratory disease.

   c. *Social*: If implemented as a revenue-producing program, the revenue could help support public transit, thereby providing greater transportation choice and helping to meet the needs of the growing elderly population and individuals who cannot afford personal vehicles. There are added advantages through reduced dependence on foreign oil as higher fuel economy leads to reduced overall demand. However, by increasing the cost of vehicles, this measure might – depending on the size of the fee – adversely affect individuals who cannot, or choose not to, use public transportation or purchase fuel-efficient vehicles.

   d. *Other:*

3. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):

   a. *Technical*: The existing variation in vehicle fuel economy is sufficient to allow the establishment of a registration fee. Advanced vehicle technologies (e.g., batteries, fuel cells) are still under development, but the carbon-based registration fee could help to drive technological development by increasing demand for high fuel economy/low carbon vehicles and send a clear market signal.

   b. *Economic*: This measure would have an economic benefit for those who own fuel-efficient vehicles. This measure might also create economic opportunities for the state by generating revenues to expand transit opportunities within New Hampshire and between other states. The program could be designed to support itself so as not to be an economic burden to the state budget.

   c. *Statutory/Regulatory*: Adding a new fee will involve political challenges, and may require legislation to implement. Given level of support for climate change actions now this seems plausible.

   d. *Social*: There would be social resistance to adding another "tax" but broad and increasing public support for addressing climate change and use of the revenues to expand transportation options could drive acceptance.

4. Other Factors of Note:

5. Level of Group Interest: High. The working group considered this an essential action to undertake in the early mid-term (2012) to achieve significant reductions in $CO_2$ emissions from the transportation and land use sector.

6. References:

**TLU Action 1.D.4 – Reduce Emissions through Enhanced Vehicle Inspection Programs**

Summary

Improve motor vehicle operations, and thus vehicle fuel efficiency, through continuation of existing vehicle Inspection and Maintenance (I/M) programs, including on-board diagnostics (OBD) for light-duty vehicles. Also, expand implementation of more stringent I/M programs for medium- and heavy-duty vehicles, including OBD inspections for these vehicles when national standards are established. A well maintained vehicle operates as a more fuel-efficient and less polluting one.

Specifically,

- Continue the on-board diagnostics motor vehicle inspection program for light-duty/passenger vehicles (LDV) and expand the program to include heavier vehicles up to 10,000 pounds (11,000 would be consistent with New Hampshire's vehicle lemon law).
- Upon issuance of federal standards requiring OBD systems for medium-duty (8,500-14,000 lbs) and heavy-duty (>14,000 lbs) vehicles, implement a statewide testing program for these vehicles.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): Expand and revise current emission inspection process and start advisory program for heavier-weight/heavier-duty vehicles.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. Method of Establishment (e.g., legislation, executive order): Legislation.
    b. Resources Required: Network of stations/inspectors exist. State (DOS/DMV) would have to expand program with contracted vendor for program management (Gordon-Darby)and there would be a need for program outreach to citizens.
    c. Barriers to Address (especially for medium to low feasibility actions): Public acceptance of impacts on small businesses.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. Parties Responsible for Implementation: NH Department of Safety, Division of Motor Vehicles, and Department of Environmental Services.
    b. Parties Paying for Implementation: DOS/DMV, state inspection stations, customers.
    c. Parties Benefiting from Implementation: Citizens, vehicle owners.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*): New Hampshire's Enhanced Safety Inspection and OBD Program (the annual safety and emission control equipment inspection for LDV).

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):
    a. *Existing*: Federal fuel economy and vehicle certification standards.
    b. *Proposed*:
    TLU Action 1.A.1 – Support Stricter Corporate Average Fuel Economy Standards
    TLU Action 1.A.2 – Support Fuel Economy Standards for Heavy-Duty Vehicles
    TLU Action 1.A.3 – Adopt California Low Emission Vehicle (CALEV) Standards

6. Timeframe for Implementation:
    a. For light-duty vehicles: Immediate.
    b. Medium-duty vehicles are required to have OBD systems beginning with the 2008 model year, so this program could be implemented immediately. OBD is not yet required for heavy-duty vehicles.
7. Anticipated Timeframe of Outcome:
    a. For light-duty vehicles: Immediate.
    b. Requirements for heavier vehicles should have an impact by about 2012 to 2015.

Program Evaluation

1. Estimated $CO_2$ Emission Reductions:
    a. Short-term (2012): 0.03 $MMTCO_2e$/year
    b. Medium-term (2025): 0.09 $MMTCO_2e$/year
    c. Long-term (2050): 0.12 $MMTCO_2e$/year

2. Economic Effects:
    a. Costs:
        i. Implementation Cost: Moderately low ($2.5 million to $25 million)
        ii. Timing: Constant / even
        iii. Impacts: Evenly distributed
    b. Savings:
        i. Potential Economic Benefit: Low (0-$2.5 million)
        ii. Timing: Constant / even
        iii. Impacts: Evenly distributed

3. Other Benefits/Impacts:
    a. *Environmental*: This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.
    b. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.
    c. *Social*: This measure will create an another burden/disincentive for citizens driving larger and heavier vehicles increasing the chance that they will switch to more efficient vehicles.
    d. *Safety*: There will also be more safety inspected vehicles on road.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):
    a. *Technical*: Minimal technical challenges and easy implementation for all vehicle classes.
    b. *Economic*: OBD framework and systems are already in place at all state-approved inspection stations, so there would be no cost to them and the potential for increased revenue. Owners of light-duty and medium-duty vehicles could be faced with vehicle repairs they have not had to undertake before.
    c. *Statutory/Regulatory*:

- For light-duty vehicles: Very feasible – state framework already exists.
- Moderately feasible for larger vehicles. Implementation for medium-duty vehicles would require legislative action, and implementation for heavy-duty vehicles would require federal action.

d. *Social*: This may have economic impacts on the smaller commercial businesses that typically use larger light-duty vehicles (SUVs and PUs) and smaller heavy-duty vehicles. Current infrastructure exists for OBD testing, making program implementation easy to achieve to. Acceptance by vehicle inspection stations is not anticipated to be a problem. The general public may have concerns with the impacts on small businesses. The general public would benefit from any emission reductions realized..

5. Other Factors of Note:

6. Level of Group Interest: Moderate. The working group considered this a supporting action to undertake in the near-term (i.e., supports other actions and/or achieves moderate reductions but not considered "essential" to achieve substantial $CO_2$ reductions from the transportation and land use sector)

7. References:

- NH Employment Security, "Vital Signs 2008: Economic & Social Indicators for NH 03-06." There are an estimated 60,000-90,000 medium-duty vehicles; 1.2 million registered passenger vehicles; and 205,000 commercial vehicles in New Hampshire.
- Average vehicle occupancy is 1.1 persons per passenger car.

**TLU Action 2.A.2 – Implement Congestion Pricing**

Summary

Implement congestion pricing on major highways in southern New Hampshire. Congestion pricing discourages highway use during peak hours of highway travel by increasing toll rates for single-occupant vehicles at these times. This action could reduce carbon emissions in two ways: 1) by shifting discretionary rush-hour highway travel to off-peak periods, resulting in more efficient traffic flow; and 2) by making other transportation modes, such as public transit or carpools, more attractive as an alternative to single-occupant vehicles because of the cost penalty associated with the latter. Reduced or free access could also be provided for high-occupancy vehicles (HOVs) during peak periods. Funds raised by increasing tolls during peak periods could be directed toward development/expansion or subsidization of public transit systems through appropriate legislation.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*):

   Congestion pricing has been used in many other areas of the country as part of toll pricing scenarios. On the New Jersey Turnpike, toll rates are approximately 25 percent higher during peak weekday hours. Toronto's 407ETR also utilizes congestion pricing, a sample of toll rates showed an increase of approximately 7.1 percent during peak hours, High-occupancy vehicles (HOV's) on both of the above systems are required to pay the same toll as other travelers. On the NJ Turnpike, hybrid single-occupancy vehicles (SOVs) are permitted to travel in HOV lanes.

   Congestion pricing in New Hampshire was attempted between August 1995 and August 1997 on the FE Everett Turnpike, in Bedford. The "3 for free" program allowed vehicles with 3 or more occupants to travel toll-free through the Bedford toll plaza. The program on average recorded 2.5 percent HOV use that resulted in 455 HOV's per day.

   A congestion-pricing program requires a toll collection system. In New Hampshire, tolls are collected on the Central Turnpike, in Bedford and Hooksett, and on the Eastern Turnpike, in Hampton, Dover, and Rochester. The previous "3 for free" program provided an incentive for HOV use but did not penalize SOV use. It would seem that a congestion-pricing program that provided both an incentive for HOV use and a disincentive for SOV use would be more effective in reducing vehicle miles traveled. Such a system could reduce congestion by varying toll rates in an effort to shift discretionary travel to off-peak periods. Also, alternative toll lanes would be set up to provide free or reduced-rate access for HOV's.

   A similar program could be implemented on the I-93 corridor if a toll station were constructed there. Because of the current lack of toll booths, such a program on I-93 would have far greater initial costs in comparison with initial program costs on the existing turnpike system. It is estimated that a new toll facility on I-93 would cost 42 million dollars. Approximately 42 million vehicles travel on I-93 annually. Therefore, a 1 dollar toll for passenger cars would raise sufficient revenue in the first year to cover construction costs.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
   a. *Method of Establishment (e.g., legislation, executive order):*
      - G & C approval to modify toll rates/times.
      - Legislation required if increased toll revenue is to be shifted toward development/expansion or subsidization of public transit systems.
      - (I-93 option only) Legislation to establish new tolls.
      - (I-93 option only) Environmental permitting for construction of new toll facilities.

- (I-93 option only) Federal Highway Administration approval if new toll facilities were added on the federal highway system.

b. *Resources Required:*

- Additional funding to modify tolls and provide signing for HOV identification, estimated at $100, 000.
- Additional personnel to operate and manage the congestion pricing facility.
- Funding for new toll station construction estimated at $42 million (I-93 option only).

c. *Barriers to Address (especially for medium to low feasibility actions):* Minimal barriers

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
   a. *Parties Responsible for Implementation:* NHDOT/Safety
   b. *Parties Paying for Implementation:* NHDOT Turnpike authority, via tolls, gas taxes, NH Highway fund.
   c. *Parties Benefiting from Implementation:* Traveling public, transit riders, HOV riders. Most vacation travelers would probably not be effected by this action because they usually travel in HOVs.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):
   a. *Existing*: Existing park-and-ride facilities
   b. *Proposed*:
      - Future park-and-ride facilities
      - TLU Actions 2.A.1 and 2.A.7, and all of TLU Goal 2B (Congestion pricing encourages modes of travel other than SOVs.)

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):
   a. *Existing*: None
   b. *Proposed*: TLU Action 2.B.2.d – Implement Recommendations of the I-93 Transit Investment Study

6. Timeframe for Implementation: Congestion pricing on the existing turnpike facility could be implemented in 6 to 12 months. I-93 implementation would involve approval and construction time, estimated at 5 years or more.

7. Anticipated Timeframe of Outcome: Immediate

<u>Program Evaluation</u>

1. Estimated $CO_2$ Emission Reductions:
   a. Short-term (2012): 0.03 $MMTCO_2e$ /year
   b. Medium-term (2025): 0.03 $MMTCO_2e$ /year
   c. Long-term (2050): 0.04 $MMTCO_2e$ /year

2. Economic Effects:
   a. Costs:
      i. Implementation Cost: Moderate ($25 million to $125 million)
      ii. Timing: Immediate / higher initial cost
      iii. Impact: Evenly distributed

b. Savings:

   i. Potential Economic Benefit: Moderately low ($2.5 million to $25 million)
   ii. Timing: Low short-term/Mostly long-term
   iii. Impacts: Evenly distributed

3. Other Benefits/Impacts:

   a. *Environmental*: This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.

   b. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.

   c. *Social*: Higher toll rates would have greater impacts on individuals at lower income levels, particularly if few other transit oriented travel alternatives exist.

      This action would create more efficient use of the transportation infrastructure by encouraging discretionary drivers to use the facility during off peak periods, thereby increasing the level of service of the facility and increasing vehicle throughput.

   d. *Other*

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):

   a. *Technical*: There will be minimal technical challenges.

   b. *Economic*: There will be minimal cost for implementation on the existing turnpike system.

   c. *Statutory/Regulatory*: There will be minimal regulatory issues on the existing turnpike system, requiring G & C approval only. The I-93 option will require new toll facilities, which will most likely be seen as new taxes, and have issues surrounding it..

   d. *Social*: Few transit options presently exist for commuters who must travel at peak hours.

5. Other Factors of Note:

6. Level of Group Interest: Moderate. The working group considered this a supporting action to undertake in the mid-term (i.e., supports other actions and/or achieves moderate reductions but not considered "essential" to achieve substantial $CO_2$ reductions from the transportation and land use sector).

7. References:

**TLU Action 2.A.3 – Create a VMT-Based Insurance Premium Structure**

Summary

Create an incentive for consumers to drive less to reduce the cost of vehicle insurance. Some portion of the annual insurance premium would be based on the vehicle miles traveled (VMT) above a standard minimum (e.g., 12,000 miles per year). Consumers would have an incentive to reduce their VMT by making more efficient travel decisions and location choices, e.g., living closer to work and services. Mileage data could be collected in many ways. The cheapest would be for motorists to submit odometer readings, verified with occasional spot-checks. The most costly would be to install GPS transponders in each participating vehicle. An intermediate approach would be to certify vehicle service businesses (garages, oil change shops, and perhaps some insurance brokers) to perform odometer audits. Governments could certify these auditors and collect odometer readings in vehicle registration databases. Current insurance pricing practices use miles driven as a pricing factor in the premiums they charge. However, a limited study (93 participants) by Progressive Insurance Co. performed in Oregon, Minnesota, and Michigan found a 10 percent reduction in VMT for motorists choosing VMT-based insurance policies.[1]

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): Some portion of the annual insurance premium would be based on the vehicle miles traveled (VMT), thus giving consumers an incentive to make more efficient travel decisions and location choices (e.g., living closer to work and services) to reduce their VMT. Verification of actual miles driven would be required. Pilot programs have been tried in several areas within the U.S. and abroad. In Oregon, insurance companies receive a tax credit ($100) for each vehicle covered by a mileage-based policy.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* State government would work with vehicle insurance companies to identify any necessary legislation to allow companies to offer this option.
    b. *Resources Required:*
    c. *Barriers to Address:* Participation by insurance companies.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* Insurance companies and state facilities.
    b. *Parties Paying for Implementation:* Vehicle owners
    c. *Parties Benefiting from Implementation:* Vehicle owners who drive fewer miles per year than average motorists.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):
    a. *Existing:* Currently insurance policy pricing is scaled by how much one drives but is not based on actual odometer readings and is not, in many cases, a significant factor in setting an insured's rate.

[1] Pay-As-You-Drive Vehicle Insurance: Converting Vehicle Insurance Premiums Into Use-Based Charges TDM Encyclopedia, Victoria Transport Policy Institute, http://www.vtpi.org/tdm/tdm79.htm

b. *Proposed:* other mechanisms that increase the price of additional VMT (greater total increase in cost of driving will produce greater shifts in driving behavior resulting in greater VMT reduction):
TLU Action 2.A.2 – Implement Congestion Pricing (*cross-referenced as TLU Action 1.D.5*)
TLU Action 2.A.4 – Implement VMT-Based Registration Fees
TLU Action 2.A.5 – Increase the State Gasoline Tax
TLU Action 2.A.6 – Apply a Surcharge to High Carbon Fuels
TLU Action 2.A.7 – Create Initiative to Reduce Availability of Free and Inexpensive Parking

6. Timeframe for Implementation: Would likely take a year of working with insurance companies to implement.

7. Anticipated Timeframe of Outcome: Would expect to see near-term changes in VMT, which might increase over time as people make alternative home-work location choices.

Program Evaluation

1. Estimated $CO_2$ Emission Reduction:

| Action to Implement | $CO_2$ Emission Reductions ($MMTCO_2e$) | | |
|---|---|---|---|
| | 2012 | 2025 | 2050 |
| 2.7% reduction in total light duty VMT | 0.15 | 0.16 | 0.22 |
| 5% reduction in total light duty VMT | 0.28 | 0.30 | 0.41 |
| 7% reduction in total light duty VMT | 0.39 | 0.42 | 0.57 |

2. Economic Effects:
   a. Costs:
      i. Implementation Cost: Moderately low ($2.5 million to $25 million)
      ii. Timing: Constant / even
      iii. Impacts: Evenly distributed
   b. Savings:
      i. Potential Economic Benefit: Moderate ($25 million to $125 million) to Moderately high ($125 million to $500 million)
      ii. Timing: Low short-term / mostly long-term
      iii. Impacts: Evenly distributed

3. Other Benefits/Impacts:
   a. *Environmental*: This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.
   b. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.
   c. *Social*: Current vehicle insurance pricing tends to overcharge motorists who drive their vehicles less than the average amount each year, and undercharges those who drive more than the average amount, within each price class (Edlin, 2003; Litman, 2001).[2]

[2] Pay-As-You-Drive Vehicle Insurance: Converting Vehicle Insurance Premiums Into Use-Based Charges TDM Encyclopedia, Victoria Transport Policy Institute, http://www.vtpi.org/tdm/tdm79.htm

Since lower-income motorists drive their vehicles significantly less on average than higher-income motorists, this pricing structure is regressive.[3] There is, however, some concern that by increasing the cost of vehicle ownership and use, this measure – depending on the premium structure – could adversely affect individuals who cannot, or choose not to, use public transportation, or who otherwise cannot reduce their VMT.

d. *Other:*

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):
    a. *Technical*: There are no technical barriers or challenges to implementing this measure.
    b. *Economic*: This measure will have economic impacts on individual consumers, though those impacts may be reduced for many as a result of behavior modification/reduced VMT.
    c. *Statutory/Regulatory*:
    d. *Social*: There would be social resistance as this would be perceived to increase costs.

5. Other Factors of Note: None

6. Level of Group Interest: Moderate. The working group considered this a supporting action to undertake in the mid-term, as an additional incentive mechanism once other actions to provide alternative travel and location options through compact development were in place (i.e., this action supports other actions and/or achieves moderate reductions but not considered "essential" to achieve substantial $CO_2$ reductions from the transportation and land use sector).

i.

7. References:

[3] Jason E. Bordoff (2008) *Pay-As-You-Drive Car Insurance*, Brookings Institution (www.brookings.edu/articles/2008/spring_car_insurance_bordoff.aspx).

**TLU Action 2.A.4 – Implement VMT-Based Vehicle Registration Fees**

Summary

Create an incentive for consumers to drive less to reduce the cost of vehicle registration. Some portion (or all) of the annual vehicle registration fee would be based on the vehicle miles traveled (VMT) in the previous year above a standard minimum (e.g., 10,000 miles per year). VMT would be determined by an odometer-reading performed with the annual inspection. Consumers would have an incentive to reduce their VMT by making more efficient travel decisions and location choices, e.g., living closer to work and services.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): Some portion of the annual vehicle registration fee would be based on the vehicle miles traveled (VMT) in the previous year above a standard minimum (e.g., 10,000 miles per year), thus giving consumers an incentive to make more efficient travel decisions and location choices (e.g., living closer to work and services) and reduce VMT

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* State government – legislation
    b. *Resources Required:* Resources to revise current vehicle registration procedures and materials.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Potential equity impacts due to relatively higher impact on low-income and rural drivers, and those unable (or unwilling) to reduce VMT.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* State government
    b. *Parties Paying for Implementation:* Car owners
    c. *Parties Benefiting from Implementation:* If revenue-generating (versus revenue-neutral), additional funds collected could be directed to GHG-reducing transportation investments (e.g., public transportation)

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):
    a. *Existing:*
    b. *Proposed:* Other mechanisms that increase the price of additional VMT (greater total increase in cost of driving will produce greater shifts in driving behavior resulting in greater VMT reduction):
    TLU Action 2.A.2 – Implement Congestion Pricing (*cross-referenced as TLU Action 1.D.5*)
    TLU Action 2.A.3 – Create a VMT-Based Insurance Premium Structure
    TLU Action 2.A.5 – Increase the State Gasoline Tax
    TLU Action 2.A.6 – Apply a Surcharge to High Carbon Fuels
    TLU Action 2.A.7 – Create Initiative to Reduce Availability of Free and Inexpensive Parking

6. Timeframe for Implementation: It would likely take a year or two to develop vehicle registration policies to implement this program.

7. Anticipated Timeframe of Outcome: Would expect to see near-term changes in VMT, which might increase over time as people make alternative home-work location choices.

Program Evaluation

1. Estimated $CO_2$ Emission Reductions:

| Action to Implement | $CO_2$ Emission Reductions ($MMTCO_2e$) |
|---|---|

| | 2012 | 2025 | 2050 |
|---|---|---|---|
| 2.7% reduction in total light duty VMT | 0.15 | 0.16 | 0.22 |
| 5% reduction in total light duty VMT | 0.28 | 0.30 | 0.41 |
| 7% reduction in total light duty VMT | 0.39 | 0.42 | 0.57 |

2. Economic Effects:
    a. Costs:
        i. Implementation Cost: Low (0-$2.5 million)
        ii. Timing: Constant / even
        iii. Impacts: State government
    a. Savings:
        i. Potential Economic Benefit: Moderate ($25 million to $125 million) to Moderately high ($125 million to $500 million)
        ii. Timing: Low short-term / mostly long-term
        iii. Impacts: Evenly distributed

3. Other Benefits/Impacts:
    a. *Environmental*: This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend. In addition, there would be reduced noise pollution as well.
    b. *Health*: Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.
    c. *Social*: By increasing the cost of vehicle ownership and use, this measure – depending on the premium structure – could adversely affect individuals who cannot, or choose not to, use public transportation, or who otherwise cannot reduce their VMT. However, those who drive very little could see a reduced vehicle registration cost that more accurately reflects their impact on the transportation system.
    d. *Other:*

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):
    a. *Technical*: There are no technical barriers or challenges to implementing this measure.
    b. *Economic*: This measure will have economic impacts on individual consumers, though those impacts may be reduced for many as a result of behavior modification/reduced VMT.
    c. *Statutory/Regulatory:*
    d. *Social*: There would be social resistance to the increased costs, especially without alternative transportation modes.

5. Other Factors of Note: None

6. Level of Group Interest: High. The working group considered this an essential action to undertake in the mid-term to achieve significant reductions in $CO_2$ emissions from the transportation and land use sector (implemented once other actions to provide alternative travel and location options through compact development were in place).

7. References:

**TLU Action 2.A.5 – Increase the State Gasoline Tax**

Summary

Increase New Hampshire's gasoline tax (and consequently the price of gasoline) by a substantial amount – on the order of $1 to 2 per gallon – to increase the cost of driving and encourage behavior modifications to reduce vehicle miles traveled (VMT). Such modifications could take the form of fewer trips, shorter trips, and increased use of carpooling and public transportation. The current gasoline tax of $0.18 per gallon is not indexed to inflation and has not been changed since 1991.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): An increase in the gasoline tax would make driving more expensive and be a disincentive for excessive, unnecessary, and inefficient travel. A higher gas tax would also serve as a way to capture the true social, economic, and environmental costs of over-reliance on single-occupant vehicles and increasing per capita VMT. A substantial increase in the gas tax would be required to produce the desired level of VMT reductions that could occur from changes in driver behavior and choice of home/work locations.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* Legislative amendment of RSA 260:32.
    b. *Resources Required:* Analysis to determine appropriate gasoline tax to promote behavior modification and thereby reduce VMT (and to achieve other co-benefits discussed below); possible state staff support for legislative action.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Political

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* Legislature
    b. *Parties Paying for Implementation:* Consumers of gasoline
    c. *Parties Benefiting from Implementation:* All of New Hampshire, as a result of reduced GHGs, reduced VMT, reduced demands on highway infrastructure, and increased revenues to maintain existing roads and bridge infrastructure.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*): None.

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):
    a. *Existing:* This action will generate additional, much-needed revenues to fix and maintain existing roads and bridges, thereby avoiding the GHG impacts associated with major overhauls required by deferred maintenance.
    b. *Proposed:* This action will generate additional revenues which, with the amendment of Article 6-a of the N.H. Constitution (see TLU 2B2c), would provide much-needed funding support for public transportation. Enhanced public transportation would provide greater opportunity for behavior modification that reduces VMT and GHG emissions.

6. Timeframe for Implementation: Timeframe for implementation will be tied to the legislative process.

7. Anticipated Timeframe of Outcome: Behavior changes would be expected immediately, with the potential for greater reductions in travel over the long-term as people make alternative location choices regarding where they live and work to reduce travel costs.

Program Evaluation

1. Estimated $CO_2$ Emission Reductions:
    a. Short-term (2012): 0.22 $MMTCO_2e$ /year
    b. Medium-term (2025): 0.67 $MMTCO_2e$ /year
    c. Long-term (2050): 1.47 $MMTCO_2e$ /year

2. Economic Effects:
    a. Costs:
        i. Implementation Cost: High ($500 million to $1 billion)
        ii. Timing: Constant / even
        iii. Impacts: Evenly distributed
    b. Savings:
        i. Potential Economic Benefit: Very high (Greater than $1 billion)
        ii. Timing: Constant / even
        iii. Impacts: Evenly distributed

3. Other Benefits/Impacts:
    a. *Environmental*: This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend. In addition, there would be reduced noise pollution as well. If, however, enhanced revenues were used to support expansion and construction of new roads, these benefits could be lost and VMT and associated GHGs could actually increase.
    b. *Health*: Reduced Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.
    c. *Social*: Enhanced revenues will help the State implement a "fix it first" policy of fixing and maintaining existing roads and bridges. With amendment of Article 6-a of the Constitution, these enhanced revenues also could help support public transit, thereby providing greater transportation choice and helping to meet the needs of the growing elderly population and individuals who cannot afford a personal vehicle. By increasing the cost of gasoline, this measure may – depending on the size of the gas-tax increase – adversely affect individuals who cannot, or choose not to, use public transportation, or who otherwise cannot reduce their VMT.
    d. *Other:*

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):
    a. *Technical*: There are no technical barriers or challenges to implementing this measure.
    b. *Economic*: This measure will have economic impacts on individual consumers of gasoline, though those impacts may be reduced for many as a result of behavior modification/reduced VMT. This

measure will create economic opportunities for the State by generating additional, much-needed revenues to fix and maintain existing roads and bridges.

c. *Statutory/Regulatory*: Increasing the gasoline tax will involve political challenges

d. *Social*: There would be social resistance to increasing the gas tax

5. Other Factors of Note:

6. Level of Group Interest: Low. The working group, recognizing the political infeasibility of increasing the gas tax enough to have a significant impact on driving behavior (on the order of $1 to$2 or more dollars), considered this a supporting action to undertake in the long-term, as an additional incentive mechanism after other actions to provide alternative transportation options and encourage compact development.

7. References:

**TLU Action 2.A.6 – Apply a Surcharge to High-Carbon Fuels**

Summary

Apply a higher fuel tax to motor vehicle fuels that have a high carbon intensity[4] to make these fuels more costly to use, thus providing an incentive for development and use of advanced technologies and lower carbon fuels.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): Increasing the tax on high-carbon-intensity fuels to make them more expensive relative to lower-carbon fuels can create demand for, and thus supply of, cleaner fuels.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* legislation required
    b. *Resources Required*: funds for consultant to research carbon intensity of various fuels and state staff time to set tax levels.
    c. *Barriers to Address (especially for medium to low feasibility actions):* lack of low carbon fuel options for the transportation sector, lack of sufficient life-cycle data on many fuels to accurately determine carbon intensity

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* all fuel providers and users
    b. *Parties Paying for Implementation:* all fuel providers and users
    c. *Parties Benefiting from Implementation:* general public with reduced air pollution and GHG emissions

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):
    a. *Existing:*
    b. *Proposed:* TLU Action 1.A.3 – Adopt California Low Emission Vehicle (CALEV) Standards
    TLU Action 1.C.2 – Promote Advanced Technology Vehicles and Supporting Infrastructure
    GLU Action 4.1 – Revise State Vehicle Procurement Policy

6. Timeframe for Implementation: After 2015 or beyond. Alternative low carbon fuels must be available before a carbon surcharge is implemented.

