Energy Supply and Demand Technical Work Group

Summary List of Policy Options

v0.4 June 29, 2007

	Mitigation Option	GHG Reductions ($MMtCO_2e$)			Net Present Value (Million $)	Cost-Effectiveness ($/t$CO_2e$)	Level of Support
		2012	2028	Total 2008-2030	2008–2030		
ESD-1	Evaluation and continuation / expansion of existing DSM for electricity and natural gas	0.66	1.68	25.11	($274)	($10.9)	
ESD-2	Evaluation and expansion of DSM to Other Fuels	0.12	0.59	7.49	($172)	($23.0)	
ESD-3	Building Efficiency Codes, Training, Tracking	*See ESD-2*					
ESD-4	Evaluate Potential for Contracting Nuclear Power						
	(scenario 1)	0.87	1.30	24.3	$0	$0.0	
	(scenario 2)	0.43	0.65	12.1	$0	$0.0	
ESD-5	Support for Combined Heat and Power	0.06	0.23	3.05	($33)	($11)	
ESD-6	Incentives and/or Mandate for Renewable Electricity						
	(scenario 1)	0.08	0.55	6.5	($1)	($0.2)	
	(scenario 2)	0.20	1.11	13.02	2.60	0.20	
ESD-7	GHG Cap & Trade and/or GHG tax	*pending*					
ESD-8	Incentives for Clean Distributed Technologies for Electricity or Heat						
	Natural Gas fuel switching	0.08	0.13	2.51			
	Solar thermal water heating	0.05	0.22	2.74	$126	$46.1	
ESD-9	Wind-specific support measures						
	(New wind, scenario 1)	0.03	0.22	2.58	$11	$4.3	
	(New wind, scenario 2)	0.08	0.44	5.12	$30	$5.9	
ESD-10	Hydro-specific support measures						
	(Continued large hydro, scenario 1)	0.02	1.28	19.9	$0	$0.0	
	(Continued large hydro, scenario 2)	0.01	0.64	9.9	$0	$0.0	
	(New hydro, scenario 1)	0.01	0.08	0.97	($5)	($5.6)	
	(New hydro, scenario 2)	0.03	0.17	1.95	($12)	($6.0)	
	Total						
	Scenario 1 (generation of nuclear and hydro at historic levels)	1.88	5.77	88.52	($321)	($3.6)	
	Scenario 2 (generation of nuclear and hydro at 50% historic levels)	1.60	5.26	76.00	($351)	($4.6)	

Note: Positive numbers for Net Present Value (NPV) and Cost-effectiveness reflect net costs. Negative numbers reflect net cost ***savings.***

ESD-1. Evaluation and Continuation / Expansion of Existing DSM for Electricity and Natural Gas

1. Policy Description

ESD-1 builds on Vermont's substantial existing demand-side management efforts. It seeks to ensure that Vermont's utility energy efficiency delivery mechanisms continue to deliver cost-effective services, are adequately funded, and are fully integrated into the utility planning environment,.

This policy seeks to stabilize and ensure that efficiency programs remain (1) appropriately designed to deliver cost-effective system-wide programs (2) appropriately targeted to ensure that reliable service is delivered at the lowest cost when considering alternative transmission and capacity additions, (3) are designed to exploit emerging opportunities for cost-effective energy efficiency.

2. Policy Design

1. Ensure adequate funding, sound and appropriately focused program design, and ongoing delivery of electric and gas efficiency programs to capture all reasonably available cost-effective energy efficiency potential.

2. Explore ways to better integrate the efficiency utility into the resource planning environment in Vermont. Such a role is currently being deliberated in the context of Docket 7081 by the Vermont PSB.3. For better resource planning and continuity, consider ways to effectively further institutionalize the role of EVT as a going concern rather than a time bounded performance contractor.

3. Explore ways to empower consumers to effectively respond to advanced time-of-use pricing programs (including reliance on utility, or efficiency utility programs initiatives).

4. Consider ways to mitigate rate impacts of energy efficiency programs by allowing amortization of efficiency expenditures in order to reduce electric rate impact and increase generational equity.

5. Explore new avenues of oversight, accountability, and incentives for efficient delivery of efficiency services to ensure the that ratepayer funds used to deliver efficiency services are used as effectively as possible.

6. Foster the development of effectively functioning competitive market for delivering efficiency services and/or programs. Ensure that the program strategies of the EEU are consistent with this policy.

7. Foster resource neutrality in the planning, delivery, and payment for supply and demand-side resources (e.g., allow regional cost recovery of investments in energy efficiency that avoid bulk transmission expenses otherwise borne by load serving entities in the region).

Goals: Based on results of the GDS study, an electric sector target of a 31% reduction relative to the reference case is recommended, to be achieved by 2028. This target, which was identified based on currently commercial technologies, is a lower bound on what can be achieved. The target thus should be updated on a periodic basis, to take into account the commercialization of new technologies and other factors affecting the potential for or desirability of energy efficiency.