7. Anticipated Timeframe of Outcome: 2025

Program Evaluation

1. Estimated $CO_2$ Emission Reduction: Not individually quantified.

2. Economic:
    a. Costs:
        i. Implementation Cost: Low (0-$2.5 million) (to be subject of study)
        ii. Timing:
        iii. Impacts:
    b. Savings:
        i. Potential Economic Benefit: Supporting mechanism; not individually quantified.

[4] Carbon intensity is defined as the relative amount of carbon emitted per unit of energy or fuel consumed.

ii. Timing:
iii. Impacts:

3. Other Benefits/Impacts:
    a. *Environmental*: As many alternative fuels also lower emissions of ozone pre-cursors and particulate emissions this action would reduce harm to vegetation from ozone, and reducing regional haze issues. This would also lead indirect effects on the fish and wildlife and the ecosystems upon which they depend.If, the surcharge revenues were used to support expansion of public transit, then VMT and associated GHGs emissions could decrease and these benefits could be increased.
    b. *Health*: The human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.
    c. *Social*: These additional revenues also could help support public transit, thereby providing greater transportation choice and helping to meet the needs of the growing elderly population and individuals who cannot afford a personal vehicle. There are added advantages through reduced dependence on foreign oil as well as regional economic development from new local fuels industry. However, by increasing the cost of gasoline, this measure may – depending on the size of the gas-tax increase – adversely affect individuals who cannot, or choose not to, use public transportation, or who otherwise cannot reduce their VMT.
    d. *Other:*

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):
    a. *Technical*: The available vehicle technology (e.g., batteries, fuel cells) are still developing, but the demand for LCFs that could be created through "disincentives" such as the added surcharge, could help to drive technological development by providing a guaranteed market. This surcharge could also drive development of advanced biofuels, which currently exist, but are not yet being produced on a commercial scale.
    b. *Economic*: This measure will have economic impacts on individual consumers of gasoline, though those impacts may be reduced for many as a result of behavior modification/reduced VMT. This measure will create economic opportunities for the State by generating additional, much-needed revenues to expand transit opportunities within New Hampshire and to other states.
    c. *Statutory/Regulatory*: Adding another fee will involve political challenges, and will require legislation to implement. Given level of support for climate change actions now this seems more likely to occur.
    d. *Social*: There would be social resistance to adding another "tax" but broad and increasing public support for addressing climate change and use of the revenues to expand transportation options could drive acceptance.

5. Other Factors of Note:

6. Level of Group Interest: Low. The working group recognized the need for substantial additional research on this action and considered this a supporting action to undertake in the long-term, as an additional incentive mechanism once other actions to encourage compact development were in place (i.e., supports other actions and/or achieves moderate reductions but not considered "essential" to achieve substantial $CO_2$ reductions from the transportation and land use sector)

7. References:

**TLU Action 2.A.7 – Create Initiative to Reduce Availability of Free and Inexpensive Parking**

Summary

Establish an initiative to reduce the availability of free and inexpensive parking. This action would create a disincentive for travel by single-occupancy vehicles and provide an incentive for greater use of public transportation to access services by making parking less readily available and/or more expensive. The result would be fewer vehicle miles traveled and more efficient location choices that facilitate access to activities and services with reduced need for individual vehicles and parking.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): With technical assistance from state government and regional planning agencies, municipalities would study and implement appropriate options for reducing the availability of free and inexpensive parking. The following are among the options to be considered:
    - Reduce parking requirements in zoning for new development under local planning board review.
    - Implement state or local level legislation requiring that all parking spaces be metered.
    - Impose an annual impact fee on businesses and institutions per parking space as an incentive to charge for and reduce parking.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* Local policy and/or regulatory/zoning changes, could require legislation or redirection of existing resources to fund technical assistance to implement
    b. *Resources Required:* Funding for technical assistance to municipalities
    c. *Barriers to Address (especially for medium to low feasibility actions):* Challenging to implement; there would be considerable social resistance

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* Municipalities, with assistance from regional planning commissions.
    b. *Parties Paying for Implementation:* Car owners.
    c. *Parties Benefiting from Implementation:* Transit providers.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):
    a. *Existing:* None
    b. *Proposed:* Other mechanisms that increase the price of additional VMT (greater total increase in cost of driving will produce greater shifts in driving behavior resulting in greater VMT reduction):
    TLU Action 2.A.2 – Implement Congestion Pricing (*cross-referenced as TLU Action 1.D.5*)
    TLU Action 2.A.3 – Create a VMT-Based Insurance Premium Structure
    TLU Action 2.A.4 – Implement VMT-Based Registration Fees
    TLU Action 2.A.5 – Increase the State Gasoline Tax
    TLU Action 2.A.6 – Apply a Surcharge to High Carbon Fuels

6. Timeframe for Implementation: Implement later once alternative transportation options are in place to further encourage changes in driving behavior.

7. Anticipated Timeframe of Outcome: Would take many years to change parking pricing and/or availability within municipalities and see associated reductions in VMT.

Program Evaluation

1. Estimated $CO_2$ Emission Reductions: Not individually quantified.

2. Economic Effects:
    a. Costs:
        i. Implementation Cost: Low (0-$2.5 million)
        ii. Timing: Immediate / higher upfront
        iii. Impacts:
    b. Savings:
        i. Potential Economic Benefit: Supporting mechanism; not individually quantifiable
        ii. Timing:
        iii. Impacts:

3. Other Benefits/Impacts:
    a. *Environmental*: This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend. In addition, there would be reduced noise pollution as well. If, however, enhanced revenues were used to support expansion and construction of new roads, these benefits could be lost and VMT and associated GHGs could actually increase.
    b. *Health*: Reduced Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.
    c. *Social*: By increasing the cost of vehicle use, this measure could adversely affect individuals who cannot, or choose not to, use public transportation, or who otherwise cannot avoid parking.
    d. *Other*

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):
    a. *Technical*: There are significant technical barriers and challenges to implementing this measure.
    b. *Economic*: This measure will have economic impacts on individual consumers, though those impacts may be reduced for many as a result of behavior modification/reduced VMT.
    c. *Statutory/Regulatory:*
    d. *Social*: There would be social resistance as this may be considered a burden in communities without viable transportation ecosystems.

5. Other Factors of Note:

6. Level of Group Interest: Moderate. Although this can be an effective action to motivating changes in driving behavior, because of the difficult nature of implementing this action, the working group considered this a supporting action to undertake in the long-term once alternative transportation options are in place and compact development options are supported (i.e., this supports other actions – enabling additional reductions, but is not considered "essential" to achieve substantial $CO_2$ reductions from the transportation and land use sector).

7. References:

**TLU Action 2.B.2.d – Implement Recommendations of I-93 Transit Investment Study**

Summary

Implement the recommendations of the I-93 Transit Investment Study, which NHDOT expects to finalize in the Summer of 2008. The I-93 Transit Investment Study is an effort to identify a long-term vision of transit investments that are needed and feasible to accommodate and diversify future travel demand in the I-93 corridor from Boston to Manchester. Rail, bus, and ridesharing strategies are being investigated to promote alternatives to single-occupant vehicle (SOV) travel within the corridor.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): The NH Department of Transportation is currently in the process of completing the I-93 Transit Investment Study. The study began in August 2006 and will be completed in the summer of 2008. The study will include three phases. Phase 1 will develop a Purpose and Need Statement, set goals and objectives, identify issues, develop and implement a Public Involvement Plan, collect and analyze data, and develop the initial alternatives. Phase 2 will include refining alternatives, developing draft recommendations, and developing the travel demand model and alternative analysis. Phase 3 will include developing and presenting a strategic plan. Successful completion of the I-93 Transit Investment Study will require the appropriate balance among three critical elements:
    - A multi-jurisdictional decision-making process, built on
    - Sound technical analysis, and informed by
    - An effective public/stakeholder involvement strategy.

2. Implementation Plan *(i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* The Department of Transportation and the Federal Highway Administration have authorized this study. Implementation of a selected alternative would require additional funding for construction of infrastructure to support the selected alternative.
    b. *Resources Required:* Policy implementation will require capital expenditure.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Public acceptance

3. Parties Affected by Implementation (i.e., residents, businesses, municipalities, etc.):
    a. *Parties Responsible for Implementation:* State DOT and FHWA, in coordination with Public Safety (State Police)
    b. *Parties Paying for Implementation:* NHDOT / NH Rail Authority
    c. *Parties Benefiting from Implementation:* Commuters using the selected alternative, drivers enjoying reduced levels of congestion.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*): Existing Bus service on I-93.

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):
    a. *Existing:* Park-and-ride facilities that encourage use of bus services.
    b. *Proposed:* Expanded park-and-ride facilities and increased bus services*;* all TLU 2A and 2B actions.

6. Timeframe for Implementation: Dependent on the alternative selected.

- Bus on shoulder, 6-12 months.
- Commuter rail on Manchester and Lawrence (M & L) Branch, several years.

7. Anticipated Timeframe of Outcome: Immediate effect upon implementation; growing impact over time.

Program Evaluation

1. Estimated $CO_2$ Emission Reductions:
    a. Short-term (2012): 0.12 $MMTCO_2e$ /year
    b. Medium-term (2025): 0.13 $MMTCO_2e$ /year
    c. Long-term (2050): 0.17 $MMTCO_2e$ /year

2. Economic Effects:
    a. Costs:
        i. Implementation Cost: Moderately high ($125 million to $500 million)
        ii. Timing: Immediate / higher initial costs
        iii. Impacts: Evenly distributed
    b. Savings:
        i. Potential Economic Benefit: Moderate ($25 million to $125 million)
        ii. Timing: Low short-term/Mostly long-term
        iii. Impacts: Consumer

3. Other Benefits/Impacts:

    See Litman, Todd. *Evaluating Public Transit Benefits and Costs: Best Practices Guidebook,* Victoria Transport Policy Institute, January 2008. Table 3.1 provides a listing of potential social costs and benefits associated with transit investments, including (among others) mobility and travel efficiency improvements, health benefits, and economic development gains. He estimates a benefit/cost ratio of 1.8 for current bus service for a case study analysis of a medium-sized city (p.84).

    The alternatives available within the I-93 Transit Investment Study, when compared to each other, all have a range of benefits. These benefits that are achievable are relatively cost-effective, and reasonable with the conservation of the environment in mind, however, not all the alternatives pose the same benefits. Bus related alternatives are fairly less costly to implement when compared to some of the other alternatives such as rail or a dedicated HOV lane. However, bus alternatives are far more limited in passenger capacities when compared to a rail transit alternative. Nevertheless, all the alternatives have a common purpose that results very similar benefits. The direct benefits include reduced travel times, which results reduce vehicle emissions, and increased service reliability. Indirect benefits may include reduced highway congestion, increased transit service, increased transit patronage, and decreased operational costs.

    a. Environmental: This action would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.

    b. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.

    c. *Social*: Increased opportunity for transit to and from Boston metro; reduced travel time using transit.

d. *Other:*

4. Potential for Implementation:
    a. *Technical*: Minimal technical challenges.
    b. Economic: There is significant cost associated with this measure.
    c. Statutory/Regulatory: No Statutory Changes anticipated (except perhaps for funding); regulatory approvals required.
    d. *Social*: acceptance requires the encouragement of transit use.

5. Other Factors of Note:

6. Level of Group Interest: High. The working group considered this an essential action to undertake in the near-term to achieve significant reductions in $CO_2$ emissions from the transportation and land use sector.

7. References:
    - http://www.i93transit.org/.
    - Litman, Todd. *Evaluating Public Transit Benefits and Costs: Best Practices Guidebook,* Victoria Transport Policy Institute, January 2008.

**TLU Action 2.B.2.f – Provide Support to Transportation Management Associations**

Summary

Provide state-funded technical and financial support to establish and operate Transportation Management Associations (TMAs) in major employment centers/areas within New Hampshire. A Transportation Management Association is a collective non-profit organization of private corporations and public agencies working to reduce traffic congestion, improve mobility and air quality, and educate employers and their employees about transportation alternatives. TMAs can be appropriate vehicles for promoting Commuter Trip Reduction Programs with employers (TLU Action 2.A.1) and establishing/improving local/intra-regional bus services (TLU Actions 2.B.1.a and 2.B.1.b).

Program Description

1. Mechanism (i.e., how the policy or program achieves the desired result): Funding would be provided directly to established transportation management associations or to the regional planning commissions to initiate and support the formation of TMAs in major employment centers/areas within the state (e.g., southern NH, central NH, coastal NH, Keene, Hanover/Lebanon). Membership in a TMA would be open to all companies or agencies, public or private, located in the target area and would be expected to include a variety of private sector businesses, management companies, developers, and transportation professionals, as well as public agencies and local government entities. TMAs can be used to promote commuter trip reduction programs with employers (TLU Action 2.A.1) and to support establishment and/or improvements of local/intra-regional bus services (TLU Actions 2.B.1.a and 2.B.1.b).

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* Legislative action to dedicated financial support for TMAs or redirect current state spending within NHDOT. If a TMA does not currently exist, a Metropolitan Planning Organization, Regional Planning Commission, or local municipality will be identified to initiate formation of TMAs within major employment centers/regions with support from NHDOT staff.
    b. *Resources Require:* Funding at significant level per TMA. NHDOT staff time and marketing expenses.
    c. *Barriers to Address (especially for medium to low feasibility actions):* May be difficult to entice area employers to participate.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* NHDOT, Metropolitan Planning Organizations, Regional Planning Commissions, and local municipalities can initiate formation of TMAs within major employment centers.
    b. *Parties Paying for Implementation:* NH government and local business sponsors
    c. *Parties Benefiting from Implementation:*
        - Commuters – increased travel options
        - Employers – can increase labor availability by reducing constraints to travel

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies *(i.e., those that achieve greater reductions through parallel implementation):*
    a. Establishment and enhancement of local/intra-regional transit service and park-and-rides.
    b. Policies that increase the cost of using a vehicle for travel (e.g., increased gas prices, higher parking charges, VMT-based insurance and/or registration).
    c. Programs that promote carpool/vanpools: Rideshare program, commuter-trip reduction programs by businesses, and Transportation Management Associations.

6. Timeframe for Implementation: May be a longer-term (future) implementation option, there can be significant barriers to implementation (e.g., how to get employers to participate) unless initiated by local employers.

7. Anticipated Timeframe of Outcome:

Program Evaluation

1. Estimated $CO_2$ Emission Reductions: Not individually quantified.

2. Economic Effects:
    a. Costs:
        i. Implementation Cost: Low (0-$2.5 million)
        ii. Timing: Constant / Even
        iii. Impacts: State government
    b. Savings:
        i. Potential Economic Benefit: Supporting mechanism; not individually quantifiable
        ii. Timing:
        iii. Impacts: Evenly distributed

3. Other Benefits/Impacts:
    a. *Environmental*: This action would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.
    b. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.
    c. *Social:* Methods of reducing energy and alternative generation technologies typically have short-term payback periods and can then provide savings for consumers and economic security for the State in the mid to long-term. By producing energy sustainably and domestically, the economy will benefit through increased jobs within the state.
    d. *Other:*

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):
    a. *Technical:* High, particularly where TMAs currently exist.
    b. *Economic:* Costs will be a factor that must be addressed.
    c. *Statutory/Regulatory:* Legislative action possible required to direct funding.
    d. *Social:* It may be challenging to entice employers to participate in the program.

5. Other Factors of Note: Has been successful in certain areas – Massachusetts, NH Upper Valley (with strong sponsorship by Dartmouth College and Dartmouth-Hitchcock Hospital). Several areas in NH have struggled to form and/or maintain effective TMAs (Concord area, Portsmouth area, Keene).

6. Level of Group Interest: Moderate. The working group considered this a supporting action to undertake in the mid-term (early 2015), following efforts to increase funding for and expand public transportation to provide additional travel options ("supporting actions" support other actions and/or achieves moderate reductions but not considered "essential" to achieve substantial $CO_2$ reductions from the transportation and land use sector).

7. References:

**TLU Action 2.B.2.g – Expand Inter-City Bus Service**

Summary

Increase access to inter-city bus service for connections in New Hampshire to reduce vehicle travel associated with longer-distance, in-state trips and to help more passengers make connections with other non-vehicle travel modes (e.g., air, rail) for out-of-state travel. Expand inter-city bus service to 1) provide service (within 10 miles) to all communities of greater than 5,000 population and along corridors with 10,000+ average daily traffic, 2) provide service to key destinations (e.g., Manchester airport), and 3) provide connections between significant economic centers in New Hampshire and to areas that develop with sufficient density and uses as to make transit service practicable.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): Current inter-city bus service in New Hampshire focuses on connections to Boston. Increased access to inter-city bus service for connections within New Hampshire would reduce vehicle travel associated with longer-distance, in-state trips and would help connect more passengers to other non-vehicle travel modes (e.g., air, rail) for out-of-state travel. It is assumed that new inter-city bus service would be introduced at a minimum level of service (e.g., 2 roundtrips per day) and supported by the necessary marketing/promotion. The level of service would be increased over time to increase ridership.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* NHDOT and commercial bus companies work together to identify new routes, provide infrastructure and put service agreements in place.
    b. *Resources Required:*
        - NHDOT staff time (may require additional staff to establish service)
        - Funding to conduct required studies
        - Capital investment in infrastructure (e.g., buses, terminals)
        - Operating subsidy
    c. *Barriers to Address (especially for medium to low feasibility actions):* Requires significant public investment and potential operating subsidy in the near term.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* NHDOT and commercial bus carriers
    b. *Parties Paying for Implementation:* NH government, passengers using service (possibly Federal subsidy/funding available also).
    c. *Parties Benefiting from Implementation:*
        - NH population as a whole benefits from reduced vehicle travel and air pollution
        - NH population benefits from improved access to bus service for longer-distance travel (potential individual cost savings for such travel)
        - NH "transit needy" residents are better served (including disabled and economically disadvantaged populations)

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*): Including new services to begin in 2008, New Hampshire currently has some level of inter-city bus service connecting about 21 locations, with approximately 60-65 round trips per day (predominantly with service to Boston), and

an estimated annual ridership of about 1.5 million passenger trips (one-way). Policies to sustain and improve current service can help support extension of service to additional routes.

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):
    a. Policies that provide funding to support bus, rail, and bike/pedestrian transportation improvements (see Action 2.C.2.c discussion on options for dedicated funding for public transit).
    b. Provision of an adequate number and sized park-and-ride facilities is an essential component of successful inter-city bus service in a rural/suburban area such as NH.
    c. Enhancement of inter-city bus service (e.g., increased service, terminals, improved marketing/informational resources).
    d. Establishment and enhancement of local transit service and additional rural "feeder" services to connect riders to inter-city service.
    e. Establishment of additional intermodal centers connecting inter-city bus service to local bus service and rail, when available.
    f. Compact, mixed-use, walkable development in the vicinity of transit access points can facilitate further reductions in VMT (eliminating additional travel by having access to other needs as well as transit) and increase access of residents to inter-city transit service.
    g. Policies that increase the cost of using a vehicle for travel (e.g., increased gas prices, higher parking charges, VMT-based insurance and/or registration).

6. Timeframe for Implementation: New services could be phased in over time beginning in 2010-2012 as state funding becomes available (could possibly be matched with federal funding). Implementing service connecting the seacoast (Dover/Portsmouth) and Manchester airport as well as adding stops on existing North-South routes to Manchester airport would be initial priorities. New intercity-bus service could continue to be added for additional corridors as those areas develop with adequate population and compact development to support transit service.

7. Anticipated Timeframe of Outcome: Reductions in VMT would be realized as soon as new service is implemented, and would be expected to increase over time as service is improved and marketed and complementary policies put in place to increase ridership.

<u>Program Evaluation</u>

1. Estimated $CO_2$ Emission Reduction: Quantified together with TLU Action 2.B.1.h

2. Economic Effects:
    a. Costs:
        i. Implementation Cost: Moderately low ($2.5 million to $25 million)
        ii. Timing: Constant / even
        iii. Impacts: Consumer – evenly distributed
    b. Savings:
        i. Potential Economic Benefit: Moderately low ($2.5 million to $25 million)
        ii. Timing: Constant / even
        iii. Impacts: Consumer - evenly distributed

3. Other Benefits/Impacts:

   See Litman, Todd. *Evaluating Public Transit Benefits and Costs: Best Practices Guidebook,* Victoria Transport Policy Institute, January 2008. Table 3.1 provides a listing of potential social costs and benefits associated with transit investments, including (among others) mobility and travel efficiency improvements, health benefits, and economic development gains. He estimates a benefit/cost ratio of 1.8 for current bus service for a case study analysis of a medium-sized city (p.84).

   a. *Environmental*: This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.

   b. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease. It may also increase use of more active travel modes (walk/bike) for part of trip, improving health of individuals.

   c. *Social:* Improved mobility for "transit needy" populations (increased need for travel alternatives from rural areas with rising gas prices). Rural connection provides a benefit to the long-distance commuter and those seeking services (e.g., medical services). Important component of balanced, multi-modal transportation system.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):

   a. *Technical:* Moderate. NHDOT has successfully worked with service providers to establish new bus service elsewhere in NH, however, bus companies have to be interested.

   b. *Economic:* Moderate / low. Adequate funding is a challenge (NH currently lacks sufficient funds for matching federal $ available for transit). Requires new, sustainable funding source to establish and maintain service.

   c. *Statutory/Regulatory:* Moderate / low. Likely requires legislative action to secure required funding.

   d. *Social:* Moderate. Marketing required to generate ridership (e.g., educate public on availability, convenience, access to system, benefits) and reduce view of bus travel as inferior to SOV travel.

5. Other Factors of Note:

   Although this action by itself was estimated to result in relatively small reductions in VMT (because of the focus on providing service to more rural areas and the very low assumptions regarding % of population utilizing the new service), there are substantially greater reductions available in expanding inter-city bus service as part of a comprehensive multi-modal transportation investment program. Complementary policies that facilitate people making use of inter-city bus service (such as local transit to allow them to easily reach their final destination) could result in substantially higher levels of ridership.

   The action is based on a NHDOT 2003 study, which found that just six towns over 5,000 population are ten miles or more from existing intercity service (based on 2000 Census data). About 20 towns with populations between 2,000-4,999 are more than 10 miles from existing service. NHDOT 2003 identified several travel corridors with greater than 10,000 ADT, including Route 101 from Milford to Hampton, Route 108 between Exeter and Dover, and Route 125 from Epping to Lee (as well as other localized road portions). NHDOT 2003 also identified a lack of service between various points in New Hampshire to Manchester Airport, Intercity passenger rail, and major medical facilities. From this assessment, NHDOT 2003 analyzed nine options to provide service to unserved corridors in the southwest (Keene to Manchester), southeast (Dover to

Manchester), north (Colebrook to Littleton), and lakes region (Wolfeboro/West Ossipee to Dover), estimating ridership, revenue and estimated deficit (subsidy required). Service north of Concord and Dover and west of Nashua are likely to require significant public subsidy to maintain.

6. Level of Group Interest: High. The working group considered this an essential action to undertake in the mid-term to achieve significant reductions in $CO_2$ emissions from the transportation and land use sector.

7. References:


- NHDOT, Draft Final Bus Transit Needs and Benefits Analysis for Long-Range Transportation Plan – Technical Memo, 2008.
- NH Department of Transportation, NH Statewide Intermodal Transportation Planning Study, Final Report, December 2003.
- Carroll County, *NH Transit Operations Expansion, Final Report*. Community Transportation Association of America, November 1, 2007.
- Greater Derry Greater Salem Regional Transportation Council, Rockingham Planning Commission, Southern NH Planning Commission, and Nashua Regional Planning Commission, *Greater Derry Greater Salem Regional Transit Plan*, 2003.
- Nashua Regional Planning Commission, *Transit Plan for the Nashua Region.* December 2003.
- Cooperative Alliance for Seacoast Transportation, www.COASTbus.org, website for bus service to several routes throughout the coastal region of New Hampshire.
- Rockingham Planning Commission and Southern New Hampshire Planning Commission, *Portsmouth-Manchester Airport Bus Feasibility Study – Draft Final Report,* December 2007.

**TLU Action 2.C.4 – Use State Funding and Grants to Encourage Low-Greenhouse Gas-Impact Development**

Summary

Through the provision of state funding and grants, encourage municipalities to adopt changes in local land use zoning regulations to promote low-GHG-Impact development (e.g., by adopting standards proposed by TLU Actions 2.C.2 and 2.C.3). Municipalities that adopt appropriate land use regulations would be given priority under existing state funding and grant programs by adding new criteria to competitive grant evaluations and/or by requiring establishment of low-GHG-impact development zones as a prerequisite for funding.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): This action is an incentive program to encourage cities and towns to adopt local zoning and development regulations that provide for low-GHG-impact development (i.e., higher-density, compact, mixed-use, walkable areas). To be successful, this program would depend on other initiatives to educate communities on the benefits of low-GHG-impact development and provide assistance to revise local zoning and development regulations. This program is just one of several proposed actions directed toward promoting low-GHG-impact development in New Hampshire communities.

   The mechanics of the incentives would depend on the grant/funding programs that the incentives are tied to. For instance, some grants could set low-GHG-impact development as a prerequisite for funding approval. Others, more tangentially related to climate change, could establish "bonus-points" for low-GHG-impact development in reviewing and scoring applications (under a competitive grant process).

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
   a. *Method of Establishment (e.g., legislation, executive order):* Depending on the existing grant program, and the statutes and administrative rules that govern the program, this may or may not require new legislation and/or revisions to administrative rules to add this incentive based evaluation criteria to each of the individual grant or funding programs.
   b. *Resources Required:* Primarily existing staff time for those programs that will need changes in legislation or administrative rules. Providing coordination of the changes across programs by one staff person would facilitate the process and reduce total staff burden. New staff could be necessary if broader changes are pursued (e.g., pooling grant funds and prioritizing/review by a single office such as the MA Commonwealth Capital program).
   c. *Barriers to Address (especially for medium to low feasibility actions):* Ideally, the barriers should be minimal as this is simply adding a single new evaluation criteria to existing grant and funding programs.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
   a. *Parties Responsible for Implementation:* Primary responsible parties – state agencies and legislature. Secondary responsible parties – municipalities
   b. *Parties Paying for Implementation:* It is assumed here that staff time to amend programs and amend rules would be borne by the agency administering the grant or other funding mechanism.
   c. *Parties Benefiting from Implementation:* Ultimately the direct beneficiaries are those communities and locals that implement Low GHG-Impact Development and are recipients of funds or grants from those programs amended to target awards to such locations. Indirectly, where the incentive spurs Low GHG-Impact Development everyone enjoys the benefits of reduced greenhouse gas emissions.

4. Related Existing Policies and Programs: Some existing grant and funding programs related to planning, transportation and infrastructure that might be considered sources to implement this initiative through include:

    - Community Development Block Grants
    - Economic Development Assistance Grants
    - Federal Aid Highway Grants – CMAQ, TE, and others
    - Community Technical Assistance Program (I-93 and NH Estuary Project)
    - Housing and Conservation Planning Program
    - Watershed Restoration/Assistance Grants
    - Alternative Fuel Vehicles and Fueling Infrastructure
    - Brownfields Assessment Grants
    - Coastal Competitive Grants
    - Drinking Water Source Protection
    - Drinking Water Supply Land Grant
    - Public Water Supply
    - Wastewater Treatment Revolving Loan Fund
    - Regional Environmental Planning Program

    *Note:* This is not to be construed as an exhaustive list; nor is it appropriate to apply this action item to all state funding programs. Additionally, this list does not guarantee that any given program can be modified as is proposed by this implementation action given the particular intricacies of the individual programs (e.g., Federal program requirements/restrictions). Some state programs already have incorporated some consideration of "smart growth principles" in the evaluation of applications.