The ESD-1 and ESD-2 goals have been established in light of their combined potential to reduce GHG emissions. The goals are defined with the explicit condition that they are to be met using efficiency measures, and not by measures that switch from electricity to more carbon-intensive fuels that ultimately increase GHG emissions. It is also explicitly recognizes that there may be measures that increase electricity consumption but decrease GHG emissions (such as shifting from conventional vehicles to plug-in hybrids), or that increase fuel consumption but decrease total GHG emissions (such as CHP). These types of measures should not be excluded from consideration.

- Efficiency improvements by 2015 that are sufficient to reduce consumption by 15% relative to the DPS reference projection.
- Efficiency improvements by 2028 that are sufficient to reduce consumption by 31% relative to the DPS reference projection. (Note the 2028 goal is a provisional goal to be updated in light of emerging efficiency opportunities.)

Timing: as above

Parties Involved: Residential, commercial, and industrial consumers of electricity and natural gas

Other: Not applicable.

3. Implementation Mechanisms

Efficiency Utility or Gas Utility

4. Related Policies/Programs in Place

Vermont has a history of leadership in the development and delivery of electric sector energy efficiency programs, beginning with early energy efficiency investment programs run by Vermont's electric utilities, and later by Vermont's Efficiency Utility. The majority of investments in energy efficiency within the electric sector are delivered under the auspices of Efficiency Vermont. The remainder is delivered through the City of Burlington's Burlington Electric Department. Vermont Gas delivers its own energy efficiency programs, primarily directed toward thermal programs associated for its own customers.

In 2004, Vermont led the nation in per customer investment in energy efficiency programs of roughly $16.5 million, or $47.35 per customer. Vermont recently completed studies of electric energy efficiency potential, concluding that with an increase in investment, Vermont could reduce its 2015 electricity demand by 15% through cost effective energy efficiency investments. After extensive review of the analysis and proposals, the Vermont Public Service increased the efficiency investment further by 75% above 2005 spending levels. (A complete summary of the analysis of the potential is available at the Board's web site at http://www.state.vt.us/psb/document/act61.htm.) By 2008, Vermont expenditures on electric sector energy efficiency will be $31.75 million per year or approximately $91 per customer, almost double that of 2004. The Public Service Board's Order noted that a further increase in funding would likely capture additional cost effective efficiency savings, but that alternative funding mechanisms should be explored, stating:

> In this Order we establish the Energy Efficiency Utility ("EEU") budgets for 2006, 2007 and 2008 and announce a subsequent process to develop a means of financing energy efficiency services to reduce the impact of the Energy Efficiency Charge ("EEC") on electricity rates in the near term. This Order is the outcome of a comprehensive, ten-month-long workshop process that followed Legislative action removing the former cap of $17.5 million on the annual EEU budget and requiring the Board to set a new level based on objectives and criteria in the law. In this Order we raise the 2006 funding level to $19.5 million, and establish funding levels of $24 million and $30.75 million for 2007 and 2008, respectively. We also conclude that higher funding levels may be appropriate, if the effect of levels on electricity rates in the near term can be reduced.

Based on the increased program activity, Vermont is now projecting roughly level growth between 2008 and 2015, assuming these program funding levels continue over time.

In parallel and overlapping initiatives, Vermont is blazing new trails for use of energy efficiency resources by strategically targeting programs toward geographically constrained areas of the state in an effort to avoid later costly investments in transmission facilities. Programs associated with this initiative are known as Geographically Targeted "GT" efficiency programs. Vermont regulators are now deliberating over the establishment of a central planning and coordinating body known as the VSPC that will be charged with, among other things, the systematic and strategic use of energy efficiency investments through GT programs to avoid or defer transmission investments. In the mean time, the Vermont Public Service Board has directed that the increased program funding levels of the Efficiency Utility be directed toward constrained areas as a pilot and transition mechanism pending the establishment of a broader planning framework.

Along with neighboring states, Vermont has also helped to shape the character of the market for installed electric capacity or Forward Capacity Market to include energy efficiency as an integral component of the resource base. This market is used in the region to ensure that there is adequate installed capacity to meet future demands for electricity. As it is designed, installed capacity can be bid in and delivered through either generation resources or energy efficiency programs and resources. In the future Vermont will bid in and invest in energy efficiency programs to meet its own commitments associated with the development of emerging markets for capacity. Vermont is currently working with other states in the region on establishing regional standards for measurement and valuation ("M&V") of efficiency programs that participate in the market.