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):

    a. *Existing:*

        - OEP's Housing and Conservation Planning Program (HCPP) provides grant funds to municipalities to plan for housing and conservation in a unified manner. The funds may be used for data collection and mapping, visioning, master plan updates, and zoning and regulation updates. In other words, grant funds to perform the basic work needed for municipalities to utilize the incentive this action intends to implement.
        - The "***Innovative Land Use Planning Techniques: A Handbook for Sustainable Development***" prepared by the nine regional planning commissions through their Regional Environmental Planning Program (REPP) grant funds from DES, provides several model ordinances including an energy efficient development ordinance that could be utilized by municipalities to establish Low GHG-Impact Development areas.
        - RSA 9-B:2 states: "It shall be the policy of the state of New Hampshire that state agencies act in ways that encourage smart growth." (See RSA 9-B:4 for a list of smart growth policy statements).
        - RSA 9-B:6 requires the Council on Resources and Development to evaluate state agency compliance with the smart growth policy including (but not limited to):
            - Progress in complying with expenditure requirements of RSA 9-B:4
            - Progress in coordinating agency activities to encourage smart growth
            - Efforts to encourage smart growth development within agency operating procedures, granting policies, and regulatory framework.

b. *Proposed:*

- TLU Action 2.C.2 – Develop Model Zoning to Support Bus/Rail Transit. Such an effort could serve as a model low-GHG-impact development standard/mechanism.
- TLU Action 2.C.3 – Develop Model Zoning for Higher-Density, Mixed-Use Development. Such an effort could serve as a model low-GHG-impact development standard/mechanism.
- TLU Action 2.C.8 – Continue/Expand Funding, Education, and Technical Assistance to Municipalities. Such education and outreach would be necessary to provide a base of information to promote and institute low-GHG-impact development through the proposed program.

6. Timeframe for Implementation: One to two years should be allocated to successfully implement this action. Time will be needed to evaluate existing grant and funding programs, identify and detail changes that need to be made, and then proceed through either (or possibly both) the legislative process or the administrative rules making process. The working group suggests implementing this action in the early-mid-term (2012-2015), to allow municipalities the opportunity to respond to other technical assistance and incentives provided under other actions to adjust their zoning in preparation for and response to the expected altering of state funding criteria.

7. Anticipated Timeframe of Outcome: Long-term, allowing for communities to institute Low GHG-Impact Development and state agencies to amend their grant programs. In theory, while the municipality can be instituting Low GHG-Impact Development simultaneous to grant and funding programmatic changes being implemented, many communities may not be spurred into action until after the incentives are in place, thus pushing the action's anticipated timeframe to see true positive outcomes further out.

<u>Program Evaluation</u>

1. Estimated $CO_2$ Emission Reduction: Not individually quantified.

2. Economic Effects:
    a. Costs:
        i. Implementation Cost: Low (0-$2.5 million)
        ii. Timing: Immediate / higher initial costs
        iii. Impacts: State government
    b. Savings:
        i. Potential Economic Benefit: Supporting mechanism only
        ii. Timing of Benefits:
        iii. Impacts:

3. Other Benefits/Impacts: Any additional benefits would be secondary ones derived from the development behavior induced through the grant and funding incentive.
    a. *Environmental*: Focusing development in already developed areas generally reduces the negative environmental impacts. It would also reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.
    b. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days.

Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease. It would lower GHG-impact development forms facilitate walking, increasing personal health

c. *Social*: Compact, mixed-use, walkable development supports increased economic activity and community vitality (e.g., citizen interaction)

d. *Other*

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):

   a. *Technical*: The technical resources and expertise required to implement this action already exist.

   b. *Economic*: This action theoretically does not require additional costs to implement beyond updates to existing programs. However, it will require additional staff time to be devoted to program updates and development that may not have ordinarily been budgeted. This action item ultimately provides an economic incentive to promote Low GHG-Impact Development.

   c. *Statutory/Regulatory*: This action will in some instances require statutory changes and updates to administrative rules.

   d. *Social*: Current development trends have been leaning more toward "green" design and energy efficiency. This may be easily supportable mechanism to promote such development.

5. Other Factors of Note: Massachusetts, as part of its Clean Energy and Smart Growth-Smart Energy initiative, aimed at promoting sustainable development, maximizing energy efficiency, growing the clean energy sector, and reducing the state's environmental footprint, has developed and implemented Commonwealth Capital. This policy, through a set scoring system, endorses municipal planning and zoning measures that are consistent with the state's Sustainable Development Principles and encourages municipalities to implement them by linking state spending programs to the municipal land use practices endorsed through the program. During 2008, eleven state grant programs based funding upon municipal Capital Commonwealth scores (an additional four grant programs are proposed to be added in 2009). For more information visit the Commonwealth Capital website at www.mass.gov/commcap.

6. Level of Group Interest: High. The working group considered this an essential action to undertake in the early mid-term (2012) to achieve significant reductions in $CO_2$ emissions from the transportation and land use sector.

7. References:

**TLU Action 2.C.5 – Enable/Apply a Two-Rate Tax Structure Based on GHG Impacts**

Summary

Create a tax structure that enables municipalities to reduce the tax burden on new development located in areas having lower GHG-impacts (e.g., higher-density, mixed-use areas served by public transit) and utilizing GHG-reducing features (e.g., walkable, energy-efficient design) as a means of encouraging this type of development. Alternatively (or additionally), apply a lower tax rate to new/existing development located in areas meeting specified criteria and/or incorporating certain GHG-reducing features. The adjusted tax rates would reflect the higher costs of municipal services and ecosystem impacts associated with sprawl development and the lower costs associated with more efficient development. The tax rate adjustments would complement (one-time) GHG-based impact fees by offering a recurring (annual) cost/benefit to property owners/buyers that is directly related to the choice of development type and location.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): Tax relief could be permanent or temporary. This action could be implemented in similar fashion to RSA 79-E, which authorizes municipalities to provide temporary tax relief for substantial rehabilitation of existing buildings in downtowns and community centers, upon request of the applicant and when certain conditions are met. Under this action, any development within a designated area and/or incorporating certain GHG-reducing features could be eligible for temporary (or permanent) tax relief. Similarly, municipalities could be authorized to apply a higher tax rate to new development located outside the targeted area (a permanent version of an impact fee; see TLU Action 2.C.1a). Alternatively (or additionally) tax relief could be provided by state and local government for new and/or existing development meeting specified criteria (could be linked to TLU Actions 2.C.2 and 2.C.3).

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. Method of Establishment (e.g., legislation, executive order): Legislative authorization and local/municipal adoption.
    b. *Resources Required:* Resources for analysis to develop program, some increased administrative burden to state and/or local government with implementation.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Public acceptance of preferential tax treatment, potential increase in tax burden on other property

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* State government and legislature; municipalities.
    b. *Parties Paying for Implementation:* State and local government (to develop and implement program); other tax payers (through reduced tax revenues from targeted development)
    c. *Parties Benefiting from Implementation:* Landowners/developers within designated areas; communities trying to encourage downtown revitalization

4. Related Existing Policies and Programs: RSA 79-E, *Community Revitalization Tax Relief Incentive*

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):
    a. *Existing:*
    b. *Proposed:* Other policies that reduce the cost of low-GHG impact location decisions (e.g, location-efficient mortgages, GHG-based impact fees).

6. Timeframe for Implementation: Subject to legislative process – likely 2 years. Because of the need for substantial study and research to implement (and likely public resistance), the working group suggests

deferring implementation of this action to later years. This timing also allows other policies designed to create incentives and support alternative development location choices to be implemented in advance of "pricing" changes.

7. Anticipated Timeframe of Outcome: Although would expect to see immediate changes in some development decisions, the full effect would be realized over time as future investment and development occurs and ultimately creates a different future land use pattern than under the status quo.

Program Evaluation

1. Estimated $CO_2$ Emission Reduction: Not individually quantified.

2. Economic Effects:
    a. Costs:
        i. Implementation Cost: Low (0-$2.5 million)
        ii. Timing: Immediate / higher initial cost
        iii. Impacts: State government
    b. Savings:
        i. Potential Economic Benefit: Supporting mechanism only
        ii. Timing of Benefits:
        iii. Impacts:

3. Other Benefits/Impacts:
    a. *Environmental*: Focusing development in already developed areas generally reduces the negative environmental impacts
    b. *Health*: Low GHG-impact development forms facilitate walking, increasing personal health
    c. *Social*: Compact, mixed-use, walkable development supports increased economic activity and community vitality (e.g., citizen interaction)
    d. *Other:*

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):
    a. *Technical*: Conceptually easy, but details to implement could be challenging.
    b. *Economic*: Unsure of economic implications (requires further study).
    c. *Statutory/Regulatory*: Very difficult to change tax structure at state level, difficult to implement as enabling legislation, particularly without supporting research.
    d. *Social*: Could face significant public resistance.

5. Other Factors of Note: This dual tax strategy is based on the well established concept of a *Pigouvian tax* (after economist Arthur Cecil Pigou) levied to correct the negative externalities of a market activity. As proposed here for property taxes, Pigovian taxes are widely levied on polluters to encourage them to reduce pollution and to provide revenue to counteract the negative effects of the pollution.

6. Level of Group Interest: Low. The working group recognized the need for substantial additional research on this action and considered this a supporting action to undertake in the long-term, as an additional incentive mechanism once other actions to encourage compact development were in place (i.e., supports other actions and/or achieves moderate reductions but not considered "essential" to achieve substantial $CO_2$ reductions from the transportation and land use sector)

7. References:

**TLU Action 2.C.6 – Promote Availability and Use of Location Efficient Mortgages**

Summary

Explore the potential to expand the availability of Location Efficient Mortgages (LEMs), which are designed to recognize the reduced transportation costs associated with living in compact, mixed-used, walkable areas and/or availability of public transportation. LEMs provide a financial incentive for homeowners to locate in such areas and, consequently, provide support to developers who undertake projects of this type. By assigning economic value to efficient development, LEMs promote affordable living in close proximity to work and services.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): Location Efficient Mortgages typically require a smaller down payment, competitive interest rates, and/or more flexible criteria for financial qualification to encourage homeownership in qualifying areas. In doing so, LEMs provide an incentive for homeowners to locate in qualifying areas and an incentive for development in areas having reduced GHG impacts. The financial benefits of LEMs increase the affordability of living in close proximity to work and services and contribute to reduced VMT in comparison with the travel needs of similar households located farther out.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* State government could work with select banking institutions to evaluate the potential applicability of this technique within NH. If appropriate, these entities would then work to establish and publicize an LEM program.
    b. *Resources Required:* Staff time to explore opportunities and work with state mortgage providers.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Potential reduced applicability in New Hampshire due to lower-availability of transit.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* Mortgage providers
    b. *Parties Paying for Implementation:* State government, mortgage providers
    c. Parties Benefiting from Implementation: Home purchasers/borrowers

4. Related Existing Policies and Programs:

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):
    a. *Existing:*
    b. *Proposed:* Proposed legislation at the Federal level may increase the availability of this product through national entities (Freddie Mae, Freddie Mac). Tax policies that reduce the cost of low-GHG impact location decisions (e.g., two-rate tax structure, GHG-based impact fees).

6. Timeframe for Implementation: Could be implemented in a relatively short time frame, provided NH mortgage providers are receptive. Likely more effective once other actions to increase availability of local transit and "in-town" housing are implemented. Proposed for mid/late-term implementation.

7. Anticipated Timeframe of Outcome: Full effect of this action would not be felt for many years, but could help shape future land use development patterns to reduce travel demand.

Program Evaluation

1. Estimated $CO_2$ Emission Reduction: Not individually quantified.

2. Economic Effects:
    a. Costs:
        i. Implementation Cost: Low (0-$2.5 million)
        ii. Timing: Constant / even
        iii. Impacts: State government
    b. Savings:
        i. Potential Economic Benefit: Supporting mechanism only
        ii. Timing:
        iii. Impacts:

3. Other Benefits/Impacts:
    a. *Environmental*: Focusing development in already developed areas generally reduces the negative environmental impacts
    b. *Health*: Low GHG-impact development forms facilitate walking, increasing personal health
    c. *Social*: Compact, mixed-use, walkable development supports increased economic activity and community vitality (e.g., citizen interaction)
    d. *Other:*

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):
    a. *Technical*: Easy action to implement provided mortgage lenders are receptive (may not be substantial savings available from "in-town" locations without transit available).
    b. *Economic*:
    c. *Statutory/Regulatory*: Could be supported by Federal legislation; few/unknown state legislative/regulatory obstacles.
    d. *Social*:

5. Other Factors of Note:

6. Level of Group Interest: Moderate. The working group considered this a supporting action to undertake in the mid-term (i.e., supports other actions and/or achieves moderate reductions but not considered "essential" to achieve substantial $CO_2$ reductions from the transportation and land use sector).

7. References:

**TLU Action 2.C.7 – Establish Entity(ies) to Support Compact Land Use Patterns and Open Space Preservation**

Summary

Establish an educational and administrative support entity (at state or regional level) to facilitate implementation of transfer of development rights (TDR) or density transfer credit (DTC) programs, through which open space would be preserved in targeted areas in exchange for higher-density development in designated areas. A regional or state organization would be tasked with promoting this tool, assisting communities to develop and adopt the necessary zoning and regulations, and implementing the program at the municipal level (e.g., valuing "density" to be transferred, processing transactions). A successful TDR program could facilitate the creation of compact land use patterns that reduce transportation energy consumption, reduce municipal infrastructure delivery costs and energy consumption, preserve rural open space, and support public transportation.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): Regional or state agency(ies) would be designated and funded to promote and assist municipalities in adopting and implementing transfer of development rights programs. Through municipal implementation of density transfer mechanisms, real estate development could be directed to designated development or growth locations (i.e., town and city centers). This action would assist in creating more compact, mixed-use development that could significantly reduce transportation-based energy consumption and foster greater provision for, and use of, public transportation. Adjacent municipalities could also choose to execute inter-municipal agreements to establish sending and receiving zones across municipal boundaries. The state or regional entities could also use their expertise to assist participating municipalities in managing the implementation of the local programs.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* State funding to develop and maintain the expertise to implement the program. The program could be voluntary, incentivized or mandatory. If it was voluntary it would rely exclusively on the education and promotional efforts of the regional or state agencies. An incentive based program would link the availability of a wide variety of funding and grant opportunities to adoption of the program in participating municipalities. A mandatory program would require municipalities to establish a transfer of development rights program as part of their master planning and zoning process.
    b. *Resources Required:* A legal entity with sufficient staff resources and expertise to educate and advise municipal boards on how to establish zoning and development regulations that support the program and administer the density transfer program. Initially would require state funding, but eventually could be self-funded by a portion of the density transfer payments.
    c. *Barriers to Address (especially for medium to low feasibility actions):* A funding mechanism to support creation of the administering entity(ies) and program.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* Municipalities, regional planning commissions, and/or the State of New Hampshire.
    b. *Parties Paying for Implementation:* State, regional and/or local governments initially, eventually supported by development.
    c. *Parties Benefiting from Implementation:* Potentially everyone, especially if receiving zone municipalities desire additional density, development and tax base.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*): Existing state planning and zoning legislation; individual municipal master plans and development regulations; regional and state land use plans; NGO land conservation programs.

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):

    a. *Existing:* RSA 9-B. Innovative Land Use Techniques Handbook, which contains a model ordinance for Density Transfer Fee.

    b. *Proposed:* Other Actions under 2.C.

6. Timeframe for Implementation: For a voluntary program, the enabling legislation for funding could occur within two years. Developing in-state educational and administrative resources could be developed in one year. Changes in local land use regulations would take at least 3-5 years. An incentivized program could be established in the same time frame. A mandatory program would have the added impact of a more difficult legislative approval process that might take several sessions of the legislature to approve.

7. Anticipated Timeframe of Outcome: The voluntary approach would likely take three to five years to begin achieving desired outcomes. Ten to thirty years to achieve sufficient density transfer volume to produce measurable carbon footprint benefits. An incentivized program should shorten the timeframe to produce significant and measurable carbon footprint benefits. A mandatory program would specify a compliance date by which all communities with zoning and development regulations would have to have the necessary regulations and procedures in place. This would result in the shortest timeframe to achieve measurable outcomes.

<u>Program Evaluation</u>

1. Estimated $CO_2$ Emission Reduction: Not individually quantified.

2. Economic:

    a. Costs:

        i. Implementation Cost: Low (0-$2.5 million)
        ii. Timing: Constant / even
        iii. Impacts: State government

    b. Savings:

        i. Potential Economic Benefit: Supporting mechanism only
        ii. Timing of Benefits:
        iii. Impacts:

3. Other Benefits/Impacts:

    a. *Environmental*: Preservation of New Hampshire's rural character and critical natural resource features (wildlife habitat, agriculture/forest land, water supply areas)

    b. *Health*: Increased walking, less obesity

    c. *Social*: Preservation of traditional NH pattern of land use. Preserves economic value of current zoning but provides for an alternative future development scheme.

    d. *Other*: Increased potential for critical mass to support more extensive public transportation if densities of 8+dwelling units per acre can be achieved.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):
    a. *Technical*: Used extensively throughout the U.S. = many replicable models.
    b. *Economic*: Shift from rural and suburban development patterns to small urban is supported by market desire for smaller lot sizes that are closer to in-town amenities and employment.
    c. *Statutory/Regulatory*: TDR is permitted by state planning enabling legislation. Regional or statewide support systems and marketing to individual municipalities will require extensive effort. Some communities may desire additional growth and density. Others may resist loss of potential future tax base expansion if they are "sending" communities
    d. *Social*: Generally, TDR is supportive of NH goal of protecting state's rural character.

5. Other Factors of Note: Based on criteria established by the governing body, there are two implementation structures: 1) developers directly acquire open space or conservation easements in designated sending zones and convey them to a designated land stewardship entity; in exchange they receive additional development density in designated receiving zones; and 2) developers pay a specified "density transfer fee" to the administering entity in exchange for additional development density in a receiving zone, and the administering entity uses the transfer fee to acquire open space/conservation easements in sending zones.

6. Level of Group Interest: Moderate. The working group considered this a supporting action to undertake in the near-term (i.e., supports other actions and/or achieves moderate reductions but not considered "essential" to achieve substantial $CO_2$ reductions from the transportation and land use sector).

7. References:

**AFW Action 1.1.1 – Increase Cover Crops**

Summary

Cover crops should be promoted in agricultural activities. Soil carbon content and the capacity of soil to hold nitrogen can be increased by cultivating cover crops. Because of the increase in soil nitrogen, increasing the use of cover crops can also reduce the amount of fertilizer needed.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): Planting cover crops at the end of the cropping season utilizes residual soil nitrogen. Winter rye, as an example, becomes established in cool fall weather, overwinters, and grows vigorously in early spring. The plants are then incorporated into the soil in late spring, building soil organic matter. Summer cover crops have the same benefit and can be planted during fallow periods in the growing season. The cover crops may also collect soil nitrogen and then release it as they break down rather than allow some of it to escape as the greenhouse gas nitrous oxide ($N_2O$) into the atmosphere. There may also be a reduced need for fertilizer application, which would reduce energy and greenhouse gas emissions indirectly.

2. Implementation Plan (*i.e., how to implement the specific policy or program*)
    a. *Method of Establishment (e.g., legislation, executive order):* Education
    b. *Resources Required:* Funding for educational materials and outreach to farmers and farming communities; seed; additional labor and farm equipment.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Cost of seed, availability of labor.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*)
    a. *Parties Responsible for Implementation*: Cooperative Extension Service and its agents, the New Hampshire Department of Agriculture, Markets & Food, as well as individual farms and farmers.
    b. *Parties Paying for Implementation:* Potentially federal grants, state agencies, and farmers.
    c. *Parties Benefiting from Implementation:* Farmers would benefit from improved soil health, and citizens all would benefit from reduced $CO_2$ and $N_2O$ emissions.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*)
    a. *Existing:*
    b. *Proposed:* AFW Action 1.1.2 – Increase Conservation Tillage/No-Till Farming Practices
    AFW Action 1.1.3 – Protect Agricultural Land

6. Timeframe for Implementation: Immediate

7. Anticipated Timeframe of Outcome: Immediate

Program Evaluation

1. Estimated $CO_2$ Emission Reductions
    a. Short-term (2012): <0.01 $MMTCO_2e$ /year
    b. Mid-term (2025): <0.01 $MMTCO_2e$ /year
    c. Long-term (2050): <0.01 $MMTCO_2e$ /year

2. Economic Effects
    a. Costs
        i. Implementation Cost: Moderately low ($2.5 million to $25 million)
        ii. Timing: Constant / even
        iii. Impacts: Business – small
    b. Savings
        i. Potential Economic Benefits: Moderately low ($2.5 million to $25 million)
        ii. Timing: Constant / even
        iii. Impacts: Business – small

3. Other Benefits/Impacts:
    a. *Environmental:* Cover drops help prevent wind and water erosion, and utilize nutrients that might run off to surface waters or leach to ground waters. Cover crops may also reduce the ability of weedy species to become established between plantings and can therefore reduce herbicide application rates.
    b. *Health:* Avoiding nutrient runoff can contribute to the maintenance of surface and groundwater water quality in nearby areas. Some nutrients, such as nitrates, can impact children's health.
    c. *Social:*
    d. *Other:*

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*): This action has a high potential for implementation.
    a. *Technical:* There is an immediate potential for implementing this action as the technology is available and some farms are already engaged in these practices.
    b. *Economic:* There is an additional cost to farmers at a time when fuel prices are increasing on-farm costs; however, retaining nutrients in the soil may allow lower fertilizer applications on conventional farms, which would reduce costs.
    c. *Statutory/Regulatory:*
    d. *Social:*

5. Other Factors of Note:

6. Level of Group Interest:

7. References:

**AFW Action 1.1.2 – Increase Conservation Tillage/No-Till Farming Practices**

Summary

There should be wider adoption of agricultural practices that reduce soil disruption and that can increase soil organic content through carbon deposition. Tillage/no-till farming can increase the total carbon content (stock) of soil and reduce the rate of carbon loss (flow) to the atmosphere through decomposition.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): Conservation tillage/no-till farming minimizes soil disturbances and the release of soil nitrogen. This practice prevents the rapid loss of organic matter.

2. Implementation Plan (*i.e., how to implement the specific policy or program*)
    a. *Method of Establishment (e.g., legislation, executive order):* Education
    b. *Resources Required:* Funding for educational materials and outreach to farmer and farming communities.
    c. *Barriers to Address (especially for medium to low feasibility actions)*

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*)
    a. *Parties Responsible for Implementation:* Cooperative extension and extension agents; the New Hampshire Department of Agriculture, Markets & Food; and individual farms and farmers.
    b. *Parties Paying for Implementation:* Potentially federal grants, state agencies, and farmers.
    c. *Parties Benefiting from Implementation:* Farmers would benefit from improved soil health, and all citizens would benefit from reduced $CO_2$ and $N_2O$ emissions.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*)
    a. *Existing*
    b. *Proposed:* AFW Action 1.1.1 – Increase Cover Crops
       AFW Action 1.1.3 – Protect Agricultural Land

6. Timeframe for Implementation: Immediate

7. Anticipated Timeframe of Outcome: Immediate

Program Evaluation

1. Estimated $CO_2$ Emission Reductions
    a. Short-term (2012): <0.01 $MMTCO_2e$ /year
    b. Mid-term (2025): <0.01 $MMTCO_2e$ /year
    c. Long-term (2050): <0.01 $MMTCO_2e$ /year

2. Economic Effects

a. Costs

i. Implementation Cost: Low (0-$2.5 million)
ii. Timing: Constant / even
iii. Impacted: Business – small

b. Savings

i. Potential Economic Benefits: Low (0-$2.5 million)
ii. Timing: Constant / even
iii. Impacted: Business – small

3. Other Benefits/Impacts

a. *Environmental:* Reduced tillage is less energy-intensive and requires less fuel. This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend. In addition it may also helps prevent wind and water erosion, and may lead to reduced nutrient runoff to surface waters or leach to ground waters.

a. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease. Avoiding nutrient runoff can contribute to the maintenance of surface and groundwater water quality in nearby areas. Some nutrients, such as nitrates, can impact children. The reduced fuel consumption can

b. *Social:*

c. *Other:*

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*)

a. *Technical:* There is an immediate potential for implementing this action as the technology is available and some farms are already engaged in these practices.

b. *Economic:* The reduced fuel use would come at a time when fuel prices are increasing on-farm costs. The reduced need to work the soil will result in direct cost savings. However, there may be an associated increase in the need to apply herbicides to control weedy species.

c. *Statutory/Regulatory:*

d. *Social:*

5. Other Factors of Note:

6. Level of Group Interest:

7. References:

**AFW Action 2.1 – Encourage the Use of Bioreactors for Landfills**

Summary

Bioreactors should be evaluated as an alternative to conventional landfills in order to speed up the decomposition of solid waste and improve the recoverability of landfill gas (LFG) as an available fuel for space heating or power generation. The energy content in landfill gas is provided by methane (natural gas), which makes up about half of landfill gas at a typical municipal solid waste landfill. A bioreactor landfill facilitates the natural degradation of organic waste through the addition of liquid and (sometimes) air to enhance microbial processes. This concept differs from the traditional "dry tomb" landfill approach. Although bioreactor technology is not currently used at landfills in New Hampshire, a few of the state's landfills collect landfill gas and combust it to generate electricity. Of particular interest is the Turnkey Recycling and Environmental Enterprise landfill, located in Rochester and owned by Waste Management, Inc. This landfill, the largest in the state, has contracted to supply landfill gas to the University of New Hampshire in Durham to meet space heating needs and to power electrical generators. The state could seek to increase the number of landfill-gas-to-energy (LFGE) projects in the state through application of New Hampshire's Renewable Portfolio Standard and by engaging the PUC and NHDES to streamline project permitting and implementation. For landfills where LFGE is feasible, bioreactor technology might provide additional benefits.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): The anaerobic biological processes that take place in landfills generate methane ($CH_4$, a greenhouse gas), which has a global warming potential 20 times greater than that of $CO_2$. Often the methane is released into the air, or it is collected and burned off (flared) to reduce harmful emissions. But methane can also be collected and utilized as an alternative fuel to produce energy. The capture and use of methane prevents release of the gas to the environment and replaces energy derived from fossil fuels. Bioreactor technology does not alter the basic function of a landfill but serves to speed up the natural processes that cause the waste to decompose. In so doing, a bioreactor allows stabilization of the landfill material to occur sooner and may therefore improve the economic feasibility of energy production from collected gas.

2. Implementation Plan (*i.e., how to implement the specific policy or program*)

    d. *Method of Establishment (e.g., legislation, executive order):* Federal and state laws to accomplish this are already in place. Federal rules exempt bioreactors from the normal ban on liquids in landfills and state rules allow it as well.

    *e. Resources Required:* Financial resources (moderate to significant) and engineering expertise are necessary.

    f. *Barriers to Address (especially for medium to low feasibility actions):* Landfill bioreactors have not been proven on a wide scale, and technical questions remain. This technology might be appropriate for larger landfills, of which there are few in New Hampshire. For projects where landfill bioreactors are found to be feasible, there are likely to be infrastructure needs, including pipelines and electrical transmission lines.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc*.)

    a. *Parties Responsible for Implementation:* Decisions to implement energy recovery are made by the landfill owners.

    b. *Parties Paying for Implementation:* The landfill owners, either private or public, would be responsible for the capital expenses, although municipalities could allow private entities to capture

methane from public landfills in exchange for fees and/or energy. Regulatory requirements already require that large landfills have active gas collection and control systems, so the energy recovery systems would be built upon what is already there.

c. *Parties Benefiting from Implementation:* Depending on the size of the project, the power might be used on site as an alternative fuel or sold for profit. In addition, the project might be eligible for renewable energy credits. If the investment is at a public facility, the taxpayers or ratepayers would benefit; if it is at a private facility, the company would benefit and might be able to pass along some of the savings to ratepayers. All citizens would benefit from collecting landfill gas to produce energy: Greenhouse gas emissions would be prevented and reliance on fossil fuels would be reduced.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*): Forty-seven percent of New Hampshire's waste is landfilled. Most of this waste is disposed of at a handful of large landfills, where there is significant potential for energy recovery and where, in a few cases, landfill gas is already collected and used for energy production.

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):

   a. *Existing:* DES has long advocated the flaring of methane to minimize its environmental impacts; the capture and use of methane makes the benefit two-fold because emissions are prevented and fossil fuels are replaced. Use of bioreactor technology would need to demonstrate compliance with federal and state landfill rules.

   b. *Proposed:*

6. Timeframe for Implementation: Other than the financial and engineering resources required to prepare, submit, process, and approve the necessary solid waste and air permit applications for bioreactor landfills, there are no constraints to implementation.

7. Anticipated Timeframe of Outcome: The additional collection of methane can begin as soon as a project is complete.

<u>Program Evaluation</u>

1. Estimated $CO_2$ Emission Reductions – Analysis not completed.
   a. Short-term (2012)
   b. Mid-term (2025)
   c. Long-term (2050)

2. Economic Effects
   a. Costs
      i. Implementation Cost: Moderately low ($2.5 million to $25 million)
      ii. Timing: Immediate / Higher upfront
      iii. Impacts: Business - Small
   b. Savings
      i. Potential Economic Benefits: Low (0-$2.5 million)
      ii. Timing: Constant / even
      iii. Impacts: Business – evenly distributed

3. Other Benefits/Impacts

a. *Environmental*: Unmitigated release of landfill gas is unpleasant smelling and a potent contributor to greenhouse gas emissions. Capturing and combusting landfill gas is a way to control emissions by destroying methane and other harmful landfill gas components. Using the collected gas for energy encourages higher rates of capture and provides benefits as an alternative fuel.

b. *Health*:

c. *Social*: Facilities that handle waste – even recycling facilities – are not popular among the residents of a town or neighborhood. A landfill that generates energy in addition to proper disposal of solid waste might be one step more acceptable to the public.

d. *Economic*: Capturing and using or selling methane is a way to maximize the significant investment in a landfill.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*)

   a. *Technical:* The technology for this application exists and is being used.

   *b. Economic:*

   *c. Statutory/Regulatory:*

   d. *Social:* Citizens who oppose landfills in general do not favor methane recovery because it favors continued use of landfills for waste disposal.

5. Other Factors of Note:

6. Level of Group Interest:

7. References:

**AFW Action 2.3 – Increase Development and Use of Secondary Feedstocks for Biodiesel**

Summary

New Hampshire should promote the research and development (R&D) and commercialization of biodiesel production in-state that relies on alternative, sustainable feedstocks such as yellow and brown grease and oil derived from algae. Up to now, the soy industry has been the driving force behind biodiesel commercialization because of product surpluses in the Midwest states and a decline in prices. Although a large portion of U.S. soybean oil is currently used for food purposes, the 20.4 billion pounds of oil cultivated in 2007 could have produced 2.65 billion gallons of biodiesel. Compared with the U.S. demand for distillate fuel of 62 billion gallons in 2006, the hypothetical use of all soy oil for fuel would amount only to 4.3 percent of demand. Furthermore, production of biodiesel from virgin vegetable oils on a large scale would be disruptive to global food markets. Unlike biodiesel based on vegetable oils, biodiesel produced from alternative, renewable resources could replace a greater portion of fossil fuels used for transportation and heating without adversely affecting food costs or supplies.

Program Description

1. Mechanism *(i.e., how the policy or program achieves the desired result):*

   Production of biodiesel domestically will reduce $CO_2$ emissions through the displacement of fossil fuels used for home heating oil (HHO) and transportation fuels. Biodiesel does produce $CO_2$ emissions when burned as fuel but is considered nearly carbon-neutral because $CO_2$ is sequestered during the cultivation of the feedstock. However, a life-cycle analysis would show that biodiesel does release $CO_2$ during harvesting, production, and distribution; and these processes should be considered when evaluating the overall carbon output of a feedstock option.

   Currently, the most common sources of oil for biodiesel production in the U.S. are soybean oil (80 percent of biodiesel feedstock) and yellow grease (primarily, recycled cooking oil from restaurants). Although the soy biodiesel industry has experienced tremendous growth in the past few years, the raw material needed for production is limited and creates a strain on commodities prices. Achieving the biodiesel industry's vision of replacing diesel demand at a price that is equivalent to or less than petroleum diesel calls for additional focus on alternative feedstocks for biodiesel production.

   Because of New Hampshire's seasonal climate and amount of agricultural land available, it is not feasible to grow soybeans or any other oilseed crop for mass biodiesel production within the state. However, yellow grease is one promising option for the state to take forward. Biodiesel can also be produced from brown grease, which is pan scrapings and washed oil residue that accumulate in grease traps under restaurant sinks. Brown grease is typically collected and treated at municipal wastewater treatment plants with anaerobic digestion, or it is accepted at landfills. In San Francisco, it was determined that there are more than 2.5 million gallons of brown grease, compared with 1.5 million gallons of yellow grease[1]. New Hampshire's demand for distillate fuels was 350 million gallons in 2006. Nearly 12 million lbs of yellow grease and 9.4 million lbs of brown grease are available in NH. If these were converted to biodiesel, the state could displace 1 percent of its distillate fuel use.

   Another potential feedstock, algae, has emerged as one of the most promising sources for biodiesel production for two main reasons: 1) the yields of oil from algae are substantially higher than those from traditional oilseed crops, potentially as much as 30 times more energy per acre than land crops like soybeans; and 2) algae can be grown on land separate from farmlands and forests, thus minimizing damage to those ecosystems and disruption to the global food market. There is a third interesting reason as well: Algae can be

grown in sewage waters and next to power-plant smokestacks, where they thrive on $CO_2$ and $NO_x$ emissions and produce up to 50 percent of their body weight in oil at a rate of 1,850(actual)-15,000(theoretical) gal/acre/year.[2]

2. Implementation Plan *(i.e., how to implement the specific policy or program):*

    a. *Method of Establishment*: Establish state policy by Executive Order for all restaurants to dedicate their waste grease to biofuel production.

    b. *Resources Required*: Changes in infrastructure will be necessary to produce and distribute biofuels. Pick-ups at restaurants will need to be coordinated through dedicated businesses or entities such as waste management. Research and development of algae technology is required.

    c. *Barriers to Address*: Permitting for biodiesel processing facilities due to fire codes (handling of methanol) and waste management (glycerin and contaminated water) has been an issue in New Hampshire in the past. Currently, the algae technology is not a well-established feedstock for biodiesel, although research has been underway since the 1970's, the process has not quite reached the level of commercialization.

*3.* Parties Affected by Implementation *(i.e., residents, businesses, municipalities, etc.):*

    a. *Parties Responsible for Implementation*: The state government will need to develop legislation that requires restaurants to collect and transfer their yellow and brown waste grease to appropriate entities. Permitting of the biodiesel production facilities will be necessary at the state level; including fire codes (due to methanol use in transesterification of biodiesel) and waste disposal (eg., glycerin, water) regulations.

    b. *Parties Paying for Implementation*: Processing infrastructure and research funding is required from the federal and state governments. Commercialization in NH will incur further capital and operational costs to build and maintain large algae greenhouse farms. Funding could come from capital investors, as is the case for many start-up algae companies already on track.

    c. *Parties Benefiting from Implementation*: Small businesses that produce and distribute biofuels now and in the future, as well as citizens who will benefit from a cost-effective means of producing large amounts of biofuel for transportation and home heating. State and municipal governments, privately-owned businesses, and large corporations will all benefit greatly by a reduced, stable cost of fuel.

4. Related Existing Policies and Programs (i.e., those that address similar issues without interacting): ASTM D6751 provides the specifications for pure biodiesel. In December 2007, ASTM passed its specification D6751-06a for 6-20% biodiesel. Senate Bill 522 has been passed by both the NH House of Representatives and Senate that will require that all biodiesel sold in the state meet the ASTM D6751 fuel quality standard by January 1, 2009.

5. Complementary Policies *(i.e., those that achieve greater reductions through parallel implementation):*

    a. *Existing:* House Bill 1631-FN was established by legislators in NH this year. This bill requires the DOT and the Division of Plant and Property Management to purchase fuels containing a certain percentage of biodiesel. Also in NH, the recycling of yellow grease is regulated under NH Code Administrative Rules Env-Sw 100-2100 (Solid Waste Rules, www.des.n h.gov/rules/desadmin_list.htm#solid). Processed waste vegetable oil has been certified as a waste-derived product by DES and can be used as a substitute for No. 6 oil or as a feedstock for the manufacture of biodiesel (see www.des.nh.gov/sw/waste_derived.htm).

b. *Proposed*: AFW 1.2 – Invest in Forests to Maximize Carbon Sequestration
TLU 1.C.1 – Adopt a Low-Carbon Fuel Standard
TLU 1.C.3 – Install Retrofits to Reduce Black Carbon Emissions
GLA 4.1.2 – Increase Use of Cleaner Fuels and Advanced Technologies
GLA 4.2.1 – Reduce Diesel Particulate Emissions through Use of Retrofit Devices

6. Timeframe for Implementation: In the case of yellow and brown grease, implementation can take place as soon as collection fleets are organized and processing facilities are built. Research on cultivation and harvesting of algae is still emerging.

7. Anticipated Timeframe of Outcome: 1-5 years for waste grease collection infrastructure and biodiesel processing plants, 10-20 years for algae production facilities.

Program Evaluation

1. Estimated $CO_2$ Emission Reductions – Analysis not completed.
    a. Short-term (2012): On a volumetric basis, biodiesel generates 6 to 8 percent less energy per gallon than petroleum diesel, meaning more biodiesel by volume than diesel fuel is necessary to power a vehicle the same distance. Despite its lower energy content, biodiesel reduces carbon dioxide emissions compared to diesel fuel. A 1998 study sponsored by the U.S. DOE and USDA found that pure biodiesel (B100) used in urban transit buses reduced net $CO_2$ emissions by 78 percent compared with petroleum diesel.
    b. Mid-term (2025):
    c. Long-term (2050):

2. Economic Effects – Analysis not completed.
    a. Costs
        i. Short-term (2012):
        ii. Mid-term (2025):
        iii. Long-term (2050):

    b. Savings
        i. Short-term (2012):
        ii. Mid-term (2025):
        iii. Long-term (2050):

3. Other Benefits/Impacts
    a. *Environmental*: Biodiesel significantly cuts harmful environmental emissions. Use of biodiesel reduces greenhouse gas emissions of carbon dioxide, hydrocarbon emissions that contribute to the formation of ground level ozone, and carbon monoxide, a poisonous gas associated with fuel combustion.
    b. *Health*: Biodiesel is the only alternative fuel to have fully completed the health effects testing requirements of the 1990 Clean Air Act Amendments, and it is registered with the U.S. EPA as a motor fuel legal for sale and distribution. Use of biodiesel reduces particulate matter emissions that are associated with major health impacts, including cancer.
    c. *Social*: In addition to the environmental and health benefits of the fuel, biodiesel also helps reduce the country's dependence on foreign oil imports (fuel security), increase liquid fuel diversity, dampen petroleum price spikes, and create local jobs. Notably, with feedstocks such as yellow/brown grease and algae, New Hampshire will gain a local biodiesel supply.
    d. *Other*: Using yellow and brown grease provides a beneficial re-use of a material that might otherwise be disposed in landfills or be shipped elsewhere for biodiesel production.

4. Potential for Implementation *(i.e., including challenges, obstacles and opportunities)*
   a. *Technical*: Technical issues for converting waste greases into biodiesel are due to high percentages of free fatty acids (FFA) that require refining before transesterification of the oil with an alcohol and catalyst into biodiesel. Other methods are available, such as caustic stripping, acid esterification, and glycerolosis[5]. Research is still necessary in scaling up the technology of growing algae with high oil content for biodiesel production.
   b. *Economic*: Biodiesel promotes greater energy independence and boosts the domestic economy. Waste grease from restaurants and septage appear to be growing in economic value. San Francisco will begin to retrieve yellow grease from area restaurants and transfer it to a processing facility where it will be turned into biodiesel. This new arrangement is a win-win for both parties. The city provides the pick-up service free of charge to the restaurants, while securing for itself essentially cost-free feedstock for biodiesel production for use in its municipal fleet. Algae-based R&D is thriving, particularly for companies funded by capital investors.
   c. *Statutory/Regulatory*: Updated fire codes and waste regulations will need to be developed for biodiesel production facilities.
   d. *Social*:

5. Other Factors of Note: A project is proposed, yet remains unfunded, at the University of New Hampshire to grow algae for biodiesel using landfill gas (pure $CO_2$ is stripped from landfill gas, $CH_4$ is sent to UNH for energy cogeneration) and leachate at the Waste Management of New Hampshire site in Rochester. Notably, biodiesel production capacity is estimated to be 1.7 million gallons per year from a full scale facility with existing resources ($CO_2$ is limiting factor).

6. Level of Group Interest:

7. References:

   - San Francisco to build the first City Grease to Biodiesel Plant, May 29, 2008, http://www.nbc11.com/news/16426862/detail.html.
   - Journey to Forever, http://journeytoforever.org/biodiesel_yield.html.
   - NHDES Environmental Factsheet. Environmental Permitting, Regulations and Other Requirements Related to the Manufacture of Biodiesel, CO-16, 2008, http://www.des.state.nh.us/factsheets/co/co-16.htm.
   - New Hampshire Department of Environmental Services, Compliance Status on Municipal Responsibility for Septage Disposal, November 1, 2007.
   - K. Shaine Tyson, Brown Grease Feedstocks for Biodiesel, NREL, June 19, 2002. http://www.nrbp.org/pdfs/pub32.pdf.
   - G. Wiltsee, Urban Waste Grease Resource Assessment, publication no. NREL/SR-570-26141, available from the National Renewable Energy Laboratory, 1617 Cole Boulevard, Golden, Colorado 80401-3393.
   - Biofuels Digest, Biotech Research boosts algae production rate by 34 percent with new micronutrient blend, May 23, 2008, http://biofuelsdigest.com/blog2/2008/05/23/biotech-research-boosts-algae-prodcution-rate-by-34-percent-with-new-micronutrient-blend-sending-samples-to-labs-universities-for-testing-on-more-algae-strains/.

**AFW Action 4.1 - Strengthen Local Food Systems**

Summary

Stronger local food networks should be promoted and developed within the state. Food processing, packaging, storage, refrigeration, transportation, and marketing consume the vast majority of the energy used in the food industry. Food transported from the larger food producing centers can travel more than 20 times the distance of locally grown produce. Development of a stronger local food network can reduce the carbon emissions associated with distant food production, and may also insulate the state from disruptions in the food supply in the event that energy supply or transportation is threatened. These objectives would be accomplished by raising public awareness of the benefits and availability of locally grown and produced foods. New Hampshire could assist by developing and supporting marketing channels and programs, similar to the *fair trade* concept, to harvest the needed price premiums from local and regional markets for local and regional producers.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result)*

   Only a small fraction of food consumed in the state is currently produced here. Today, the state's farmers produce enough milk to supply nearly 100 percent of the state's fluid milk consumption but not enough for other dairy products (cheese, yogurt, butter, ice cream, etc.). Production of apples and maple syrup is nearly in balance with quantities consumed. Vegetables, small fruits, and herbs are produced in quantities that supply a significant but undetermined portion of the state's needs during the growing season. All of these products may be sold across state borders, however. Regionally (within New England or the Northeast), food production fills more diverse needs.

   Agriculture in New Hampshire has suffered from competition from foods produced more cheaply in other regions and other countries. Local farm businesses can thrive and supply significantly larger portions of the state's food requirements if consumers are willing to accept the often higher prices of locally produced foods. These higher prices reflect the true nutritional values and generally greater production costs of foods grown on New Hampshire's smaller and medium-sized farms. Increasing the farmers' and growers' share of the consumer food dollar is essential to achieving this goal.

   Support for this goal will also result in better utilization of available land resources. Strengthening local food systems and building a more prosperous agricultural economy will help prevent conversion of land for development by keeping more land in profitable agricultural production.

   Local food systems can be strengthened by:

   - Raising public awareness of the benefits and availability of locally grown and produced foods.
   - Developing and supporting marketing channels and programs, like the *fair trade* concept, that can harvest the needed price premiums from local and regional markets for local and regional producers.
   - Fostering growth of marketing connections between farmers and food producers and food consumers and buyers at all level – household, institutional, restaurant and hospitality industry, etc.
   - Supporting development of local agricultural and food processing and marketing enterprises and infrastructure in all regions of the state.
   - Encouraging development of urban agriculture, including community gardens. Preventing loss of farms and encouraging new farming enterprises in the more developed or developing communities and regions of the state.

- Recognizing the role of agriculture and farming in the economy of more rural parts of the state, and supporting market development.
- Improving opportunities for new farmers and encouraging and educating new professionals and the workforce to provide the necessary services and support for strong local food systems.

2. Implementation Plan (*i.e., how to implement the specific policy or program*)
    a. *Method of Establishment (e.g., legislation, executive order)*: Public education and outreach; market development; increase state support for agricultural education at all levels; establish state meat inspection program and support development of meat processing and other food and agriculture support industries and services.
    b. *Resources Required*
    c. *Barriers to Address (especially for medium to low feasibility actions)*: New Hampshire lacks infrastructure for processing food, which would increase shelf life. Lack of slaughter facilities and meat processing and inspection is a barrier to access to local meats. Municipal zoning and other regulations often create barriers and/or add burdensome costs for farms or other food producers. Fuel costs are a barrier, as well as higher feed, fertilizer, etc. costs in New England. High cost of land is a barrier to new start-up farmers and intergenerational transfer of family farm businesses.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*): Every person who eats in New Hampshire. All residents, visitors; farm businesses and agricultural suppliers and service-providers as well as local processors, distributors and marketers of local foods; every community in the state.
    a. *Parties Responsible for Implementation*: Cooperative extension and extension agents, and the New Hampshire Department of Agriculture, Markets & Food, Farmers Markets, as well as individual farms and farmers.
    b. *Parties Paying for Implementation*: Everybody will have to pay.
    c. *Parties Benefiting from Implementation*: Everybody will benefit.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*)
    a. *Existing*:
    b. *Proposed*: AFW Action 1.1.1 – Increase Cover Crops
    AFW Action 1.1.2 – Increase Conservation Tillage/No-Till Farming Practices
    AFW Action 1.1.3 – Protect Agricultural Land

6. Timeframe for Implementation: Immediate

7. Anticipated Timeframe of Outcome: Immediate, continuous, and cumulative impacts.

<u>Program Evaluation</u>

1. Estimated $CO_2$ Emission Reductions
    a. Short-term (2012): <0.01 $MMTCO_2e$/year
    b. Mid-term (2025): <0.01 $MMTCO_2e$/year
    c. Long-term (2050): <0.01 $MMTCO_2e$/year

2. Economic Effects

    a. Costs

        i. Implementation Cost: Low (0-$2.5 million)
        ii. Timing: Constant / even
        iii. Impacted: State government

    b. Savings

        i. Potential Economic Benefits: Moderately low ($2.5 million to $25 million)
        ii. Timing: Constant / even
        iii. Impacted: Business – small

3. Other Benefits/Impacts

    a. *Environmental*: Strengthening local food systems and building a more prosperous agricultural economy will help prevent conversion of land for development by keeping more land in agricultural production. In addition to carbon savings, this will preserve and protect varied wildlife habitats, protect ground and surface water quality, and more. Food produced and sold locally generally uses much less packaging as well as reduces transportation.

    b. *Health*: New Hampshire farmers produce the healthy foods that are cornerstones of a varied, healthy diet: milk and dairy products, fruits and vegetables, lean meats, etc. No high-fructose corn sweeteners or partially hydrogenated (high in trans-fats) oils are produced locally. Fresher, local foods taste better and children and adults are more likely to eat more of these nutritionally valuable foods. Agricultural education programs at all grade levels will encourage more outdoor activity and exposure to nature. Community and school gardens combine the health benefits of improved nutrition and increased outdoor activity.

    c. *Social*: Communities, families and individuals benefit from rediscovering and reconnecting with their agricultural heritage. Farmers markets and Community Supported Agriculture (CSA or membership) farms strengthen community ties and involve people of all ages in agricultural activities. The economic benefits for communities of supporting local farms and other businesses are immense.

    d. *Educational*: Increased emphasis on local food systems and the values contributed by local foods and farms will help educate residents of all ages and education levels about where food comes from and how it is produced, and what the environmental and social impacts are. Increasing agricultural education opportunities will make more young people aware of opportunities in food and agriculture and related fields.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*)

    a. *Technical*:

    b. *Economic*: While there may be a greater cost associated with local food products, the dollars spent on New Hampshire agricultural products stay in New Hampshire and strengthen the entire community and increase economic stability.

    c. *Statutory/Regulatory*:

    d. *Social*: Local foods, whether CSAs or Farmers' Markets have become increasingly popular in the recent past and will likely receive greater support as questions concerning food safety and higher food costs remain.

5. Other Factors of Note:

A 2005 report from FoodShare, in Toronto, titled "Fighting Global Warming at the Farmers Market" compared eight items available at a farmers market during November to the same eight items at a supermarket down the street. The locally grown food from the farmers' market traveled an average of 63 miles compared to 3,353 miles for the supermarket foods. Carrots from California, for example, traveled 59 times further than carrots from Hamilton, Ontario. (New Hampshire is even farther from California than Toronto.) When comparing the carbon emissions from transporting these same foods, the local foods generated about 119 grams of carbon compared to 11,887 grams for the imported foods. In just one example, a lamb chop from New Zealand not only traveled 193 times farther than a lamb chop produced at a farm in Ontario, it generated more than 1,000 times the carbon because it was flown to the store in which it was sold.

Looking at the total carbon emissions associated with local food and imported food, the differences become even clearer. The entire $CO_2$ emissions created by transporting the local food is less than the $CO_2$ emissions for any single imported product except the New Jersey mixed baby salad greens. As a result, the $CO_2$ emissions caused by transporting food locally is 0.118 kg, while the emissions caused by importing those exact same foods is 11kg. Over the course of a year, if you were to buy only locally produced food, the associated $CO_2$ emissions would be .006316 metric tons. If instead you were to buy only imported foods like those studied here, the associated $CO_2$ emissions would be .573 metric tons. This means that if you switched from eating all imported food to eating only locally produced food, you would already be half way towards achieving Canada's one metric ton challenge.

While Canada spends considerable sums on food imports, economic necessity is forcing many Canadian agricultural producers to quit farming as a full-time vocation. Between 1996 and 2001, the number of Canadian farms in operation decreased by eleven percent. Among those farmers who remain in business, net farm income continues to fall as a percentage of total income. Thus, farmers are becoming increasingly dependent on work from other industries to earn a livelihood. While opponents of the Kyoto Protocol often argue that ratification will cost jobs, they often fail to mention the jobs that will be created as we make the transition to a more environmentally sustainable economy.

Mechanisms that promote urban food production and direct marketing strategies such as farmers' markets and community supported agriculture (CSA) programs can go along way. Further research into season extension strategies could also lessen the impact of global warming by facilitating the development of a local, sustainable food system that operates for much the year.

6. Level of Group Interest: High

7. References:

**GLA Action 2.1 – Apply High-Performance Building Standards to New Construction and Renovations**

Summary

New Hampshire should adopt aggressive building and energy code requirements for all construction and renovation of state-owned facilities. Accordingly, the state should set an immediate target of 30 percent greater energy efficiency than the existing State Energy Code. This requirement should extend to all building projects receiving state funding (e.g., state facilities, with the possible exception of local schools). Over the longer term, the state should set additional targets as follows:

- By 2015, mandate that all construction subject to the policy be designed to exceed existing code by 40 percent, or reduce energy use on a kBtu /sq ft basis by a similar amount;
- By 2025, require that all construction receive LEED silver certification through the U.S. Green Buildings Council (USGBC), or reduce energy use on a kBtu /sq ft basis by 50 percent, whichever is more stringent.

To achieve these goals, the state should provide education and outreach to cities and towns, to the NH Department of Education, and other appropriate entities, to assist them with understanding the new standards and the benefits they would provide. In the case of schools, rather than impose a mandate, it would be more effective to increase the state's CHPS bonus from 3 percent to 5 percent as an incentive to entice schools to meet the higher standards.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*):

   Current state policy requires that new construction and major renovations projects exceed existing State Energy Code by 20 percent. This standard satisfies the mid-level criteria for Leadership in Energy and Environmental Design (LEED) – Energy & Atmosphere Section. Past projects have shown that a more stringent level of efficiency may be in order. Because both energy codes and LEED criteria are changing quite frequently, an alternate solution would be to set targets of total energy usage in buildings on a kBtu/sq/ft/yr basis. Energy codes and criteria vary considerably by building type, so the goals should be set by building type as well.

   Before new construction or major renovation takes place, a calculation should be made to assess a building's current kBtu/sq/ft/yr usage based on actual consumption or building design code. Improvements would begin with an immediate target of 30 percent reduction in energy usage. The target reductions would increase to 40 percent by 2015 and to 50 percent by 2025, which the building's architect and contractor would be expected to meet. Targets would vary by building type (i.e., warehouse, office building, elementary school, etc), and a chart would be prepared to aid this process. Once a project is completed, both energy modeling and actual data collection would be performed to ensure that the applicable standards have in fact been met.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):

   a. *Method of Establishment (e.g., legislation, executive order):* Create a working group to bring existing Code, LEED criteria, and kbtu/sq/ft/yr into meaningful congruence in a table by building type. Circulate these goals and then implement legislation or rules whichever is appropriate to establish these for all state building construction.

   b. R*esources Required*: Funding to cover the costs associated with any incremental increases in first costs.

c. *Barriers to Address (especially for medium to low feasibility actions):* Funding for the costs associated with upgrades may not be available in current State fiscal environment. There may also be a resistance to change.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):

   a. *Parties Responsible for Implementation:* Director of Plant & Property, the State Energy Manager, and the Energy Management Unit (to be formed).

   b. *Parties Paying for Implementation:* New Hampshire taxpayers.

   c. *Parties Benefiting from Implementation:* Any state agency involved in a renovation or construction project; New Hampshire taxpayers.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):

   a. *Existing:*

   b. *Proposed:*

      - GLA Action 2.2 – Maximize Energy Efficiency in Existing Government Buildings
      - GLA Action 2.3 – Revise State Appliance and Equipment Procurement Policies
      - GLA Action 2.4 – Implement Energy Reduction Measures for State Employees
      - RCI Action 1.1 – Maximize Energy Efficiency in New Construction
      - RCI Action 1.2 – Maximize Energy Efficiency in Existing Residential Buildings
      - RCI Action 1.3 – Maximize Energy Efficiency in Existing Commercial, Industrial, and Municipal Buildings
      - RCI Action 1.4A – Upgrade Building Energy Codes
      - RCI Action 1.4B – Improve Building Energy Code Compliance

6. Timeframe for Implementation: Immediate

7. Anticipated Timeframe of Outcome: Immediate

Program Evaluation

1. Estimated $CO_2$ Emission Reductions:

   - Mandate that by 2012, all new construction and renovation (0.05% building turnover rate) must be designed to exceed current energy code 20% according to the exec order, enforced with >80% compliance, model 6.6% (not exceeding code) and 8% energy reductions (code exceeded 20%).
   - After 2025, all new construction must receive LEED silver certification through the U.S. Green Buildings Council (USGBC) reducing the overall energy use by 32% from the CBECS average of 91 kBTU/SF.

| **$CO_2$ Emission Reductions (MTCO2eq/yr):** | | |
|---|---|---|
| | 6.6% reduction | 8% reduction |
| 2012 | 21 | 26 |
| 2025 | 91 | 94 |
| 2050 | 91 | 94 |

2. Economic Effects

a. Costs:

   i. Short-term (2012):
   ii. Mid-term (2025)
   iii. Long-term (2050)

b. Savings:

   i. Short-term (2012):
   ii. Mid-term (2025)
   iii. Long-term (2050)

3. Other Benefits/Impacts:

   a. *Environmental*: This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.

   b. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.

   c. *Social*: Increased awareness and implementation of energy saving and sustainable generation efforts through public participation and education will alleviate climate change. However, methods of reducing energy and alternative generation technologies typically have short-term payback periods and can then provide savings for consumers and economic security for the State in the mid to long-term. By producing energy sustainably and domestically, the economy will benefit through increased jobs within the state.

   d. *Other*: The government would be able to set an example for municipalities and New Hampshire businesses to watch and model in their own operations.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):

   a. *Technical:* There should be no technical barriers to implementing this action.

   b. *Economic:* Due to the current fiscal limitations there may be resistance to the slight incremental first costs associated with higher efficiency buildings, even with the short-term payback and long-term avoided costs associated with many energy efficiency actions.

   c. *Statutory/Regulatory*: There should be no barriers to implementation.

   d. *Social*: This could have a positive impact on municipalities and businesses and individual households as they observe the government integrating this in standard operating procedures and may begin to do so on their own.