The nature and character of the efficiency utility and the programs and opportunities that may be explored through the efficiency utility will continue to evolve over time. The Vermont General Assembly is currently debating legislative proposals for requiring utility plans and investments in advanced metering technology and advanced time-of-use pricing programs known as "real-time" or "critical-peak-pricing" programs. Vermont's efficiency programs, over time, will inevitably change in response to changing market circumstances and new technologies, including opportunities presented by advanced meter equipment and advanced time-of-use rates.

The Vermont General Assembly is also entertaining proposal to expand the scope of programs delivered through the efficiency utility to include non-regulated fuels, such as heating oil, propane, and kerosene. Movement in this direction could potentially require substantial expansion of efficiency program activities. (See ES-2)

More broadly, Vermont's efficiency utility mechanism undergoing tremendous change and will need to respond to and help inform the delivery of programs and policy choices for Vermont consumer, and in concert with the broader planning efforts Vermont utilities, Vermont regulators and the Vermont General Assembly.

In summary, Vermont has been a leader in its reliance on energy efficiency as a resource alternative to energy and now transmission resources. EVT is already going through major expansion and changes through the targeting of its programs activities around GT, and potentially non-regulated fuels in the future. It operates in a complex and dynamic market and technological environment.

5. Types(s) of GHG Reductions

Net reduction in GHG emissions arising from electricity production (either in-state or out of state as appropriate) and natural gas usage.

6. Estimated GHG Savings and Costs per $MtCO_2e$

- **Data Sources:** The Department of Public Service Electric Efficiency Potential Study, prepared by GDS Associates.[1] Marginal emissions coefficients reported by New England ISO for the shorter term. The emissions coefficients of likely new generators (likely natural gas or a combination of natural gas with other generation types). While Vermont's embedded resource mix reflect our overall costs, any reduction in energy demand that occurs in Vermont will reduce load in the region at the margin. Over the shorter term, this will

[1] http://www.publicservice.vermont.gov/energy-efficiency/vteefinalreportjan07v3andappendices.pdf

translate into reductions in marginal emissions from embedded resources. Over the longer term this will help displace investments in new generating capacity.

- **Quantification Methods:**

This analysis builds on the recent comprehensive study "Vermont Electric Energy Efficiency Potential Study Final Report" (January 2007) by GDS Associates, prepared for the Vermont Department of Public Services. This study identified a total technical potential for savings of 34.6% of electricity consumption in 2015 based on current technologies. It then took into account a maximum penetration rate (of 80%) and the slow stock turnover expected between the current year and 2015, which together limited the achievable potential to 22.1%. This was modestly reduced by 19.4% by cost-effectiveness considerations, given fuel prices projections available at the time of the study.

For this study, we have adapted these results using the following assumptions. First, we assume an ongoing DSM program up to the 2030 time horizon of the analysis, allowing much more time for stock turnover and implementation of efficient measures.

Second, we assume a more ambitious DSM program that incorporates more outreach, education, training, consumer incentives, etc, all of which enable deeper and more rapid penetration of the measures, but comes at the cost of a doubling of the program implementation costs (relative to the GDS study costs).

Third, we assume that the existing DSM program is complemented by other non-DSM efficiency measures such as standards, procurement requirements, building codes (see ESD-3), real-time pricing, etc., which contributes to the deeper and more rapid penetration than would be available exclusively using a DSM delivery mode.

Fourth, we neglect the DSM measures that are based on switching from electricity to other fuels. This entails subtracting of the ~22% the efficiency potential that comes from such fuel-switching measures in the residential sector.

Fifth, we assume that as a result of these steps, the full technical potential is ultimately achievable. The GDS study included a modest reduction in each sector from the achievable potential to the cost-effective achievable, to eliminate measures that were not cost-effective. This leads to an overall efficiency target of 31% below the reference case. We assume this can be implemented over the 20 year period from 2008 to 2028.

- **Key Assumptions:** as above

7. Key Uncertainties

TBD

8. Additional Benefits and Costs

There are several additional benefits of energy efficiency that are not quantified here. As noted in the GDS report, these additional benefits include:

- improved electric sector reliability
- reduced building maintenance costs
- improved comfort and public health (e.g., elimination of mold due to better ventilation)
- enhanced worker productivity
- decreased local air pollution
- economic stimulus of increased discretionary income
- reduced electricity prices and price volatility
- improved energy services for low-income households
- increased in-state jobs in efficiency industry

9. Feasibility Issues

TBD

10. Status of Group Approval

TBD

11. Level of Group Support

TBD

12. Barriers to Consensus

TBD

ESD–2. Evaluation and Expansion of DSM to Other Fuels

1. Policy Description

ESD-2 aims to extend Vermont's substantial existing demand-side management efforts in electricity and natural gas (see ESD-1) to other fuels used in residential, commercial, and industrial establishments (oil, LPG, kerosene). This policy seeks to establish efficiency programs for fuels that are (1) appropriately designed to deliver cost-effective system-wide programs