5. Other Factors of Note:

6. Level of Group Interest:

7. References:

**GLA Action 2.2 – Maximize Energy Efficiency in Existing Government Buildings**

Summary

New Hampshire should develop a set of policies to increase the energy efficiency of the existing building stock occupied by state agencies, including both state-owned and leased properties. The policies would include the establishment of criteria with which all existing state-owned buildings would need to comply as well as criteria specific to leased space. Additional policies should be established to ensure that the builds are continually recommissioned in order to realize any and all reasonable efficiency gains throughout the remaining life or occupancy of a space.

Program Description

1. *Mechanism (i.e., how the policy or program achieves the desired result):* The existing state-occupied building stock may be operating at a low level of energy efficiency and consuming larger amounts of energy than necessary. This situation may be due to less stringent codes that the buildings were designed to meet or to the gradual degradation of efficiencies resulting from the aging of facilities and equipment. Reduced efficiencies could also be caused by diminished system integration resulting from altered equipment settings (e.g., adjustments to HVAC equipment that were not reset).

   To address this problem, efficiency criteria such as EPA's Energy Star rating system should be established for all state-owned facilities and translated into a desired kBtu/sq/ft/yr thermal usage number. The target selected should take into account the energy efficiency associated with the code for new and renovated state buildings and should exceed the targeted efficiency rating of existing commercial space in the private sector.

   All state buildings should be benchmarked to determine their energy efficiency ratings. For the Energy Star program, those buildings achieving a rating in the 75th percentile or better would be entitled to Energy Star status. For those buildings not meeting the desired specifications, a series of management and capital improvement projects should be developed to provide retrofits or upgrades. A financial model should be run on the various alternatives to establish which ones are most cost-effective and to enable prioritization of projects. The full gamut of state buildings should then be ranked by department to give a clear indication of where energy efficiency improvements should start. All buildings should be upgraded within 10 years, beginning with the least efficient.

   The state should additionally develop a policy of leasing only Energy Star or better-rated space. This policy would provide an incentive for private building owners to incorporate energy efficiency into their leased spaces. The state should require all landlords that sign *Gross Leases* to supply the occupying agencies with copies of utility bills for their review. This measure would help to ensure that reductions in energy use by state employees in leased space are being reflected in cost savings to the state.

   To maintain optimum operating efficiency in existing state facilities, the state should develop a policy for periodic re-commissioning of buildings. Re-commissioning (or continuous commissioning) is a systematic process to make sure that a building performs in accordance with the design intent, contract documents, and the owner's operational needs. Over time, routine maintenance may not be performed at intervals needed to keep building systems operating at optimal energy efficiency. By re-commissioning buildings on a regular schedule, each building's energy systems can be maintained at their highest levels of efficiency while providing the highest degree of integration among related system components. The initial re-commissioning schedule should also include "retro-commissioning," an independent process that takes place after construction for buildings not previously commissioned.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):

a. *Method of Establishment (e.g., legislation, executive order):* Create a working group to bring develop a stringent efficiency rating for existing state-owned buildings and leased space, expressed in kbtu/sq/ft/yr as well as a recommissioning schedule for all State facilities. These goals will be circulated and then the legislation or rules will be implemented as appropriate to establish these for all state building construction.

b. *Resources Required*: Funding to cover the costs associated with any incremental increases in first costs.

c. *Barriers to Address (especially for medium to low feasibility actions*): Funding for the costs associated with upgrades may not be available in current State fiscal environment. There may also be a resistance to change.

3. Parties Affected by Implementation *(i.e., residents, businesses, municipalities, etc.):*

   a. *Parties Responsible for Implementation:* Dir. of Plant & Property & the State Energy Manager and the Energy Management Unit (to be formed).
   b. *Parties Paying for Implementation:* NH taxpayers
   c. *Parties Benefiting from Implementation:* Any state agency occupying existing state-owned facilities which are not scheduled for renovation as well as NH taxpayers.

4. Related Existing Policies and Programs *(i.e., those that address similar issues without interacting):*

5. Complementary Policies *(i.e., those that achieve greater reductions through parallel implementation):*

   a. Existing

   b. Proposed:

      - GLA Action 2.1 – Apply High-Performance Building Standards to New Construction and Renovations
      - GLA Action 2.3 – Revise State Appliance and Equipment Procurement Policies
      - GLA Action 2.4 – Implement Energy Reduction Measures for State Employees
      - RCI Action 1.1 – Maximize Energy Efficiency in New Construction
      - RCI Action 1.2 – Maximize Energy Efficiency in Existing Residential Buildings
      - RCI Action 1.3 – Maximize Efficiency in Existing Commercial, Industrial, and Municipal Buildings
      - RCI Action 1.4A – Upgrade Building Energy Codes
      - RCI Action 1.4B – Improve Building Energy Code Compliance

6. Timeframe for Implementation: Immediate

7. Anticipated Timeframe of Outcome: Immediate

<u>Program Evaluation</u>

1. Estimated $CO_2$ Emission Reductions
   - Require state buildings to reduce energy use by 10% by 2012 according to the exec order.
   - Require state buildings to achieve an energy star rating of 75, increasing efficiency by 20%, by 2015.
   - Require state buildings to achieve an energy star rating of 95, increasing efficiency by 50%, by 2030.

| **$CO_2$ Emission Reductions:** | |
|---|---|
| | MTCO2eq/year |
| 2012 | 6,268 |

| | |
|---|---|
| 2025 | 12,536 |
| 2050 | 31,340 |

2. Economic Effects

    a. Costs:
        i. Short-term (2012):
        ii. Mid-term (2025)
        iii. Long-term (2050)

    b. Savings:
        i. Short-term (2012):
        ii. Mid-term (2025)
        iii. Long-term (2050)

3. Other Benefits/Impacts:

    a. *Environmental*: This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.

    b. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.

    c. *Social*: Increased awareness and implementation of energy saving and sustainable generation efforts through public participation and education will alleviate climate change. However, methods of reducing energy and alternative generation technologies typically have short-term payback periods and can then provide savings for consumers and economic security for the State in the mid to long-term. By producing energy sustainably and domestically, the economy will benefit through increased jobs within the state.

    d. *Other*: The government would be able to set an example for municipalities and New Hampshire businesses to watch and model in their own operations.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):

    a. *Technical:* There should be no technical barriers to implementing this action.
    b. *Economic:* Due to the current fiscal limitations the funding to establish and maintain the fund may be difficult to set aside, even with the short-term payback associated with much energy efficiency actions.

    c. *Statutory/Regulatory*: There should be no barriers to implementation.

    d. *Social*: This could have a positive impact on municipalities and businesses and individual households as they observe the government integrating this in standard operating procedures and may begin to do so on their own.

5. Other Factors of Note:

6. Level of Group Interest:

7. References:


- US DOE – Energy Efficiency and Renewable Energy – Commercial Buildings – Commissioning, http://www1.eere.energy.gov/buildings/commercial/commissioning.html.

**GLA Action 2.3 – Revise State Appliance and Equipment Procurement Policies**

Summary

Current state policy requires all electronic equipment and appliances purchased or leased for use in state buildings to be Energy Star certified or better. This policy should be expanded and more widely implemented as a way to provide energy savings and reduce greenhouse gas emissions in state government.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): The proposed action would revise state procurement policies to ensure improved power efficiency and reduced energy consumption of computers, other office equipment, and appliances used in state buildings via the requirement of Energy Star certification. This action would apply to products not covered elsewhere by energy efficiency criteria in new construction, renovation, and retrofit projects.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* The current state policy, established by Executive Order, requires all purchases for office equipment, appliances, lighting, and other building components to be Energy Star compliant. (See the Energy Star Products & Equipment Procurement Policy.) The policy could be revised to require purchases to meet the best energy efficiency standards available at the time, including Energy Star, Climate Savers, or other. The state should also join the Climate Savers Computing Initiative, lead by the National Governor's Association (NGA). The initiative is a nonprofit organization dedicated to promoting smart technologies that can improve the power efficiency and reduce the energy consumption of computers.
    b. *Resources Required:* There is currently no oversight for ensuring that smaller purchases such as field purchase orders are complying with current policy, and energy and monetary savings are not currently being tracked. The establishment of an Energy Management Unit could help ensure compliance with the policy and measure its effectiveness.
    c. *Barriers to Address (especially for medium to low feasibility actions):* None

3. Parties Affected by Implementation *(i.e., residents, businesses, municipalities, etc.):*
    a. *Parties Responsible for Implementation:* Department of Administrative Services – Purchasing
    b. *Parties Paying for Implementation:* NH taxpayers (for establishment of the Energy Management Unit)
    c. *Parties Benefiting from Implementation:* The state (cost savings in energy use reductions); NH taxpayers

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*): New Hampshire state government has signed on to the State Electronics Challenge (a regional off shoot of the Federal Electronics Challenge at http://stateelectronicschallenge.net/). The challenge for New Hampshire includes 3 components: Acquisition & Procurement Activities, Operation & Maintenance Activities, and End-of-Life Management Activities.

*5.* Complementary Policies *(i.e., those that achieve greater reductions through parallel implementation):*
    a. *Existing:*

    b. *Proposed:*
        - GLA Action 2.1 – Apply High-Performance Building Standards to New Construction and Renovations

- GLA Action 2.2 – Maximize Energy Efficiency in Existing Government Buildings
- GLA Action 2.4 – Implement Energy Reduction Measures for State Employees
- RCI Action 1.1 – Maximize Energy Efficiency in New Construction
- RCI Action 1.2 – Maximize Energy Efficiency in Existing Residential Buildings
- RCI Action 1.3 – Maximize Energy Efficiency in Existing Commercial, Industrial, and Municipal Buildings
- RCI Action 1.4A – Upgrade Building Energy Codes
- RCI Action 1.4B – Improve Building Energy Code Compliance
- HB 877 which established a state recycling program.

6. Timeframe for Implementation: Immediate

7. Anticipated Timeframe of Outcome: Immediate

Program Evaluation

1. Estimated $CO_2$ Emission Reductions:
   - Require state buildings to reduce energy use by 10% by 2012 according to the exec order.
   - Require state buildings to phase in energy star office equipment, 20% each year starting in 2010, reducing energy use by 925,000kWh/year by 2015
   - Require state buildings to phase in energy star refrigerators, 1% each year starting in 2010, reducing energy use from refrigerators by 15% by 2025.
   - Require state buildings to phase in efficient lighting by 2010, 7.2% replacement per year, reducing energy use from lighting by 72% by 2020.

| **$CO_2$ Emission Reductions:** | |
|---|---|
| | MTCO2eq/year |
| 2012 | 4,976 |
| 2025 | 12,941 |
| 2050 | 12,941 |

2. Economic Effects
   a. Costs:
      i. Short-term (2012)
      ii. Mid-term (2025)
      iii. Long-term (2050)

   b. Savings:
      i. Short-term (2012)
      ii. Mid-term (2025)
      iii. Long-term (2050)

3. Other Benefits/Impacts:
   a. *Environmental*: This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This

would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.

b. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.

c. *Social*: Increased awareness and implementation of energy saving and sustainable generation efforts through public participation and education will alleviate climate change. However, methods of reducing energy and alternative generation technologies typically have short-term payback periods and can then provide savings for consumers and economic security for the State in the mid to long-term. By producing energy sustainably and domestically, the economy will benefit through increased jobs within the state.

d. *Other*: The government would be able to set an example for municipalities and New Hampshire businesses to watch and model in their own operations.

4. Potential for Implementation *(i.e., including challenges, obstacles and opportunities):*

   a. *Technical:* There will need to be education of individual state departments about the requirements for purchasing of small electronic devices that are not processed by the DAS to assure energy efficient equipment purchases.

   b. *Economic:* Due to the current fiscal limitations the funding to establish and maintain the fund may be difficult to set aside, even with the short-term payback associated with much energy efficiency actions.

   c. *Statutory/Regulatory*: There should be no barriers to implementation.

   d. *Social*: This could have a positive impact on municipalities and businesses and individual households as they observe the government integrating this in standard operating procedures and may begin to do so on their own.

5. Other Factors of Note:

6. Level of Group Interest: High

7. References:

**GLA Action 2.4 – Implement Energy Reduction Measures for State Employees**

Summary

New Hampshire should establish and implement policies to reduce energy use by government employees in their daily business conduct. The policies should cover, but not be limited to, 1) personal computers, laptops, speakers, monitors, copiers, and printers; 2) lighting and miscellaneous electrical equipment; 3) water conservation; and 4) waste/paper reduction.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): A new program would be developed by the proposed Energy Management Unit (EMU) to implement policies, track their effectiveness, and educate all state employees in ways to reduce energy use. This program would go beyond simply raising awareness of actions to save energy by making use of research-based techniques that utilize social norms and incentives to promote the desired behaviors. The proposed action would reduce the energy consumption of computers, other office equipment, and appliances used in state buildings and would conserve water, paper, and other expendable resources.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* Establish state policy by Executive Order.
    b. *Resources Required:* The establishment of an Energy Management Unit to develop policy and perform oversight to help ensure compliance with the new policy and measure the effectiveness of the policy.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Funding to establish an EMU.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* Energy Management Unit
    b. *Parties Paying for Implementation:* New Hampshire taxpayers (for establishment of the EMU)
    c. *Parties Benefiting from Implementation:* The state (cost savings in energy use reductions): New Hampshire taxpayers

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):
    a. *Existing:*
    b. *Proposed:*
        - GLA Action 2.1 – Apply High-Performance Building Standards to New Construction and Renovations
        - GLA Action 2.2 – Maximize Energy Efficiency in Existing Government Buildings
        - GLA Action 2.3 – Revise State Appliance and Equipment Procurement Policies
        - GLA Action 2.4 – Implement Energy Reduction Measures for State Employees
        - RCI Action 1.1 – Maximize Energy Efficiency in New Construction
        - RCI Action 1.2 – Maximize Energy Efficiency in Existing Residential Buildings
        - RCI Action 1.3 – Maximize Energy Efficiency in Existing Commercial, Industrial, and Municipal Buildings
        - RCI Action 1.4A – Upgrade Building Energy Codes
        - RCI Action 1.4B – Improve Building Energy Code Compliance

6. Timeframe for Implementation: After establishment of the EMU.

7. Anticipated Timeframe of Outcome: Short-term (by 2012) and occurring throughout the life of the program.

Program Evaluation

1. Estimated $CO_2$ Emission Reductions
    a. Short-term (2012): N/Q
    b. Mid-term (2025)
    c. Long-term (2050)

2. Economic Effects
    a. Costs:
        i. Short-term (2012): N/Q
        ii. Mid-term (2025)
        iii. Long-term (2050)
    b. Savings:
        i. Short-term (2012): N/Q
        ii. Mid-term (2025)
        iii. Long-term (2050)

3. Other Benefits/Impacts:
    a. *Environmental*: This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.
    b. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.
    c. *Social*: Increased awareness and implementation of energy saving and sustainable generation efforts through public participation and education will alleviate climate change. However, methods of reducing energy and alternative generation technologies typically have short-term payback periods and can then provide savings for consumers and economic security for the State in the mid to long-term. By producing energy sustainably and domestically, the economy will benefit through increased jobs within the state.
    d. *Other*: The government would be able to set an example for municipalities and New Hampshire businesses to watch and model in their own operations.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):
    a. *Technical: E*ducation of individual state employees about the requirements the new policy
    b. *Economic: C*ost savings will benefit the state taxpayer overall and each department in particular.
    c. *Statutory/Regulatory:* There should be no barriers to implementation.
    d. *Social:* This could have a positive impact on municipalities and businesses and individual households as they observe the government integrating this in standard operating procedures and may begin to do so on their own.

5. Other Factors of Note:

6. Level of Group Interest: High

7. References:

**GLA Action 2.5 – Implement Energy Reduction Measures for State Facilities**

Summary

The state should establish and implement policies to reduce energy use in state facilities relative to operation and maintenance of equipment and buildings. The policies should cover, but not be limited to, 1) lighting and miscellaneous electrical equipment; 2) facilities management (e.g. thermostat settings, hot water settings); 3) water conservation; and 4) waste/paper reduction.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): A new program would be developed by the proposed Energy Management Unit (EMU) to implement policies, track their effectiveness, and educate all facility managers to reduce energy use. The proposed action would reduce the energy consumption of equipment and appliances used in state buildings and would conserve water, paper, and other expendable resources.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* Establish state policy by Executive Order.
    b. *Resources Required:* The establishment of an Energy Management Unit (EMU) to develop policy and perform oversight to help ensure compliance with the new policy and measure the effectiveness of the policy.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Funding for establishing an EMU and funds that may be needed for equipment upgrades (e.g. energy efficient boilers, thermostats, energy efficient lighting, etc.)

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* The proposed Energy Management Unit, Department of Administrative Services, other departments that own or lease a facility.
    b. *Parties Paying for Implementation:* NH taxpayers
    c. *Parties Benefiting from Implementation:* The state (cost savings in energy use reductions); NH taxpayers

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):
    a. *Existing*

    b. *Proposed:*
        - GLA Action 2.1 – Apply High-Performance Building Standards to New Construction and Renovations
        - GLA Action 2.2 – Maximize Energy Efficiency in Existing Government Buildings
        - GLA Action 2.3 – Revise State Appliance and Equipment Procurement Policies
        - GLA Action 2.4 – Implement Energy Reduction Measures for State Employees
        - RCI Action 1.1 – Maximize Energy Efficiency in New Construction
        - RCI Action 1.2 – Maximize Energy Efficiency in Existing Residential Buildings
        - RCI Action 1.3 – Maximize Energy Efficiency in Existing Commercial, Industrial, and Municipal Buildings
        - RCI Action 1.4A – Upgrade Building Energy Codes

- RCI Action 1.4B – Improve Building Energy Code Compliance

6. Timeframe for Implementation: After establishment of the proposed Energy Management Unit and the required funding mechanisms.

7. Anticipated Timeframe of Outcome: There may be a slight delay in outcome as these require behavioral modification and could take time to set in initially and even later to achieve widespread long-term adoption.

Program Evaluation

1. Estimated $CO_2$ Emission Reductions
    a. Short-term (2012): N/Q
    b. Mid-term (2025)
    c. Long-term (2050)

2. Economic Effects
    a. Costs:
        i. Short-term (2012): N/Q
        ii. Mid-term (2025)
        iii. Long-term (2050)

    b. Savings:
        i. Short-term (2012): N/Q
        ii. Mid-term (2025)
        iii. Long-term (2050)

3. Other Benefits/Impacts:
    a. *Environmental*: This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.
    b. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.
    c. *Social*: Increased awareness and implementation of energy saving and sustainable generation efforts through public participation and education will alleviate climate change. However, methods of reducing energy and alternative generation technologies typically have short-term payback periods and can then provide savings for consumers and economic security for the State in the mid to long-term. By producing energy sustainably and domestically, the economy will benefit through increased jobs within the state.
    d. *Other*: The government would be able to set an example for municipalities and New Hampshire businesses to watch and model in their own operations.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):
    a. *Technical* - education of individual facility managers about the requirements the new policy;
    b. *Economic* - cost savings will benefit the state taxpayer overall and each department in particular; funding for the proposed Energy Management Unit and facility upgrades may be an obstacle due to the

current fiscal situation. However, additional funding to develop program and resources may be difficult under current fiscal climate even with short payback.

c. *Statutory/Regulatory*: There should be no barriers to implementation.

d. *Social*: This could have a positive impact on municipalities and businesses and individual households as they observe the government integrating this in standard operating procedures and may begin to do so on their own.

5. Other Factors of Note:

6. Level of Group Interest: High

7. References:

**GLA Action 3.1 - Encourage Renewable Energy and Energy Efficiency Projects for Existing State-Owned Buildings and Facilities**

Summary

New Hampshire's existing inventory of state-owned buildings is deficient in terms of energy efficiency, water consumption, and other resource usage. In a more positive light, state government has many opportunities to reduce energy use, conserve resources, and save money by upgrading its facilities. Building upgrades that maximize energy efficiency as a priority could include creative and exciting projects using renewable technologies. Integration of wind and solar power, for example, into state government building projects would not only save energy and reduce greenhouse gas emissions but would also provide opportunities to engage the public through education and job creation.

Program Description

1. Mechanism (i.*e., how the policy or program achieves the desired result*): Using the capital budget building and maintenance schedule, New Hampshire state government would upgrade its existing buildings and facilities by making improvements to utilities and undertaking other projects that maximize energy efficiency. Projects would be designed to reduce consumption of resources and make best use of renewable energy applications. Possible examples include installing water catchments systems on university buildings to conserve water; planting roof-top gardens in high-density locations to reduce heating and cooling loads; and installing solar panels on parking garages or rooftops.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* In conjunction with the BECI program and the earlier chapters of this section, inventory all existing state buildings and facilities; while other programs will identify and prioritize based on a hierarchy of energy efficiency measures and resource use, this program will focus on renewable energy application; then using the capitol budget schedule apply upgrades.
    b. *Resources Required:* Funds in the capitol budget would need to be shifted to prioritized upgrades; perhaps new staff or at least new responsibilities
    c. *Barriers to Address (especially for medium to low feasibility actions):* Hiring freeze; shifting resources that have a longer-term benefit, local code ordinances, and PUC regulations.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* budget committees, the Department of Admin Services, and facility managers
    b. *Parties Paying for Implementation:* the State as well as potential revenue streams resulting from RGGI allowance auctions and the RPS alternative compliance payment (ACP).
    c. *Parties Benefiting from Implementation :* Taxpayers, local business providers

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (i.e., those that achieve greater reductions through parallel implementation):
    a. Existing: Building Energy Conservation Initiative (BECI); The Renewable Portfolio Standard (RPS); and The Regional Greenhouse Gas Initiative (RGGI)
    b. *Proposed:*
        - GLA Action 2.1 – Apply High-Performance Building Standards to New Construction and Renovations

- GLA Action 2.2 – Maximize Energy Efficiency in Existing Government Buildings
- GLA Action 2.3 – Revise State Appliance and Equipment Procurement Policies
- GLA Action 2.4 – Implement Energy Reduction Measures for State Employees
- RCI Action 1.1 – Maximize Energy Efficiency in New Construction
- RCI Action 1.2 – Maximize Energy Efficiency in Existing Residential Buildings
- RCI Action 1.3 – Maximize Energy Efficiency in Existing Commercial, Industrial, and Municipal Buildings
- RCI Action 1.4A – Upgrade Building Energy Codes
- RCI Action 1.4B – Improve Building Energy Code Compliance

6. Timeframe for Implementation: Immediate

7. Anticipated Timeframe of Outcome: unknown

Program Evaluation

1. Estimated $CO_2$ Emission Reductions
    a. Short-term (2012): unknown
    b. Mid-term (2025): unknown
    c. Long-term (2050): unknown

2. Economic Effects:
    a. Costs:
        i. Short-term (2012)
        ii. Mid-term (2025)
        iii. Long-term (2050)
    b. Savings:
        i. Short-term (2012)
        ii. Mid-term (2025)
        iii. Long-term (2050)

3. Other Benefits/Impacts:
    a. *Environmental*: This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.
    b. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.
    c. *Social*: Increased awareness and implementation of energy saving and sustainable generation efforts through public participation and education will alleviate climate change. However, methods of reducing energy and alternative generation technologies typically have short-term payback periods and can then provide savings for consumers and economic security for the State in the mid to long-term. By producing energy sustainably and domestically, the economy will benefit through increased jobs within the state.
    d. *Other*: The government would be able to set an example for municipalities and New Hampshire businesses to watch and model in their own operations.

4. Potential for Implementation (i.e., including challenges, obstacles and opportunities):
    a. *Technical:* Working with older building presents a challenge; there are a lot of opportunity and fresh ideas to apply; excellent opportunity to provide pilot educational experiences and job creation programs
    b. *Economic:* Limited funds; challenges and changes the current way of "doing business"; saves money;
    c. *Statutory/Regulatory:*
    d. *Social:* The general public is excited to be a part of the new green economy; the public outreach component can help direct that excitement and stimulate involvement

5. Other Factors of Note: Upgrading the existing infrastructure is the best place to start from when considering energy use and conservation. As with energy efficiency, the savings appear in what is not spent or phased out. By raising the level of all buildings/facilities owned by the state, the state saves money by reducing costs in land acquisition, new building construction and utility costs.

6. Level of Group Interest: This step is critical for the state and truly defines leadership.

7. References:

**GLA Action 3.2 - Use Renewables for Building Heat and Hot Water**

Summary

New Hampshire state government should lead-by-example in establishing a policy that requires a percentage of heat and hot water supply in state-occupied buildings, whether state-owned or leased, to come from systems that use renewable energy sources. The existing inventory of state government buildings is deficient with respect to energy efficiency. The proposed action would upgrade existing heat and hot water systems in state facilities to improve their energy efficiency and include a renewable component. At least some of the improvements would involve retrofits powered by biogenic heating oil, solar hot water, combined heat and power, ground source heat pumps, and biomass.

Program Description

1. Mechanism (i.e., how the policy or program achieves the desired result): Using the capital budget building and maintenance schedule, New Hampshire state government would install upgrades to existing heat and hot water systems in state-occupied buildings. These upgrades would include renewable energy applications to the maximum practicable extent. The following are examples of renewable energy systems that could save the state money, improve energy efficiency, and reducing $CO_2$ emissions:
    a. The state can use bioheat in oil burning furnaces, which is a mixture of biodiesel and petroleum-based #2 residential heating oil or #6 industrial fuel oil.
    b. Solar heating harnesses the power of the sun to provide solar thermal energy for hot water, space heating, and pool heaters. While higher in initial capital cost these systems typically supply 70 percent of the buildings energy requirements and hedging energy cost increases. Renewables are typically equated to the pre-purchase of that percentage of energy they are offsetting for the life of the improvement.
    c. Cogeneration, or combined heat and power (CHP), is becoming more widely accepted. Conventional electricity generation is inherently inefficient, converting only about a third of the fuel's potential energy into usable energy. CHP – which produces both electricity and useable heat – converts as much as 90 percent of the fuel into usable energy. CHP systems use fuels, both fossil and renewable, to produce electricity or mechanical power and useful thermal (heating and cooling) energy far more efficiently and with lower emissions than conventional separate heat and centralized power systems.
    d. The geothermal heat pump, also known as the ground source heat pump, is used for space heating and cooling, as well as water heating. The technology relies on the fact that the Earth (beneath the surface) remains at a relatively constant temperature throughout the year, warmer than the air above it during the winter and cooler in the summer. The geothermal heat pump takes advantage of this by transferring heat stored in the Earth or in ground water into a building during the winter, and transferring it out of the building and back into the ground during the summer. The ground, in other words, acts as a heat source in winter and a heat sink in summer.
    e. Biomass power technologies convert renewable biomass fuels, like wood, to heat and electricity using processes similar to that used with fossil fuels. There are four primary classes of BioPower systems: direct-fired, co-fired, gasification, and modular systems.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* New policies to retrofit heat and hot water systems in state buildings would be developed by the proposed Energy Management Unit (EMU), which will be responsible for implementing policy, tracking effectiveness, and educating all state departments and state employees on minimizing business travel. These policies should be instituted by an Executive

Order from the governor. In conjunction with the BECI program and the earlier chapters of this section, inventory will be required in all existing state buildings and facilities.

b. *Resources Required:* Funds in the capitol budget would need to be shifted to prioritize upgrades. The establishment of an EMU will be necessary to develop policy, perform oversight, ensure compliance, and measure effectiveness.

c. *Barriers to Address (especially for medium to low feasibility actions):* Barriers include funding for funding an EMU. Renewable technologies will need to adhere to state building codes and local ordinances. Work force development, expansion of existing energy programs in colleges and universities. Education of building owners and citizens in their current energy purchase practice

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*)

   a. *Parties Responsible for Implementation:* The proposed Energy Management Unit, budget committees, the Department of Admin Services, facility managers
   b. *Parties Paying for Implementation :* State, federal incentives
   c. *Parties Benefiting from Implementation:* Improves profitability of local companies, job stability and job creation, state technical colleges and universities through increased enrollments for workforce development. Taxpayers through reduced and stable future energy costs.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (i.e., those that achieve greater reductions through parallel implementation)

   a. *Existing:* Established in April 1997, the Building Energy Conservation Initiative (BECI) program analyzes State buildings for energy and resource conservation opportunities. BECI utilizes a "paid from savings" procedure known as “Performance Contracting.” This allows agencies to perform energy retrofits and building upgrades that would otherwise not be funded through capital appropriations, providing the energy savings can pay for the project cost, as outlined in RSA 21-I. PSNH and COOP CORE utility programs currently include incentives for the installation of geo-thermal heat pumps, and Solar Thermal systems.

   b. *Proposed:*

      - RCI Goal 1 – Maximize Energy Efficiency in New Construction and Existing Buildings
      - GLA Goal 2 – Reduce Energy Use in Government Buildings
      - GLA Action 3.1 – Encourage Renewable Energy and Energy Efficiency Projects for Existing State-Owned Buildings and Facilities

6. Timeframe for Implementation: Technologies are currently available; however, funding may not be available immediately.

7. Anticipated Timeframe of Outcome: All heating and hot water systems in state buildings should be converted to a portion of renewable energy by 2050.

<u>Program Evaluation</u>

1. Estimated $CO_2$ Emission Reductions

   i. Bioheat: Biodiesel is non-toxic, biodegradable, and renewable. NOx, sulfur, carbon monoxide, smoke, hydrocarbons, and particulate matter are all reduced when using bioheat (although different studies find differing reductions). B20’s net life cycle $CO_2$ emissions are reduced by 15.66% due to carbon recycling by the plants

ii. Geothermal: According to the EPA, geothermal heat pumps can reduce energy consumption—and corresponding emissions—up to 44% compared to air-source heat pumps and up to 72% compared to electric resistance heating with standard air-conditioning equipment.
iii. Combined Heat and Power: Nationally, and primarily from large industrial facilities such as in the paper, refining and chemical industries, CHP reduces:
    - NOx emissions by 0.4 million tons per year
    - SO2 emissions by over 0.9 million tons per year
    - Emissions of CO2e into the atmosphere by 35 million metric tons.

Reduce energy use 10% by 2012 according to the exec order and continue to 30%,50%, and 80% less fossil-based energy in 2050.

| **$CO_2$ Emission Reductions ($MTCO_2e$/year):** | | | |
|---|---|---|---|
| Year | (30%) | (50%) | (80%) |
| 2012 | 5,448 | 5,448 | 5,448 |
| 2025 | 7,743 | 12,906 | 18,500 |
| 2050 | 16,349 | 27,249 | 43,600 |

2. Economic Effects
    a. Costs
        i. Short-term (2012)
            - Bioheat: In Massachusetts, heating oil prices have increased by 64% over the past three years. Bioheat prices, on the other hand, will drop as more distributors and processing plants come online in New England, increasing the supply and competition. As of November 2007, there were 165 credited processing plants in the US and 80 under construction, up from 25 plants in 2004. Biodiesel prices should be more stable than oil, as biodiesel is not affected by global supply or political issues.
            - Solar: Solar energy systems typically have a high initial cost and extremely low operating costs. Solar domestic water heaters systems are reasonably priced ($6,000-$8,000) and can show pay backs of four to seven years depending upon the fuel displaced (electric or gas). Space air heating systems can vary from inexpensive wall heaters ($1,600) to costly large central systems ($30,000+). Space cooling systems are not currently competitive.
            - Geothermal: Even though the installation price of a geothermal system can be several times that of an air-source system of the same heating and cooling capacity, the additional costs are returned in energy savings in 5–10 years. System life is estimated at 25 years for the inside components and 50+ years for the ground loop.
        ii. Mid-term (2025)
        iii. Long-term (2050)

    b. Savings:
        i. Short-term (2012)
            - Solar: The U.S. Energy Policy Act implemented a 30% tax credit, currently capped at $2,000 for consumers who install solar water heating systems. To be eligible for this tax credit, the systems must be certified by the Department of Energy's non-profit partner, the Solar Rating & Certification Corporation (SRCC).
            - Geothermal: The biggest benefit of geothermal heat pumps is that they use 25%–75% less electricity than conventional heating or cooling systems.
            - Combined Heat and Power: Produces over 9% of the electric power generated in the U.S., saving users over $5 billion each year in energy costs and decreasing energy consumption by almost 1.3 trillion Btus a year.

ii. Mid-term (2025)
iii. Long-term (2050)

3. Other Benefits/Impacts:
    a. *Environmental:* Biomass burning without controls may emit air pollutants including nitrogen oxides, carbon monoxide, organic gases, and particulate matter, many of which have adverse health effects. In many urban and rural areas, smoke from wood burning is a major contributor to air pollution. Because of this, some municipalities restrict wood heating appliance use when the local air quality reaches unacceptable levels. Others restrict or ban the installation of wood-burning appliances in new construction.
    b. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.Specifically, renewable energy types, such as solar, geothermal, and biomass help clean our air and could help reduce the NH asthma rate, one of the highest in the country.
    c. *Social:* The general public is excited to be a part of the new green movement; the government should take the lead in this paradigm shift. A public outreach component can help direct that excitement and stimulate involvement.
    d. *Other:* Renewables like CHP reduce the load on Electric Transmission Infrastructure through distributed generation.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):
    a. *Technical:* Working with older building presents a challenge. Over a four-year period, B20 was field tested by Brookhaven National Laboratories in several hundred homes in the Northeast and no significant problems were found. Active and passive solar space heating and water heating, are well-developed technologies. Active solar space cooling is marginally developed. Geothermal heat pumps (sometimes referred to as GeoExchange, earth-coupled, ground-source, or water-source heat pumps) have been in use since the late 1940s.
    b. *Economic:* Limited funds to retrofit existing buildings; challenges and changes the current way of "doing business"; most lenders are not knowledgeable of renewable systems. Excellent opportunity to provide pilot educational experiences and job creation programs.
    c. *Statutory/Regulatory:*
    d. *Social:* There are problem areas associated with the general public perception of renewable systems because they are assumed to be futuristic, still needing technological breakthroughs to be viable, and uneconomic. A primary concern for owners of renewable systems is whether they can be maintained by conventional means (the owner does not have to assume extraordinary responsibilities).

5. Other Factors of Note: Upgrading the existing infrastructure is the best place to start from when considering energy use and conservation. As with energy efficiency, the savings appear in what is not spent or phased out. By raising the level of all buildings/facilities owned by the state, the state saves money by reducing costs in land acquisition, new building construction and utility costs.

6. Level of Group Interest: This step is critical for the state and truly defines leadership

7. References:

    - U.S. DOE Energy Efficiency and Renewable Energy, Renewable Energy, http://www.eere.energy.gov/.
    - UMASS Amherst Center for Energy Efficiency and Renewable Energy, Combined Heat and Power, http://www.ceere.org/iac/iac_combined.html.
    - Bioheat Fact Sheet, Harvard Green Campus Initiative, http://www.greencampus.harvard.edu/cre/documents/bioheatfactsheet.pdf.

**GLA Action 4.1.1 – Increase Overall Efficiency of State Vehicle Fleet**

Summary

New Hampshire should increase the overall fuel efficiency of the state vehicle fleet by requiring that any vehicle purchased for state use be matched to the intended use, and therefore "right-sized," and that each such vehicle be among the most fuel efficient in its class for the year of acquisition. This policy would need to recognize that the most fuel efficient vehicles could have higher first costs but, as in the case of high-MPG hybrids, significantly lower operating costs over their useful life.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): By focusing on purchasing vehicles based on their intended use, the state could avoid buying "more vehicle" than is necessary, reduce the average vehicle size, and increase the average fuel economy of the fleet. Through such action, the state will save operating costs through reduced fuel consumption and set an example for New Hampshire businesses and residents. The proposed Energy Management Unit (EMU) would develop the necessary and appropriate policies, verify compliance, track effectiveness, and inform and educate all state departments of the program in place.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* The governor's Executive Order 2005-4; *An Order for State Government to Lead-by-Example in Energy Efficiency* was established to direct state agencies and departments to purchase new passenger and light duty vehicles with efficiency as a priority[1]. Updated policies would be developed by the EMU to reduce emissions of the state fleet further.
    b. *Resources Required:* The establishment of an EMU will promote and extend policy by performing oversight necessary to ensure compliance and measure its success. A list of vehicles that identifies the life cycle cost of owning the vehicle over its useful life will be necessary to make informed vehicle purchases that balance higher capital costs with the lower operating costs. This list will need to be updated annually.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Barriers include funding for establishing an EMU and legislative resistance to new, more stringent policies.

3. Parties Affected by Implementation:
    a. *Parties Responsible for Implementation:* State government agencies must follow Executive Order or other new legislation when purchasing new fleet vehicles. They must not only consider highly fuel efficient or alternative vehicles, but also consider the appropriate size for the tasks required of the vehicle (i.e., right-sizing).
    b. *Parties Paying for Implementation:* State government agencies will purchase and maintain the vehicles; however, tax monies will provide financial support for the implementation of the policy by the EMU.
    c. *Parties Benefiting from Implementation:* The public will benefit from cleaner air with reduced pollution from vehicle emissions.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*): The Granite State Clean Cities Coalition is a collaborative of over 70 public and private interests from all regions in New Hampshire. Coalition members support the goals of reducing dependence on foreign oil, and improving air quality, through the use of domestically produced, cleaner burning alternative fuels and other fuel reduction strategies.

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):

a. *Existing:* Executive Order 2005-4; *An Order for State Government to Lead-by-Example in Energy Efficiency* directs state agencies to develop Clean Fleets Programs and reduce fuel use[1]. This policy requires the purchase of high fuel efficiency vehicles whenever possible and requires implementation of best management practices for existing vehicles, such as right-sizing (choosing the smallest sized vehicle capable of the task intended), the use of low rolling resistance tires, a reduction in vehicle idling time, and the implementation of preventative maintenance programs. Based on this policy, the State of New Hampshire has established a Clean Fleets Policy for the purchase of new or used state vehicles and the implementation of procedures to improve fuel efficiency in state vehicles.

b. *Proposed:*

- TLU 1.A.1 – Support Stricter Corporate Average Fuel Economy Standards
- TLU 1.A.3 – Adopt California Low Emission Vehicle (CALEV) Standards
- TLU 1.C.1 – Adopt a Low-Carbon Fuel Standard
- TLU 1.C.2 – Promote Advanced Technology Vehicles and Supporting Infrastructure
- GLA 4.1.2 – Increase Use of Cleaner Fuels and Advanced Technologies
- GLA 1.1 – Establish an Energy Management Unit (EMU)

6. Timeframe for Implementation: Adoption of the policy took place with the governor's Executive Order set in 2005; for CT it took four years (2004-2008) from the date of adoption to actual implementation[3].

7. Anticipated Timeframe of Outcome: Immediate. Full implementation will require ~ 15 years as a vehicle's average lifetime is approximately 15 years. Therefore, all vehicles should be replaced with the most fuel efficient, right-sized vehicle in their class within 15 years of the implementation of policy.

Program Evaluation

1. Estimated $CO_2$ Emission Reductions

**$CO_2$ Emission Reduction ($MTCO_2e/yr$)**

| | 2012 | 2025 | 2050 |
|---|---|---|---|
| Replace LTs with vehicles that get 26mpg, 42% increase in efficiency, by 2020 | 1,073 | 2,064 | 2,064 |
| Replace PVs with vehicles that get 45 mpg, 50% increase in efficiency, by 2020 | 970 | 1,763 | 1,763 |

2. Economic Effects
    a. Costs:
        i. Short-term (2012):
        ii. Mid-term (2025):
        iii. Long-term (2050):

    b. Savings:
        i. Short-term (2012):
        ii. Mid-term (2025):
        iii. Long-term (2050):

3. Other Benefits/Impacts:

    a. *Environmental:* Improving efficiency of the state fleet is expected to reduce toxic pollutants such as acetaldehyde, 1,3-butadiene, formaldehyde, and benzene and improve air quality. These policies also address vehicle greenhouse gas emissions including non-methane organic gas (NMOG), oxides of nitrogen (NOx), and carbon monoxide (CO).
    b. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.
    c. *Social:* Reduced reliance on foreign oil is a benefit for society. Continued use of the automobile for transportation is beneficial, however, does not necessarily create a large impact on reducing emissions or changing people's habits for the long term.
    d. *Other*: Adoption of regulations requiring vehicle efficiency in state fleets will strengthen regional demand for the sale of more efficient vehicles. Increased demand will lower the cost of these efficient vehicles.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):

    a. *Technical:* Minimal technical challenges, as alternative vehicle technologies are rapidly improving in the automobile manufacturing industry.
    b. *Economic:* Continued escalation of petroleum costs will make efficient vehicles more desirable; greater demand will, in turn, lower costs.
    c. *Statutory/Regulatory:*
    d. *Social:* Continued use of the automobile provides minimal social change.

5. Other Factors of Note:

6. Level of Group Interest:

7. References:


- Lynch, John H. Executive Order Number 2005-4 – *An Order for State Government to Lead-by-Example in Energy Efficiency*. State of New Hampshire. http://www.nh.gov/governor/orders/index.htm
- National Highway Traffic Safety Administration (NHTSA) Website http://www.nhtsa.dot.gov/
- Connecticut Climate Change Action Plan 2005. Transportation and Land Use Sector. Action I: California LEV II Standards.
- 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.

**GLA Action 4.1.2 – Increase Use of Cleaner Fuels and Advanced Technologies**

Summary

A policy should be established that requires New Hampshire government to purchase vehicles with advanced technologies, such as new hybrid electric vehicles (HEV), plug-in hybrids (PHEV), advanced electric vehicles (EV), fuel cell vehicles (FCV), and vehicles capable of operating on alternative and renewable fuels such as ethanol, biodiesel, methanol, compressed natural gas, propane, hydrogen and electricity. These vehicles should represent a growing portion of the state's vehicle fleet. Aside from the substantial clean air benefits, these fuels are also produced domestically, strengthening America's energy independence. Attention should be paid, however, to the life-cycle carbon emissions of these newer technologies and fuels. Government agencies that own and operate vehicle fleets represent a small yet highly visible component of the transportation sector. Under the proposed policy, the state would lead-by-example to motivate individual municipalities and their political subdivisions to establish similar vehicle purchase programs.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): New Hampshire state government can play a unique role in the promotion and establishment of advanced fuels and technologies before they are commercially viable. By adopting these fuels and technologies early, the state can assist in the development and expansion of the infrastructure required for a new fuel to become part of vehicle fleets. More importantly, by integrating advanced technologies and fuels into its daily fleet operations, the state can take on the risk that private fleet managers may be unwilling to assume. In demonstrating the effectiveness of these fuels and technologies, the state can encourage private fleets to adopt them widely.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* State legislation will be developed to require the purchase of advanced vehicles that use alternative fuels for the state fleet. Updated policies would be developed by the proposed Energy Management Unit (EMU), which will verify compliance, track effectiveness, and educate all state departments of legislation in place.
    b. *Resources Required:* The establishment of an EMU is necessary to perform oversight, ensure compliance, and measure the effectiveness of the policy.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Barriers include funding for establishing an EMU and legislative resistance to the new, stringent policies. Determination of the carbon intensity of a given fuel will need to include a full life cycle analysis and inclusion of indirect impacts. Life cycle issues need to be addressed for biofuels before purchasing diesel and FCVs with the intention of using biodiesel and ethanol. Currently, petroleum based fuels are used to harvest and produce biofuels, a practice which eliminates biofuels from significantly reducing greenhouse gas emissions.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* State government agencies must follow legislation when purchasing new fleet vehicles. Automobile manufacturers will need to see the benefit to producing and offering more fuel efficient vehicles. This can be accomplished by implementation of new CAFE standards by the federal government or Low Carbon Fuel Standards (LCFS) by the region.
    b. *Parties Paying for Implementation:* State government agencies will purchase the vehicles using either State funds or federal grant monies.
    c. *Parties Benefiting from Implementation*: Private fleet managers may benefit by allowing the State to take on the risk associated with innovation, and all residents who will benefit from improved clean air over the longer term as the pollutants associated mobile sources decreases.

4. Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

   In June of 1996, the NH Governor's Office of Energy and Community Services (ECS), now the Office of Energy and State Planning (OEP), received a Congestion Mitigation and Air Quality Improvement (CMAQ) grant to establish a State fleet of alternative fueled vehicles and develop a network of refueling stations. The Alternative Fuel Vehicle Project (AFVP) was established with members of the ECS, DES, and DOT to facilitate the distribution of funds. A second program established within the state was the Granite State Clean Cities Coalition (GSCCC). Clean Cities is a national program supported by the U.S. Department of Energy (DOE) designed to encourage the use of AFVs and build supporting infrastructure for these vehicles.

   A moderately satisfactory fleet of vehicles powered by electricity (EV), propane (LPG) and compressed natural gas (CNG) was procured for various state agencies with the CMAQ grant. CNG refueling stations were established at three locations throughout the state, as well as 13 Electric Charging stations/outlets to support the state's fleet. Flexible fuel vehicles (FFV) that can run on 85% ethanol (E85) were also purchased; however, these must run on gasoline or 10% ethanol because the infrastructure for E85 has not yet been developed in New England.

   The Granite State Clean Cities Coalition is a collaborative of over 70 public and private interests from all regions in New Hampshire. Coalition members support the goals of reducing dependence on foreign oil, and improving air quality, through the use of domestically produced, cleaner burning alternative fuels and other fuel reduction strategies. Nationally, Clean Cities is a program sponsored by the U.S. Department of Energy, which is designed to encourage the use of Alternative Fuel Vehicles (AFV's) and their supporting infrastructure throughout the nation. By encouraging AFV use, the Clean Cities program will help achieve energy security and environmental quality goals at both the national and local levels.

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):

   a. *Existing:* Federal laws mandate states incorporate Alternative Fuel Vehicles (AFVs) into their existing fleets to reduce the negative impact transportation has on air quality. The Energy Policy Act (EPAct) was passed in 1992 to establish a timeline and set targets that state fleets must meet, such that by 2001, 75% of the light duty vehicles purchased would be AFVs[1].

   b. *In Process:* A Low Carbon Fuel Standard (LCFS) reduces greenhouse gas emissions by analyzing the life cycle carbon intensity of a given motor vehicle fuel, and increasing the portion of lower carbon fuels in the transportation fuel supply mix. Fuel supply and distribution infrastructure limitations effectively prevent New Hampshire from seeking a LCFS on its own, necessitating a regional approach to adoption of a fuel standard. Currently New Hampshire is involved in LCFS workgroups with both NESCAUM (Northeast States for Coordinated Air Use Management which incorporates all New England states plus New York and New Jersey) and the NEG-ECP (Northeast Governors-Eastern Canadian Premiers). Both workgroups are in the process of identifying lower carbon fuel potentials for the region, including availability of biomass for regional production of advanced biofuels including cellulosic ethanol and biodiesel. Other alternative fuels such as natural gas and propane also offer lower carbon impacts than conventional petroleum fuels despite the fact they are fossil fuels themselves. Natural gas can be a very low carbon fuel when recovered from landfill operations, animal feed and waste facilities, and other non-traditional sources. Technological innovation is a key component of a successful LCFS, with increased use of battery electric vehicles that are charged with low carbon energy (solar, wind, etc.), being a prominent strategy to meet such a standard.

   c. *Proposed:*

- TLU 1.A.1 – Support Stricter Corporate Average Fuel Economy Standards
- TLU 1.A.3 – Adopt California Low Emission Vehicle (CALEV) Standards
- TLU 1.C.1 – Adopt a Low-Carbon Fuel Standard
- TLU 1.C.2 – Promote Advanced Technology Vehicles and Supporting Infrastructure
- GLA 4.1.2 – Increase Use of Cleaner Fuels and Advanced Technologies
- GLA1.1 – Establish an Energy Management Unit (EMU)

6. Timeframe for Implementation: Many AFVs are currently available at reasonable cost, and the state has the ability to run fleet vehicles on CNG and electricity. The PHEV market is expected to begin in 2010. Continued escalation of petroleum prices will drive this market based on economics. The FCV market is unknown because of the lack in hydrogen infrastructure and it will have to compete with a competitive PHEV market.

7. Anticipated Timeframe of Outcome: Full replacement of current fleet with AFVs should begin to phase in by 2010. By 2025 (assuming an average vehicle life of 15 years), all vehicles within the state fleet will be AFVs.

Program Evaluation

1. Estimated $CO_2$ Emission Reduction: The State could lead by example by ensuring that every vehicle it purchases gets the best achievable mileage per pound of $CO_2$ emitted in its class. For example, a new 4-door gas-electric hybrid car now gets 52 mpg city, 45 mpg highway and emits roughly 4 tons of $CO_2$/year. By comparison, the Pontiac Sunfire (in the same Small Car Class as the 4-door hybrid), gets 24 mpg city and 33 mpg highway and emits 6.9 tons $CO_2$/year. Not only would the hybrid save the State more than $450/year in fuel costs compared to the Sunfire, it also would avoid 2.9 tons $CO_2$/year, or 17.4 tons over six years. Furthermore, within every class of vehicles (e.g., small car, sedan, station wagon, pickup, van, etc.) there is at least a 25% difference in the amount of $CO_2$ emitted annually between the most efficient and least efficient car in the class.

Reduce carbon content of fuel 10% by 2010, 20% by 2020 and 50% by 2050 (better than LCFS)

a. Short-term (2012): 990 $MTCO_2e$ /year
b. Mid-term (2025): 2,063 $MTCO_2e$ /year
c. Long-term (2050): 4,126 $MTCO_2e$ /year

2. Economic Effects
    a. Costs:
        i. Short-term (2012): Until demand for advanced vehicles increases and infrastructure for alternative fuels is instituted, costs for new fleet vehicles will be greater than the petroleum-powered, internal combustion engine vehicle counterpart in the same class.
        ii. Mid-term (2025):
        iii. Long-term (2050): Over the long term, and with the introduction of more stringent federal standards (CAFÉ), advanced vehicles and their corresponding fuels will become less expensive compared to the traditional petroleum-powered internal combustion engine vehicles.
    b. Savings:
        i. Short-term (2012): In the emissions reduction example above, a hybrid vehicle would save approximately $450/year in gasoline costs compared to a comparative gasoline-powered sedan.
        ii. Mid-term (2025)
        iii. Long-term (2050)

3. Other Benefits/Impacts:

    a. *Environmental*: This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.
    b. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.
    c. Social: Reduced reliance on foreign oil is a benefit. Continued use of the automobile for transportation is beneficial, however, does not necessarily create a large impact in reducing emissions or change people's habits. However, their may be impacts of using agricultural land to grow feed stocks for biofuel rather than food. Alternative feed stocks, such as algae or waste streams for biodiesel and ligno-cellulosic material for ethanol, should be the focus of state and federal research before committing to these low-carbon, domestic fuels in state fleets.
    d. Other: None.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):

    a. *Technical:* Minimal technical challenges, technology is rapidly improving.
    b. *Economic:* Continued escalation of petroleum costs will make AFV's more desirable. The state should investigate the possibility of aggregating demand from large fleets to cause manufacturers to introduce new, significantly more efficient vehicles. This "golden carrot" approach has worked in the past, for example, in the 1990's, several states used their combined demand to bring about very high-energy efficiency refrigerators into the marketplace. Industry experts report that a manufacturer requires a minimum annual market size of about 25,000 vehicles before it will introduce a new model vehicle. A limiting factor is that market studies indicate that the immediate market is only for about 12,000 alternative vehicles per year in the U.S. An initial campaign would be to amass an annual purchase of about 12,000 vehicles to "match" the current market potential. Because the state itself does not purchase enough new vehicles each year to meet this threshold, it should explore partnering with other levels of local government and/or private fleets in the state to increase the size of purchasing aggregation[2].
    c. *Statutory/Regulatory:* Policies to promote state purchases of alternatives to gasoline and diesel fueled vehicles have emerged from both federal and state levels of government based on concerns over energy security, air quality and climate change. Other states that have issued legislation similar to that proposed here:
        i. New York Executive Order 111 (January 10, 2001) – Requires 50% of all new state light-duty vehicle acquisitions to be clean fuel vehicles by 2005, increasing to 100% by 2010. Hybrid electric vehicles are eligible under this program.
        ii. State of Maine Executive Order 05-FY 02/03, Gov. Angus S. King, Jr., "Procurement of Fuel Efficient, Less Polluting Vehicles" (Jan. 7, 2003)
    d. *Social:* Continued use of the automobile provides minimal social change.

5. Other Factors of Note:

6. Level of Group Interest:

7. References:

**GLA Action 4.2.1 - Reduce Diesel Particulate Emissions through Use of Retrofit Devices**

Summary

New Hampshire government should lead-by-example in supporting the reduction of diesel particulate emissions (i.e., "black carbon" particulate matter emissions) from all state-related activities. This action would occur by installing diesel retrofit technologies on diesel trucks in the state fleet with a model year of 2006 and older or by retiring diesel trucks and replacing them with new technology and cleaner operating engines to achieve reductions of particulate matter (PM). Retrofit technologies should also be installed on diesel non-road equipment including construction equipment, diesel generators, and the like. State contracts for road and building construction projects should also include funding for the installation of diesel retrofit equipment on vehicles and equipment in state contracts (e.g., roads, buildings). The program would require all companies that participate in state contracts to retrofit the emission control systems on their diesel vehicles. The program would target its funds to vehicles that meet criteria related to their age (i.e., remaining operational life) and hours of operation per year in order to affect the greatest reductions per dollar invested.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*):

   The retrofit of existing diesel vehicle exhaust systems, whether state- or contractor-owned, would reduce the "black carbon" (i.e., particulate matter, PM, or soot) emissions that are released by diesel fuel combustion. "Black carbon" has been identified as having a large and fast-acting warming impact on the atmosphere. It is relevant to climate change because this soot has a global warming potential of about 600 times that of $CO_2$. The dark-colored carbon component of PM reduces the reflective capabilities of the earth by absorbing light, thus increasing heat. Fine PM can travel long distances on air currents and is a major cause of haze and air pollution which contributes to respiratory health problems.

   Efforts to reduce PM affect both climate change and public health. Diesel trucks produced in 2007 and newer include technology that dramatically reduces PM, CO, etc. For older vehicles, there are currently a range of retrofit technologies available that work similar to a muffler and will reduce PM emissions in diesel vehicles. Emissions standards for non-road vehicles and equipment will not be implemented until later years, so all old and newly purchased equipment can benefit from particulate retrofit equipment. Diesel emissions are a primary source of air pollution in the northeastern United States.

   In order to address the issue of black carbon and the existing vehicle stock which contribute to its emissions, State vehicles could be rated first on the basis of their black carbon emissions per year and then on the primary location of operation. This latter consideration incorporates health considerations. Vehicles would then be schedule for retrofit based on criteria that account for both considerations.

   Those vehicles that are used to fulfill state contracts, such as transportation construction projects, would all be required to be retrofit as part of the contract terms. For this program, funds would be made available in all state contracts for the conversion of construction vehicles that have a specific remaining operation lifespan and annual hours of use. The funds would be incorporated into the total cost of the project and would target the reduction of black carbon (soot), a component of the PM released by diesel fuel combustion.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
   a. *Method of Establishment (e.g., legislation, executive order):*
      i. Establish a state policy by Executive Order to require retrofits for vehicles and equipment in the state fleet. New policies would be developed by the proposed Energy Management Unit (EMU) to implement policy, track effectiveness, inform and educate all state departments and hired

contractors about reducing the amount of PM from diesel fuel emitted in state fleet vehicles and equipment.

ii. Establish a 10-year strategic plan to achieve the maximum reduction in health risk from diesel soot. The plan should complement the federal regulations by retrofitting aftermarket emission controls into existing engines. There should be targets set for emissions reductions and deadlines to meet these targets, recommended legislation or regulations, and an established steady source of funding to help defray the cost of retrofits during the 10-year period. Anti-idling should also be encouraged for on-road state vehicles that have the potential to access idling alternatives such as auxiliary power units or shore power.

b. *Resources Required:* The establishment of an Energy Management Unit (EMU) to develop policy and perform oversight to help ensure compliance with the new policy and measure the effectiveness of the policy. The EMU will be responsible for creating awareness and mandating retrofits on government fleets.

c. *Barriers to Address (especially for medium to low feasibility actions):* The barriers involve funding for establishing an EMU, but also, funding will be needed to purchase the retrofit devices for existing diesel vehicles, which can range from $1,000 to $10,000 each.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.):*
   a. *Parties Responsible for Implementation:* NH State government departments.
   b. *Parties Paying for Implementation:* Costs will be incurred in part by the state government to administer the programs. Federal funds can be used to retrofit those State vehicles identified as candidates for conversion.
   c. *Parties Benefiting from Implementation:* The general public will benefit from better air quality, as well as operators of diesel equipment who have the greatest chronic exposures.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):
   The Northeast Diesel Collaborative (NEDC) hosts workshops for municipalities, hospitals, and universities on retrofitting, hybrid technologies, and contract specification for construction projects. After an NEDC workshop, the city of Manchester, NH applied for funding from the Diesel Emissions Reduction Act (DERA) to retrofit city-owned vehicles and encouraged the local chapter of Associated General Contractors to think about voluntary retrofits[1].

5. Complementary Policies (i.e., those that achieve greater reductions through parallel implementation):
   a. *Existing*: The statutory authority 1998 NH Laws 207, Chapter SAF-C 5800 Roadside Diesel Opacity Inspection implemented a roadside heavy-duty diesel emissions testing program. The law applies to heavy-duty vehicles with a gross vehicle weight rating (GVWR) greater than 10,000 pounds and diesel buses that can carry more than 25 passengers[2].

      In January 2001 and in June 2004, EPA finalized the Highway Diesel and Nonroad Diesel Rules, respectively, which implemented more stringent standards for new diesel engines and fuels. The rules mandate the use of lower sulfur fuels in diesel engines beginning in 2006 for highway diesel fuel, and 2007 for nonroad diesel fuel. These fuels will enable the use of after-treatment technologies for new diesel engines, which can reduce harmful emissions, including PM, by 90% or more. After -treatment technologies will start phasing into the diesel sector beginning in 2007 for highway and 2011 for nonroad[3]. While ULSD-only emission reductions for PM are relatively modest on a per-vehicle basis compared to retrofit devices (25 to 85 percent PM reduction), the emission reductions can be significant if an entire fleet is fueled with ULSD.

      In June 2005, the U.S. Senate passed an amendment to the Energy Bill that provides funding to cut emissions from high-polluting diesel engines and create a national program to fund the cleanup of all types of diesel-powered vehicles, including trucks, buses, tractors, ships, and trains. The Diesel Emissions Reduction Act builds upon successful incentive programs in Texas and California. The

legislation authorizes $200 million per year over five years in grants and loans for states and organizations to clean up existing diesel fleets[4].

b. Proposed: TLU 1.C.3 – Install Retrofits to Reduce Black Carbon Emissions

6. Timeframe for Implementation: Immediately and ongoing as diesel retrofit technology is currently available in the marketplace.

7. Anticipated Timeframe of Outcome: 2008 through 2025. Beyond 2025, diesel trucks with a model year of 2006 or older will be twenty years or older and it will be necessary to retire these vehicles as they become antiquated. Some non-road engines will likely continue to benefit from retrofits beyond this timeframe.

Program Evaluation

1. Estimated $CO_2$ Emission Reductions: By retrofitting existing non-road and on-road diesel engines with emission controls, the state can cut dangerous diesel emissions by between 50-90% per engine. The greatest reductions will occur from 2008 to 2012 with vehicles purchased after 2006 that must abide by EPA's Highway Diesel and Nonroad Diesel Rules. By purchasing diesel vehicles with enhanced emissions controls, retrofitting emission controls onto existing engines, and implementing an aggressive campaign to eliminate unnecessary idling, the state could dramatically cut emissions of PM and slow warming of the earth over the short term.

**$CO_2$ Emission Reduction ($MTCO_2e/yr$) by 2012**

| | Low range | High range |
|---|---|---|
| 100% DOCs by 2012 | 2,724 | 6,190 |
| 100% FTFs by 2012 | 4,960 | 11,274 |
| 100% DPFs by 2012 | 7,209 | 16,384 |

2. Economic Effects
   a. Costs:
      i. Short-term (2012): $1,000 to $10,000 per unit.
      ii. Mid-term (2025)
      iii. Long-term (2050)

   b. Savings:
      i. Short-term (2012)
      ii. Mid-term (2025)
      iii. Long-term (2050)

3. Other Benefits/Impacts:
   a. *Environmental:* Fine particles ($PM_{2.5}$) are the major cause of reduced visibility (haze). Particles can be carried over long distances by wind and then settle on ground or water. The effects of this settling include: making lakes and streams acidic; changing the nutrient balance in coastal waters and large river basins; depleting the nutrients in soil; damaging sensitive forests and farm crops; and affecting the diversity of ecosystems[5].

   b. *Health:* Reduced PM improves air quality, thus improving human health. Particle pollution - especially fine particles - contains microscopic solids or liquid droplets that are so small that they can get deep into the lungs and cause serious health problems. People with heart or lung diseases, children and older adults are the most likely to be affected by particle pollution exposure. However, even if you are healthy, you may experience temporary symptoms from exposure to elevated levels of particle pollution. Numerous scientific studies have linked particle pollution exposure to a variety of problems, including:

- increased respiratory symptoms, such as irritation of the airways, coughing, or breathing difficulty
- decreased lung function;
- aggravated asthma;
- development of chronic bronchitis;
- irregular heartbeat;
- nonfatal heart attacks; and
- premature death in people with heart or lung disease[5].

c. *Social:* Particle pollution can stain and damage stone and other materials, including culturally important objects such as statues and monuments[5].

d. *Other:*

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):

a. *Technical:* Minimal technical challenges exist as the technology is well developed. There are three basic types of retrofits. Diesel Oxidation Catalysts (DOCs) can be used on virtually any diesel engine and will reduce PM by approximately 25%. DOCs are similar to a muffler and there is no maintenance involved after installation and devices usually last for six years. They may not be appropriate for engines older than 1990. Flow through Filters (FTFs) work similar to DOCs but have additional filtering material, e.g. wire mesh to capture more PM. FTFs will reduce PM by approximately 50%. FTFs require a duty cycle to create a minimum exhaust temperature and not all diesel vehicles are able to meet this criteria. Diesel Particulate Filters (DPF's) can be either active or passive. A passive DPF works by simply filtering the exhaust flow. An active DPF relies on additional energy to increase the heat in the exhaust to burn off excess PM. DPF's reduce PM by approximately 85%. A passive DPF requires a duty cycle to create a minimum exhaust temperature and not all diesel vehicles are able to meet this criteria. Active DPF's can be used with virtually any diesel engine[6, 7].

b. *Economic:* DOCs range from $1,000 to $2,000 per installation. FTFs last for approximately 6 years and range from $3,000 to $4,000 per installation. DPF's cost from $5,000 to $10,000 and need to be cleaned every 12 to 24 months for a fee of $200 to $400. DPF's will also increase fuel use by 1 to 3% for passive applications and up to 7% for active applications[6, 7].

c. *Statutory/Regulatory:*

d. *Social:* As it is also associated with improved air quality and human health, this action should receive positive public support.

5. Other Factors of Note:

6. Level of Group Interest:

7. References:


- Black Carbon Pollution Emerges As Major Player In Global Warming, http://www.sciencedaily.com/releases/2008/03/080323210225.htm
- http://www.epa.gov/region01/topics/air/sips/nh/2003_saf5800_NH.pdf
- http://www.northeastdiesel.org/
- http://www.epa.gov/oms/regs/fuels/diesel/420f06033.htm
- GovTrack.us. S. 1265 - 109th Congress (2005): Diesel Emissions Reduction Act of 2005, GovTrack.us (database of federal legislation), http://www.govtrack.us/congress/bill.xpd?bill=s109-1265
- http://www.epa.gov/air/particlepollution/health.html
- http://www.epa.gov/ne/eco/diesel/retrofits.html
- http://www.epa.gov/cleandiesel/documents/retrofit-tech-prog-exp.07-2005.pdf

**GLA Action 4.2.2 – Increase Fuel Economy through Improved Vehicle Maintenance**

Summary

The most fuel-efficient vehicles achieve the greatest number of miles per gallon of fuel and, in so doing, reduce their greenhouse gas (GHG) emissions per trip. The state should maintain or improve the fuel economy of the *existing* state fleet by expanding the use of maintenance methods that contribute directly to improved fuel economy. Available methods include the use of low-friction engine oil and low-rolling-resistance replacement tires.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): State fleet managers would focus on adopting improved maintenance techniques for the vehicles in the *existing* State fleet. In so doing, the state would increase the average fuel economy of fleet vehicles prior to their replacement. The state would save operating costs through reduced fuel consumption and would set an example for New Hampshire businesses and residents. The proposed Energy Management Unit (EMU) would develop the necessary and appropriate policies, verify compliance, track effectiveness, and inform and educate all state departments of the program in place.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* The governor's Executive Order 2005-4; *An Order for State Government to Lead-by-Example in Energy Efficiency* was established to direct state agencies and departments to purchase new passenger and light duty vehicles with efficiency as a priority[1]. Updated policies would be developed by the EMU to reduce emissions of the state fleet further.
    b. *Resources Required:* The establishment of an EMU will promote and extend policy by performing oversight necessary to ensure compliance and measure its success. An education program may be required to assist fleet managers in the adoption of the required measures and EMU staff may be needed to assist in the identification and procurement of the tools and materials required to adequately maintain the vehicles.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Barriers include funding for establishing an EMU and legislative resistance to new, more stringent policies.

3. Parties Affected by Implementation:
    a. *Parties Responsible for Implementation:* State government agencies must follow Executive Order or other new legislation when purchasing new fleet vehicles. They must not only consider highly fuel efficient or alternative vehicles, but also consider the appropriate size for the tasks required of the vehicle (i.e., right-sizing).
    b. *Parties Paying for Implementation:* State government agencies will purchase and maintain the vehicles; however, tax monies will provide financial support for the implementation of the policy by the EMU.
    c. *Parties Benefiting from Implementation:* The public will benefit from cleaner air with reduced pollution from vehicle emissions.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*): The Granite State Clean Cities Coalition is a collaborative of over 70 public and private interests from all regions in New Hampshire. Coalition members support the goals of reducing dependence on foreign oil, and improving air quality, through the use of domestically produced, cleaner burning alternative fuels and other fuel reduction strategies.

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):

    a. *Existing:* Executive Order 2005-4; *An Order for State Government to Lead-by-Example in Energy Efficiency* directs state agencies to develop Clean Fleets Programs and reduce fuel use[1]. This policy requires the purchase of high fuel efficiency vehicles whenever possible and requires implementation of best management practices for existing vehicles, such as right-sizing (choosing the smallest sized vehicle capable of the task intended), the use of low rolling resistance tires, a reduction in vehicle idling time, and the implementation of preventative maintenance programs. Based on this policy, the State of New Hampshire has established a Clean Fleets Policy for the purchase of new or used state vehicles and the implementation of procedures to improve fuel efficiency in state vehicles.

    b. *Proposed:*

    - TLU 1.A.1 – Support Stricter Corporate Average Fuel Economy Standards
    - TLU 1.A.3 – Adopt California Low Emission Vehicle (CALEV) Standards
    - TLU 1.C.1 – Adopt a Low-Carbon Fuel Standard
    - TLU 1.C.2 – Promote Advanced Technology Vehicles and Supporting Infrastructure
    - GLA 4.1.2 – Increase Use of Cleaner Fuels and Advanced Technologies
    - GLA1.1 – Establish an Energy Management Unit (EMU)

6. Timeframe for Implementation: Adoption of the policy took place with the governor's Executive Order set in 2005; for CT it took four years (2004-2008) from the date of adoption to actual implementation[3].

7. Anticipated Timeframe of Outcome: Immediate. Full implementation will require about 15 years as a vehicle's average lifetime is approximately 15 years. Therefore, all vehicles should be replaced with the most fuel efficient, right-sized vehicle in their class within 15 years of the implementation of policy.

Program Evaluation

1. Estimated $CO_2$ Emission Reductions

**$CO_2$ Emission Reduction ($MTCO_2e/yr$)**

| | 2012 | 2025 | 2050 |
|---|---|---|---|
| Tires replaced and always inflated by 2012 (3%), low viscosity oils & filter changes on-time by 2025 (1.5%), and on-time air filter replacements by 2050 (5%). | 95 | 277 | 558 |
| Tires replaced and inflated properly, low viscosity oil & filter replacements by 2012 (4.5%), air filters replaced regularly by 2025 (5%). | 277 | 558 | 558 |
| Tires replaced and inflated properly, low viscosity oil & filter and air filter replacements by 2012 (9.5%). | 558 | 558 | 558 |

2. Economic Effects

    a. Costs:

i. Short-term (2012):
ii. Mid-term (2025):
iii. Long-term (2050):

b. Savings:
i. Short-term (2012):
ii. Mid-term (2025):
iii. Long-term (2050):

3. Other Benefits/Impacts:

a. *Environmental:* Improving efficiency of the state fleet is expected to reduce toxic pollutants such as acetaldehyde, 1,3-butadiene, formaldehyde, and benzene and improve air quality. These policies also address vehicle greenhouse gas emissions including non-methane organic gas (NMOG), oxides of nitrogen (NOx), and carbon monoxide (CO).
b. *Health:* Reduction of these pollutants will promote human health and well-being.
c. *Social:* Reduced reliance on foreign oil is a benefit for society. Continued use of the automobile for transportation is beneficial, however, does not necessarily create a large impact on reducing emissions or changing people's habits for the long term.
d. *Other*: Adoption of regulations requiring vehicle efficiency in state fleets will strengthen regional demand for the sale of more efficient vehicles. Increased demand will lower the cost of these efficient vehicles.

4. Potential for Implementation *(i.e., including challenges, obstacles and opportunities):*

a. *Technical:* Minimal technical challenges, as alternative vehicle technologies are rapidly improving in the automobile manufacturing industry.
b. *Economic:* Continued escalation of petroleum costs will make efficient vehicles more desirable; greater demand will, in turn, lower costs.
c. *Statutory/Regulatory:*
d. *Social:* Continued use of the automobile provides minimal social change.

5. Other Factors of Note:

6. Level of Group Interest:

7. References:


- Lynch, John H., Executive Order Number 2005-4, *An Order for State Government to Lead-by-Example in Energy Efficiency*. State of New Hampshire, http://www.nh.gov/governor/orders/index.htm.
- National Highway Traffic Safety Administration (NHTSA) Website http://www.nhtsa.dot.gov/.
- Connecticut Climate Change Action Plan 2005. Transportation and Land Use Sector. Action I: California LEV II Standards.
- 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.

**GLA Action 5.1.1 – Implement a State Vehicle Idling Policy**

Summary

New Hampshire state government should implement a no-idling policy to reduce emissions from state motor vehicles. Light- and heavy-duty vehicle idling wastes fuel, damages engines, and results in excess greenhouse gas (GHG) and criteria air pollutant emissions. An Argonne National Laboratory report estimated that more than 13 million light- and medium-duty trucks use more than 600 million gallons per year of fuel (gasoline and diesel) for idling[1]. Consumers and operators of state-owned vehicles have become accustomed to idling for a simple reason: most drivers seem not to make the connection between idle time, increased emissions, and wasted fuel. For vehicle fleets, a good idle reduction policy is the first line of attack to save fuel and ensure vehicles are idling only when necessary. Another step is to consider the technologies available for idle reduction for light- and medium-duty vehicles, such as coolant heaters, air heaters, and energy recovery systems[2].

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): To address this issue, the New Hampshire state government should implement a robust idling reduction program that targets all state fleet and contract vehicles. Effectively, the state could adopt regulations and provide outreach within departments to target excessive idling in light cars and trucks, as well as heavy-duty trucks and construction equipment, in both its fleet and contract vehicles.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* The proposed Energy Management Unit (EMU) will be responsible for implementing a robust anti-idling policy, performing oversight, ensuring compliance, tracking effectiveness, and educating all state departments and state employees. Updated policies could be instituted by an Executive Order from the governor.
    b. *Resources Required:* The EMU will be employed to execute state policy issued by the Executive Order 2005-4 to reduce idling in state fleets and contracts.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Funding for establishing an EMU will be necessary. Certain vehicles are exempt from idling regulations. Those exemptions include vehicles in traffic, emergency vehicles, vehicles providing power take-off (PTO) for refrigeration or lift gate pumps, and vehicles supplying heat or air conditioning for passenger comfort during transportation.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* State agencies will be responsible for initiating employee training and it will be the responsibility of the employees to take action on this education.
    b. *Parties Paying for Implementation:* State agencies will pay for training of employees.
    c. *Parties Benefiting from Implementation:* The state agencies will benefit financially from decreased fuel use. The general public will benefit in health from reduced air pollution from idling vehicles.

4. Related Existing Policies and Programs *(i.e., those that address similar issues without interacting*):

    The Granite State Clean Cities Coalition is a collaborative of over 70 public and private interests from all regions in New Hampshire. Coalition members support the goals of reducing dependence on foreign oil, and improving air quality, through the use of domestically produced, cleaner burning alternative fuels and other fuel reduction strategies[4].

    The State of New Hampshire has regulatory limits on the time motor vehicles operating on diesel are allowed to idle based on temperature. At 32°F or above, the limit is 5 minutes, between 10-32°F, 10 minutes is allowed, and below 10°F, there is no limit. The New Hampshire Department of Environmental Services (NH DES) has been promoting idling reduction through several voluntary programs through their Engine Idling Reduction and

School Bus Initiative programs. In an effort to reduce air pollution in New Hampshire, DES informs diesel truck and bus drivers and owners about the environmental, financial, and health consequences of engine idling while the vehicle is not in motion through information, sample idling policies, and signage. Signs are available at no charge through DES to encourage drivers to turn off engines[5].

5. Complementary Policies (i.e., those that achieve greater reductions through parallel implementation):
    a. *Existing:* The governor's Executive Order 2005-4, *An Order for State Government to Lead-by-Example in Energy Efficiency,* proposed the establishment of a Clean Fleets Program that would initiate an anti-idling policy[3].
    b. *Proposed:*
        - TLU 1.D.2 – Reduce Vehicle Idling
        - GLA 1.1 – Establish an Energy Management Unit
        - GLA 4.1.1 – Increase Overall Efficiency of State Vehicle Fleet
        - GLA 4.2.1 – Reduce Diesel Particulate Emissions through Use of Retrofit Devices
        - GLA 4.2.2 – Increase Fuel Economy through Improved Vehicle Maintenance and Technology
        - GLA 5.1.2 – Promote Improved Driver Habits

6. Timeframe for Implementation: Employee training can take place immediately with very little funding. Immediate action will provide the best savings in fuel costs and greenhouse gas (GHG) emissions.

7. Anticipated Timeframe of Outcome: The outcome will depend primarily on the attitudes of the employees, as well as how much precedence the state agencies place on the need to abate idling, particularly for diesel burning vehicles. It may take a long time to change habits. The cost of fuel may expedite this process at the business level because state agencies' funding is usually limited.

<u>Program Evaluation</u>

1. Estimated $CO_2$ Emission Reductions
    a. Short-term (2012): Idling vehicles use up to several billion gallons of fuel and emit large quantities of air pollution and greenhouse gases each year. Idle reduction technologies and practices are an important way to cut petroleum consumption and emissions. Significant $CO_2$ reductions can be realized by reducing the amount of idling in state vehicles and contracts.
    b. Mid-term (2025)
    c. Long-term (2050)

2. Economic Effects
    a. Costs:
        i. Short-term (2012): State agencies would be required to pay for training of employees that operate vehicles and are subject to the reduced idling regulations and new policy. Idling reduction devices could be installed on state vehicles.
        ii. Mid-term (2025):
        iii. Long-term (2050):

    b. Savings:
        i. Short-term (2012): Idling consumes a significant amount of fuel, adds wear and tear to the engine, and ends up costing thousands of dollars each and every year. With effective idling reduction policy, the state will save on fuel costs. The American Trucking Association (ATA) reports that engine idling not associated with normal driving makes up as much as 30 to 50% of truck operating hours. The ATA estimates that engine wear caused by idling one hour every day is equivalent to driving 64,000 miles per year. Idling not only wears the engine and leads to higher maintenance and repair costs, but it also reduces fuel economy. Idling consumes one gallon of fuel per hour, resulting in close to a billion gallons of diesel fuel wasted each year nationwide[2].

ii. Mid-term (2025)
iii. Long-term (2050)

3. Other Benefits/Impacts:
    a. *Environmental*: Drivers of diesel vehicles would create a significant impact on air quality and the environment by reducing truck engine idling. This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.
    b. *Health*: Emissions from idling trucks contribute to air pollution and haze and may affect drivers' health, as well as the health of the general public. By enforcing idling policy, exposure of truck drivers and the public to harmful pollutants in diesel exhaust would be greatly reduced. Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.
    c. *Social:* By implementing no idling policy, the image of the state vehicle fleet, particularly of the heavy-duty trucks, would be positively viewed by the public*. The government would be able to set an example for municipalities and New Hampshire businesses to watch and model in their own operations.*
    d. *Other:*

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):
    a. *Technical:* Technologies available for idle reduction for light- and medium-duty vehicles include coolant heaters, air heaters, and energy recovery systems. Although the state does not typically employ or contract long-haul truck drivers, there are alternatives to idling when cab comfort is a concern for truck operators during summer and winter months. For example, "anti-idling devices" include direct-fired burners for cab and engine block heating; thermal storage devices for heating and cooling; and auxiliary power units for heating, cooling, and electrical power. These units use only 10% to 15% of the fuel a diesel truck engine uses and also emit much less air pollution per gallon burned. All devices are commercially available, easy to install, efficient, and relatively inexpensive to operate.
    b. *Economic:* Anti-idling devices can also save the average long-haul truck driver as much as $4,000 each year in fuel costs alone. Less idling time means less wear on the engine, which saves on preventative maintenance and repair costs.
    c. *Statutory/Regulatory:* It is difficult to enforce no idling policy by means other than signage. However, police officials should make an effort; it is possible that fines may be disseminated for excessive idling.
    d. *Social*: There will be resistance to change the habit of idling because the employees do not have to pay for their gas usage, state agencies do.

5. Other Factors of Note:

6. Level of Group Interest:

7. References:


- Gaines, Linda, Anant Vyas, and John L. Anderson. Paper No. 06-2567 - Estimation of Fuel Use by Idling Commercial Trucks. Center for Transportation Research, Argonne National Laboratory. Submitted for presentation at and the 85th Annual Meeting of the Transportation Research Board, Washington, D.C.. January 22–26, 2006. http://www.transportation.anl.gov/pdfs/TA/373.pdf
- U.S.DOE. Energy Efficiency and Renewable Energy. Alternative Fuels and Advanced Vehicles Website. Idle Reduction Strategies for Light and Medium Duty vehicles. http://www.eere.energy.gov/afdc/vehicles/idle_reduction_light.html
- Lynch, John H., Executive Order Number 2005-4, *An Order for State Government to Lead-by-Example in Energy Efficiency*. State of New Hampshire, http://www.nh.gov/governor/orders/index.htm.

**GLA Action 5.1.2 – Promote Improved Driver Habits**

Summary

New Hampshire state government should seek to reduce emissions from existing state motor vehicles by implementing a policy to promote driving habits that increase vehicle fuel efficiency and save money on gas. State employees and contractors should be educated in the practice called "hypermiling." Hypermiling entails avoiding aggressive driving, such as rapid acceleration and sudden braking, observing the speed limit, consolidating and planning trips, avoiding drag by keeping windows closed, not idling, removing excess cargo weight, using cruise control, and not using air conditioning whenever feasible. These practices can be readily implemented, and overlooking them wastes copious amounts of fuel. While each vehicle reaches its optimal fuel economy at a different speed (or range of speeds), gas mileage usually decreases rapidly at speeds above 60 mph. Hypermiling can improve overall fuel efficiency by 33 percent at highway speeds and by 5 percent around town – a savings equivalent to $0.19-$1.23 per gallon of fuel at a price of $3.71 per gallon. Sensible driving is also safer, so more than gas money would be saved[1].

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): Education will be the key to implementation. By simply adjusting driving habits, one can realize a 30-percent or greater improvement in fuel economy. Hypermiling is a term that catches people's attention. It not only cuts fuel costs and vehicle emissions, but it can also reduce drivers'stress on the road. Other payoffs include lower car maintenance and repair costs, fewer accidents and traffic tickets, and reduced auto insurance premiums. Employees should be graded on their periodic evaluations for adopting improved habits in all areas of energy efficiency, including driving habits. To support the proposed action, gas mileage should routinely be calculated and recorded for all state vehicles.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* The proposed Energy Management Unit (EMU) would be employed to implement policy, track effectiveness, and educate all state departments and all state employees about improved driving habits. The governor should establish state policy by Executive Order, rather than through legislation, particularly since these actions affect only the state employees and not the common citizens.
    b. *Resources Required:* The establishment of an EMU to develop policy, provide oversight, ensure compliance and measure effectiveness.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Funding for establishing an EMU will need to be addressed. State departments that have encouraged improved driving habits, like the Department of Resources and Economic Development (DRED), have experienced resistance from their employees because people inherently do not want to drive slower, particularly when they are not paying for the fuel, their employer is.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* State agencies will need to provide education for their employees to encourage improved driver habits and the state employees and contractors will be responsible for taking action on the education received.
    b. *Parties Paying for Implementation:* State agencies will be required to pay for training of employees.
    c. *Parties Benefiting from Implementation:* The state agencies will benefit financially from decreased fuel use. Employees may benefit psychologically from driving slower, because it inherently lowers stress and lessens the potential for road rage.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*): The Granite State Clean Cities Coalition is a collaborative of over 70 public and private interests from all regions in New Hampshire. Coalition members support the goals of reducing dependence on foreign oil, and improving air quality, through the use of domestically produced, cleaner burning alternative fuels and other fuel reduction strategies[2].

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):

    a. *Existing:*

    b. *Proposed:*

        - TLU 1.D.1 – ReduceSpeed Limits
        - TLU 1.D.2 – Reduce Vehicle Idling
        - TLU 2.A.1 – Implement Commuter Trip Reduction Initiative
        - TLU 2.B – Establish a Balanced, Integrated, Multi-modal Transportation System
        - GLA 1.1 – Establish an Energy Management Unit
        - GLA 4.1.1 – Increase Overall Efficiency of State Vehicle Fleet
        - GLA 5.1.1 – Implement a State Vehicle Idling Policy
        - GLA 5.2 – Reduce State Business-Related Travel
        - GLA 6 – Reduce Fuel Consumption by State Employee Vehicles

6. Timeframe for Implementation: Employee training can take place immediately with very little funding. Immediate action will provide the best savings in fuel costs and greenhouse gas (GHG) emissions.

7. Anticipated Timeframe of Outcome: The outcome will depend primarily on the attitudes of the employees, as well as how much precedence the state agencies place on the need to change the driving habits of employees. It may take a long time to change habits. The cost of fuel may expedite this process at the business level because state agencies' funding is usually limited.

Program Evaluation

1. Estimated $CO_2$ Emission Reductions

**$CO_2$ Emission Reduction ($MTCO_2e/yr$)**

| | 2012 | 2025 | 2050 |
|---|---|---|---|
| 25% of people change habits by 2012, 50% by 2025. | 171 | 343 | 343 |
| 50% of people change habits by 2012. | 343 | 343 | 343 |

2. Economic Effects

    a. Costs:
        i. Short-term (2012): Short-term costs include training for employees on fuel-saving driving habits.
        ii. Mid-term (2025)
        iii. Long-term (2050)

    b. Savings:
        i. Short-term (2012): State agencies will save money from improved employee driving habits.

ii. Mid-term (2025): In the mid- to long-term, even with the addition of advanced vehicle technologies and alternative fuels, improved driver habits will continue to generate emission reductions.
iii. Long-term (2050)

3. Other Benefits/Impacts:
    a. *Environmental*: Improved driver habits will have an impact on air quality; by reducing the amount of fuel used, fewer pollutants will be emitted. This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.
    b. *Health*: Improved air quality decreases exposure of humans to toxic and hazardous air pollutants. Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.
    c. *Social*: This action will make employees more aware of fuel wasting habits, which they will also apply to their daily lives outside of work.
    d. *Other*

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):
    a. *Technical:* Vacuum gauges can be installed on some vehicles to give drivers an indication of the fuel economy they are achieving in various driving situations. Sampling air pressure in the intake manifold, the gauge signals when the driver is using excessive throttle and wasting gas. Another control that can be installed on state vehicles are pilot monitors that set off an alarm if the driver exceeds a maximum revolutions per minute (rpm).
    b. *Economic:* Reduction in fuel costs will result from less aggressive and more conscious driving habits.
    c. *Statutory/Regulatory:* It is difficult to enact legislation on this issue, however employee evaluations are a good way to monitor and encourage improved driving habits.
    d. *Social:* There will be resistance to changing habits of employees, because people do not inherently want to drive less aggressively, and because the employees do not have to pay for their gas usage when traveling for work purposes.

5. Other Factors of Note:

6. Level of Group Interest:

7. References:
    - U.S. DOE Fuel Economy Website, http://www.fueleconomy.gov/feg/driveHabits.shtml
    - Granite State Clean Cities Coalition Website, http://www.granitestatecleancities.org

**GLA Action 5.2 – Reduce State Business-Related Travel**

Summary

New Hampshire government should take strides to reduce excessive state business travel. There are a variety of available solutions for reducing or offsetting an organization's emissions related to business travel: Seminars and meetings should be accomplished via telephone, video and web-conferencing whenever feasible. Business trips should be consolidated; several short trips taken from a cold start can use twice as much fuel as a longer multipurpose trip covering the same distance when the engine is warm. Routes should be planned according to the most efficient traffic flow; and, rather than spreading miles evenly over all vehicles in the fleet, vehicle assignments should be right-sized to match the purpose of the trip and to obtain maximum overall fuel efficiency. State policy should also encourage alternative/mass transportation for travel to and from conferences and meetings within the region. For distant travel needs, particularly by air, it may be appropriate for state agencies to be required to purchase carbon offsets to compensate for air emission impacts.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): New Hampshire state government should lead-by-example in instituting policies and practices that require more widespread use of strategies to reduce state business travel and promote better trip planning. According to the Association of Corporate Travel Executives (ACTE), the corporate business community is beginning to take seriously the contribution of professional travel to global warming. Companies are looking at rail and bus service as alternatives to automobile and air travel, and are considering locating their facilities closer to public transportation centers to reduce travel-related emissions. For public and private organizations alike, consideration of climate risk should be an important component of smart financial management. Concerns about pollution are part of a general movement within the government and business communities toward greater social and environmental responsibility[1].

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* New policies would be developed by the proposed Energy Management Unit (EMU), which will be responsible for implementing policy, tracking effectiveness, and educating all state departments and state employees on minimizing business travel. These policies should be instituted by an Executive Order from the governor.
    b. *Resources Required:* The establishment of an EMU will be necessary to develop policy, perform oversight, ensure compliance, and measure effectiveness.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Barriers include funding for funding an EMU. The state may see resistance to these stringent policies that require people to change their habits. Meetings may not be as effective over the phone as in person. It also takes more time to use public transportation methods, particularly until they are well established in New Hampshire, versus driving a company vehicle.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* The EMU and state agencies will be responsible for instituting policy and outreach to educate employees on methods of minimizing business related travel.
    b. *Parties Paying for Implementation:* The state agency will be required to pay for implementation of training programs regarding new policies. It may be necessary for the state to invest in improving mass transit options for employees to use to and from work, meetings, and job sites.
    c. *Parties Benefiting from Implementation:* Wear and tear of state vehicles will be minimized by improved trip planning. By purchasing carbon offsets, the alternative energy market will improve.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*): Currently there are no courses of action or programs in New Hampshire that promote sustainable business travel policies.

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):

    a. *Existing:*

    b. *Proposed:*

        - TLU 2.A.1 – Implement Commuter Trip Reduction Initiative
        - TLU 2.B – Establish a Balanced, Integrated, Multi-modal Transportation System
        - GLA 1.1 – Establish an Energy Management Unit
        - GLA 4.1.1 – Increase Overall Efficiency of State Vehicle Fleet
        - GLA 5.1.2 – Promote Improved Driver Habits
        - GLA 5.3 – Apply Smart Growth Principals to State Office Locations
        - GLA 6 – Reduce Fuel Consumption by State Employee Vehicles

6. Timeframe for Implementation: Employee training can take place immediately with very little funding. Immediate action will provide the best savings in fuel costs and greenhouse gas (GHG) emissions.

7. Anticipated Timeframe of Outcome: The outcome will depend primarily on the actions taken by employees to minimize their business related travel. It may take a long time to change habits. The cost of fuel may expedite this process at the business level because state agencies' funding is usually limited.

<u>Program Evaluation</u>

1. Estimated $CO_2$ Emission Reductions: By instituting policy regarding business travel alternatives, particularly by reducing air and automobile travel, GHG emissions can be reduced significantly. American business travel accounts for between 20 and 60 percent of most corporations' pollutants. Transport (all forms) represents about one-third of all global climate-changing greenhouse gas emissions. A typical business jet emits a pound of climate-changing gases per passenger mile and flights deposit $CO_2$ where it does the worst possible damage, between 30,000 and 40,000 feet above the earth's surface. While travel avoidance is preferred, businesses that require travel to operate are finding a pragmatic and transparent solution in carbon-offset programs. The premise is that if a corporation tracks its pollutants, it can then take a countermeasure to offset its impact. Funding from carbon-offset programs often goes into research and development of cleaner, more reliable forms of energy. In this way, the state can attempt to make its business travel carbon neutral.

    Reduce State related travel by 10% in 2012, 25% in 2025, and 50% in 2050.

    a. Short-term (2012): 825 $MTCO_2e$ /year
    b. Mid-term (2025): 2,063 $MTCO_2e$ /year
    c. Long-term (2050): 4,126 $MTCO_2e$ /year

2. Economic Effects

    a. Costs:
        i. Short-term (2012): Training employees on new business travel policy would be a minimal cost. By purchasing carbon offsets when traveling out-of-state by airplane, the business travel becomes carbon neutral. Purchasing carbon offset for out-of-state travel by air would be a more significant cost incurred by the state government agencies.
        ii. Mid-term (2025): Invest in improved mass transportation for employees.
        iii. Long-term (2050):

b. Savings:
    i. Short-term (2012): This action will result in less wear and tear on the fleet vehicles if people travel less frequently for business purposes or use alternative forms of transportation like bus or rail. Minimizing travel will save the state agencies money because employees will not need to be reimbursed for travel expenses, nor be paid for time spent traveling.
    ii. Mid-term (2025)
    iii. Long-term (2050)

3. Other Benefits/Impacts:

    a. *Environmental*: Moderating business related travel will have a corresponding benefit to air quality because of reduced emissions. This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.
    b. *Health*: Improved air quality will, in turn, reduce the exposures of humans to toxic and hazardous air pollutants. Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.
    c. *Social:* This action will make employees more aware of fuel wasting habits, which they will then apply to their daily lives.
    d. *Other:* The government would be able to set an example for municipalities and New Hampshire businesses to watch and model in their own operations.

4. Potential for Implementation *(i.e., including challenges, obstacles and opportunities):*

    *a. Technical:* A technical issue exists in that currently the infrastructure is not established and the land use planning is inappropriate for mass transportation to be utilized efficiently for business related travel.
    *b. Economic:* Funding for mass transportation improvements will be a significant expense for the state. However, with minor changes in habits, for example teleconferencing, there are means of reducing business related travel and saving money for the state agencies.
    *c. Statutory/Regulatory:*
    *d. Social:*

5. Other Factors of Note:

6. Level of Group Interest:

7. References:


- Greenbiz.com, http://www.greenbiz.com/

**GLA Action 5.3 – Apply Smart Growth Principals to State Office Locations**

Summary

New Hampshire should lead-by-example in making *smart growth* principles a priority consideration when choosing state agency office locations, whether they involve new construction or leased facilities. There is a growing concern that current development patterns – dominated by "sprawl" – contribute significantly to excessive energy consumption and greenhouse gas (GHG) emissions. State agencies are often situated in locations that pull their employees out of downtowns and into peripheral areas, thus promoting sprawl. Current state purchasing policy limits agencies to choosing lowest rent locations. Such locations tend to be outside established downtowns[1]. State agencies can help promote smart growth by selecting office locations in urban or village centers and utilizing existing building space. Preferred sites would offer readily available transit opportunities (e.g. bus, rideshare, bicycle or pedestrian routes) and would be located so as to avoid disturbance of the natural environment. By placing future office building sites in close proximity to existing community centers and transit facilities, the state would also promote the walkability of those sites. Proper regional planning can reduce the need for vehicle use by making areas of development more compact.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): The state needs to encourage broad and forward-thinking land use and transportation plans in order to stabilize growth in VMT. This includes investments in infrastructure in or near existing population centers or in designated high-growth areas that meet defined criteria for minimum development density and have a mix of land uses. The state agencies should be encouraged or required to locate offices around bus/rail stations and interconnected walkable street patterns.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* Current policy includes RSA-9B, the State of New Hampshire's "Smart Growth" initiative. New policies would be developed by the proposed Energy Management Unit (EMU), which will be established to implement new purchasing policy, track effectiveness of Smart Growth planning, and educate all state departments. State policy will be enacted via Executive Order by the governor or legislation.
    b. *Resources Required:* The establishment of an EMU to develop new policy, perform oversight, ensure compliance, and measure effectiveness.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Funding will be required for establishing an EMU. Existing state buildings on Hazen Drive promote walkability between departments; however, do not allow employee access to downtown facilities. Therefore, state employees need to leave the facility by car to access commercial businesses or residences. A solution might be a shuttle to downtown from the Hazen Drive complex, particularly during lunch hours.

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.):*
    a. *Parties Responsible for Implementation:* State agencies and their contractors are responsible for implementing Smart Growth principles when choosing locations for state offices.
    b. *Parties Paying for Implementation:* The state agencies themselves will pay for construction or leasing of buildings for their employees.
    c. *Parties Benefiting from Implementation:* State employees will benefit from Smart Growth planning because it increases walkability and social capital, reducing their vehicle miles traveled and fuel consumption, as well as connecting them with a mixed-use downtown center and increasing interactions with colleagues.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*):

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):
    a. *Existing:* In 1999 the Legislature recognized the impact of state agency decisions on local land use patterns and enacted RSA 9-B. This statute requires each state agency to consider "smart growth" principles when providing advice, expending funds, or distributing grant monies, for public works, transportation, or major capital improvement projects, and for the construction, rental, or lease of facilities. RSA 9-B also calls for a coordinated and comprehensive effort by state agencies for economic growth, resource protection, and planning policy to encourage smart growth[1].

    b. *Proposed:*

        - TLU Subgoal 2.B.1 – Increase Use of Alternative Modes for Local/Intra-Regional Travel
        - TLU Goal 2.C – Develop Land Use Patterns That Support a Balanced Multi-Modal Transportation System and Reduce Vehicle Miles Traveled

6. Timeframe for Implementation: This action will take time to implement because changing office locations could be a difficult task for well-established state agencies. Particularly for the complex on Hazen Drive, these offices will most likely remain for years to come. Clearly, a shuttle to downtown areas running every 10-15 minutes through Hazen Drive would increase connectivity with businesses and residences throughout Concord's population center. Satellite and other remote offices could be moved closer to population centers by 2025.

7. Anticipated Timeframe of Outcome: 2025-2050.

<u>Program Evaluation</u>

1. Estimated $CO_2$ Emission Reductions
    a. Short-term (2012)
    b. Mid-term (2025)
    c. Long-term (2050): This action will only reduce $CO_2$ emissions if the present mechanisms of land use planning are completely revised. By locating offices closer together and closer to downtown centers, employees will reduce their VMT to work and mass transportation will be more feasible. Both of these changes create a significant reduction in $CO_2$ emissions.

2. Economic Effects
    a. Costs:
        i. Short-term (2012)
        ii. Mid-term (2025): Changing office buildings from remote locations could be costly, particularly if new buildings are constructed. Leasing buildings in downtowns is also more expensive.
        iii. Long-term (2050): In the long term, once buildings are built/leased closer to population centers, mass transportation becomes viable. Instituting mass transportation networks will be costly for the government.

    b. Savings:
        i. Short-term (2012)
        ii. Mid-term (2025)
        iii. Long-term (2050)

3. Other Benefits/Impacts:

a. *Environmental*: By promoting development in mixed-use community centers, development pressure on greenfield sites (sprawl) will be reduced, and preservation of open space and the character of the state's remaining undeveloped areas will be enhanced. This would also reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.
b. *Health*: Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease. Better siting may also enable State employees to walk more on breaks rather than driving to lunch or meetings downtown.
c. *Social:* Mixed-use development promotes social capital, which improves wellbeing.
d. *Other:* Between 2000 and 2003, VMT increased in New England and Eastern Canada regions by 1.8%. At this rate, annual VMT for this region is projected to increase from 177,000 million to 400,000 million miles by 2050. Various urban and suburban area studies have calculated that a doubling in residential density correlates with 20-30% lower per-capita VMT[2].

4. Potential for Implementation *(i.e., including challenges, obstacles and opportunities):*

a. *Technical:* Although the technical resources and viability already exist and are generally well understood, the new program will require substantial outreach for understanding and acceptance.
*b. Economic:*
*c. Statutory/Regulatory:* New agency administrative rules will be required.
*d. Social:* Residential and commercial development in suburban and exurban areas increases VMT as distances between homes and jobs increase. Since low-density development cannot support public transportation efficiently, single-occupancy vehicles are often the only practical transportation option.

5. Other Factors of Note:

6. Level of Group Interest:

7. References:


- The NH Council on Resources and Development 2006 Report on Growth Management, http://www.nh.gov/oep/programs/CORD/documents/2006SmartGrowthReport.pdf
- Climate Change Roadmap for New England and Eastern Canada, Environment Northeast
- ConnDOT's Master Transportation Plan, www.ct.gov/dot/cwp/view.asp?a=1383&q=259760

**GLA Action 6.1 – Promote Employee Travel Reductions**

Summary

New Hampshire state government should establish clear targets for the reduction of state employee commuter vehicle miles traveled (VMT). Specifically, the following reductions below projected VMTs are proposed:

- 10 percent by 2012
- 30 percent by 2025
- 60 percent by 2050.

This proposal would include instituting policies that promote more widespread use of strategies to reduce employee commuting miles, such as telecommuting and alternative work schedules. Commute trip reduction (CTR) programs use a variety of strategies and incentives to reduce vehicle miles and, therefore, emissions that contribute to climate change. Alternative or flexible start-end times may help employees to coordinate their work schedules with transit or car-pool schedules and avoid traffic during peak commuting hours. Compressed work weeks – e.g., four 10-hour days, or nine 9-hour days – could eliminate one trip to the office every week or two. Also, the state should lead-by-example in instituting policies that allow greater use of the state's satellite offices to reduce the number of miles that state employees must drive to reach work. In addition to reducing the number of vehicle miles traveled (VMT) and the amount of fuel consumed, this initiative would enhance the personal productivity of state workers.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result*): Today's commuting society significantly impacts environmental quality, economic vitality, productivity, and quality of life. Weekly fuel use can be reduced by more than half if commuters are driving together. New Hampshire state government should develop a comprehensive program that will enable and encourage state employees to reduce their annual VMT by substantial amounts. This program could include direct assistance to employees as well as employee incentives to reduce the number of cars traveling to and from state offices.

   To accomplish the proposed action, state agencies must be enabled, through education and policy development, to implement alternative work schedules that allow telecommuting from home or satellite offices if it would reduce their VMT. State employees should also be allowed to stagger work hours to avoid travel during peak rush hours. State agencies would need to provide resources, marketing, and possible financial (tax) incentives to encourage employees to participate in the commute trip reduction program.

   The state should lead-by-example in marketing its NH Rideshare program to increase the number of state workers who participate in carpools and vanpools[1]. At the same time, state agencies should offer the Guaranteed Ride Home benefit, described below.

   New Hampshire Rideshare is a free commuter online matching service provided by the NH Department of Transportation dedicated to finding an alternative way for commuters to travel to and from work. To help commuters cut costs and to reduce traffic congestion and air pollution, NH Rideshare uses Geographical Computer Matching to provide commuters with information and assistance about ridesharing and alternatives to the single-occupancy vehicle, including carpools, vanpools, buses, and trains[1]. State agencies should offer, along with the NH Rideshare program, the Guaranteed Ride Home benefit, which provides a free taxicab ride home in case of emergency on a day when an employee uses a commuting alternative such as carpooling. Other benefits that can be offered are payroll tax deductions for carpooling and bonuses for ridesharers like preferential parking. A posting board for ridesharing would be linked to the state agencies' websites for easy access and visibility.

Parking incentives could also be offered by state agencies to employees, including: 1) priority parking for carpools and carpool/transit users; and 2) parking cash-out, which assigns a monetary value to the employee benefit of free parking and more fairly subsidizes employee use of alternative work modes. Because it costs state agencies money to provide free parking to employees that commute in single-occupancy vehicles (SOVs), employees should receive cash allowances in lieu of parking spaces when commuting in high-occupancy vehicles (HOV). This monetary incentive motivates employees to explore alternative commuting options and reduces the state's costs to build and maintain or lease parking spaces.

2. Implementation Plan (*i.e., how to implement the specific policy or program*):
    a. *Method of Establishment (e.g., legislation, executive order):* The governor's Executive Order 2005-4, *An Order for State Government to Lead-by-Example in Energy Efficiency*, proposed the establishment of a Clean Fleets Program that would encourage telecommuting[2]. New policies would be developed by the proposed Energy Management Unit (EMU), which will be responsible for implementing the policy, tracking effectiveness, and educating all state departments and state employees on telecommuting and alternative work schedules. These policies should be instituted by an Executive Order from the governor.
    b. *Resources Required:* The establishment of an EMU will be necessary to develop policy, perform oversight, ensure compliance, and measure effectiveness.
    c. *Barriers to Address (especially for medium to low feasibility actions):* Barriers include funding for an EMU and resistance from employers to permit alternative work schedules. State employees will need to be aware not to abuse privileges of working remotely or during off-peak hours. It may also be difficult to convince people to change their habits of driving in single-occupancy vehicles without a "guaranteed ride home". Reasons people choose not to carpool include worry that an emergency might come up

3. Parties Affected by Implementation (*i.e., residents, businesses, municipalities, etc.*):
    a. *Parties Responsible for Implementation:* The EMU and state agencies will be responsible for defining policy and extending outreach to educate employees and employers on alternative work schedule rules and allowances. The New Hampshire Department of Transportation is working with the New Hampshire Regional Planning Commissions to develop the NH Rideshare program. The EMU will be responsible for implementing and promoting the program within the state departments.
    b. *Parties Paying for Implementation:* The state agencies implementing the program will be required to pay for implementation of training programs regarding new policies and to pay for the parking cash-out incentive and the guaranteed ride home benefit. These costs may be balanced out by leasing or maintaining fewer parking spaces. The state government would be required to establish the Rideshare program, costs may include emergency taxi rides for the Guaranteed Ride Home benefit and other incentives offered to ridesharers, like tax breaks. The state will also have to maintain Park and Ride lots. State agencies would be required
    c. *Parties Benefiting from Implementation:* Employees will benefit from driving to work less therefore saving on fuel costs and using less time per work focused on work.

4. Related Existing Policies and Programs (*i.e., those that address similar issues without interacting*): The governor's Executive Order Number 2005-4, an order for state government to lead-by-example in energy efficiency, was established to direct state agencies and departments to promote vehicle fuel conservation by encouraging carpooling.

5. Complementary Policies (*i.e., those that achieve greater reductions through parallel implementation*):

a. *Existing:* The Governor's Executive Order 2005-4, *An Order for State Government to Lead-by-Example in Energy Efficiency*, proposed the establishment of a Clean Fleets Program that would encourage telecommuting.
b. *Proposed:*
    GLA 1.1 – Establish an Energy Management Unit
    GLA 4.1.1 – Increase Overall Efficiency of State Vehicle Fleet
    GLA 5.3 – Apply Smart Growth Principles to State Office Locations
    TLU 1.B.2 – Implement a Carbon-Based Vehicle Registration Fee Structure
    TLU 2.A – Change Consumer Behavior to Reduce Travel Demand

8. Timeframe for Implementation: This action could be implemented immediately. The increased price of gas will accelerate adoption of alternative work schedules and telecommuting policies within state agencies. Education is necessary to influence the decisions that state government employees make regarding their commute. However, its success will depend on the education of employees and their willingness to change habits.

9. Anticipated Timeframe of Outcome: The outcome will depend primarily on the actions taken by employees to minimize their vehicle miles traveled. It may take a long time to change habits. The rising cost of fuel and limited mass transit options in New Hampshire will help expedite this process. Increased commuter ridesharing could occur over the next few years.

Program Evaluation

1. Estimated $CO_2$ Emission Reductions: Commute trip reduction methods can significantly reduce $CO_2$ emissions in the short term. By two people sharing a ride, emissions are halved. Carpooling is an effective way of reducing GHG emissions per person. Over the long term, with more mass transit options available, commuter trips could be reduced significantly, having a greater impact on $CO_2$ emissions reductions.

Reduce Commute VMT 10% by 2012, 30% by 2025, and 60% by 2050

a. Short-term (2012): 2,280 $MTCO_2e$ /year
b. Mid-term (2025): 7,868 $MTCO_2e$ /year
c. Long-term (2050): 19,694 $MTCO_2e$ /year

2. Economic Effects
    a. Costs:
        i. Short-term (2012): Initial costs include training of employers and employees in ethical alternative work schedule plans and telecommuting policies. Maintaining park and ride lots will cost the state funds, as well as providing the Guaranteed Ride Home benefit to employees that are stranded at work because of an emergency. Offering parking incentives may cost state agencies if they agree to the parking cash outs and guaranteed ride home benefit.
        i. Mid-term (2025)
        ii. Long-term (2050): Long term costs include improving the mass transit options for commuters to and from New Hampshire state facilities.
    b. Savings:
        i. Short-term (2012): Employees will save money on fuel costs from reduced commutes. State employees would save greatly on fuel costs by using the Rideshare program more often.
        ii. Mid-term (2025)
        iii. Long-term (2050)

3. Other Benefits/Impacts:

    a. *Environmental*: This would reduce emissions of carbon dioxide, greenhouse gases, and other primary air pollutants in order to mitigate the effects of climate change and pollution of our ecosystems. This would lead to improved air and water quality directly as well as have more indirect effects on the fish and wildlife and the ecosystems upon which they depend.
    b. *Health:* Human health benefits will be realized by decreasing exposure to toxic and hazardous pollutants, many of which may have an effect that is exacerbated by the increase in hot summer days. Avoiding the impacts of air pollution can reduce the incidence of cardiac and respiratory disease.
    c. *Social:* People may interact more with their community and have more time to spend with family if they are working alternative work schedules or commuting fewer days to work.
    d. *Other:* The benefits of offering a Rideshare program include increased employee productivity and lower stress levels, reduced traffic congestion, reduced demand for employee parking spaces (which saves maintenance and leasing costs), conservation of fossil fuels and improved air quality.

4. Potential for Implementation (*i.e., including challenges, obstacles and opportunities*):

    a. *Technical*: Technical barriers may include maintaining as many park and rides as possible.
    b. *Economic:* There are no major economic barriers here as the Rideshare program is already developed and may only need to be promoted through marketing. Commuter travel reductions largely rely on redistribution of funds. Employers have an incentive to offer programs because they will either pay (or negotiate) lower leases because of reduced parking demand, or they will spend less money on owned real estate that can only be used for parking (wiser use of real estate because of lower parking requirements).
    c. *Statutory/Regulatory:* Legislation is not necessary.
    d. *Social:* There may be resistance to some of these policies as the public may perceive that State government is "working less." Also, it may be difficult to change people's habits of driving to work in single-occupancy vehicles (SOVs) during normal business hours.

5. Other Factors of Note*:* The NH Rideshare program was developed in the 1970s. Interest in the RideShare program waxes and wanes but currently has close to 1,500 participants. There has been a sizeable increase in the number of applicants to the service in recent months as gas prices have skyrocketed[3].

6. Level of Group Interest:

7. References:


- http://www.nh.gov/dot/nhrideshare/index.htm.
- Lynch, John H. Executive Order Number 2005-4 – *An Order for State Government to Lead-by-Example in Energy Efficiency*. State of New Hampshire. http://www.nh.gov/governor/orders/index.htm.
- NH.com, June 12, 2008, *Rideshare can save you money,* http://www.nh.com/apps/pbcs.dll/article?AID=/NS/20080611/NEWS01/643932057/-1/NEWSBIN.

**ADP Action 7 – Establish a Permanent Climate Change Advisory Council**

Summary

A Climate Change Advisory Council should be established to orchestrate public and private partners and state agencies in planning for episodic and chronic events related to climate change. New Hampshire's population growth will result in an increased demand on public services during extreme weather events. Currently, there is a general lack of urgency in planning for adaptation to climate change. The Council would be charged with proactively planning for these incidents in a way that would minimize impacts on human health, the natural environment, and the built environment (homes, businesses, roads, bridges, damns etc). The Council would work with the responsible parties identified in the Adaptation working group's various action items to ensure that all necessary data are made available to decision makers. The Council would be responsible for keeping our state and our decision makers focused on the implementation of chosen adaptation strategies.

Program Description

1. Mechanism (*i.e., how the policy or program achieves the desired result):* The Council would engage public and private partners and state agencies and charge them with developing the plans and programs to prepare the state for episodic and chronic events related to climate change. The Council would provide the necessary education and manage the flow of information to keep New Hampshire moving proactively in response to evolving climate change conditions.

2. Implementation Plan *(i.e., how to implement the specific policy or program)*
    a. *Method of Establishment (e.g., legislation, executive order):* The Council would be established by statute**.**
    b. *Resources Required:* Staff time would be required to develop and provide support for any proposed legislation.
    c. *Barriers to Address (especially for medium to low feasibility actions):* There could be unspecified issues demanding staff time and it may be necessary to educate legislators and constituencies as to the need for this new body.

3. Parties Affected by Implementation *(i.e., residents, businesses, municipalities, etc.)*
    a. *Parties Responsible for Implementation:* Municipal leaders, regional planning commissions, the Department of Environmental Services, Department of Transportation, Department of Resources and Economic Development, Office of Energy Planning, Department of Agriculture, Fish & Game Department, Department of Health & Human Services, Office of Emergency Management, and the Public Utilities Commission.
    b. *Parties Paying for Implementation*: Same as above (costs would be mostly for staff time).
    c. *Parties Benefiting from Implementation:* The entire state would benefit from better preparation for climate change impacts.

4. Related Existing Policies and Programs *(i.e., those that address similar issues without interacting):* None known

5. Complementary Policies (i.e., those that achieve greater reductions through parallel implementation)
    a. *Existing*
    b. *Proposed:* All other actions proposed by the Adaptation working group.

6. Timeframe for Implementation: Immediately

7. Anticipated Timeframe of Outcome: On-going

Program Evaluation

1. Estimated $CO_2$ Emission Reductions

2. Economic Effects

    a. Costs

        i. Short-term (2012)
        ii. Mid-term (2025)
        iii. Long-term (2050)

    b. Savings

        i. Short-term (2012)
        ii. Mid-term (2025)
        iii. Long-term (2050)

3. Other Benefits/Impacts

    a. *Environmental:* The environment would benefit from ongoing work of an Advisory Council as it could lead to the increased resiliency of natural ecosystems.

    b. *Health:* The health of NH residents would be affected over the long terms as the development and implementation of adaptation strategies create a more stable social and economic environment in which New Hampshire residents can live directly affecting mental and physical health.

    c. *Social:* There may be increased social stability provided by safer communities and resilient economies. Even as climate change increases the frequency and intensity of extreme events, communities would be able to maintain the critical infrastructure and social networks that support communities. NH residents would benefit from a sustainable economy through increased social stability created by stable economic environments. By reducing energy costs and allowing for adaptation in advance, communities will be able to maintain the jobs and revenue required to maintain infrastructure and education that provide for a long-term quality of life.

    d. *Other:* Preparing for climate change will lead to economic benefits as the costs of adaptation are expected to be offset by the avoided costs of climate change's direct impact. By preparing for and preventing climate change impacts the worst effects may not be realized, reducing the impact born by the entire economy.

4. Potential for Implementation

    a. *Technical:* There is a large potential for implementation as the required technology is available

    b. *Economic:* High; staying focused on the impacts we will experience from climate change makes complete economic sense.

    c. *Statutory/Regulatory:* Moderate; there may be a perception that efforts to prepare for climate change are premature.

    d. *Social:* High; people would support efforts by an Advisory Council preparing to keep them out of harm's way in the event of weather related changes associated with climate change.

5. Other Factors of Note:

6. Level of Group Interest: Very high

7. References: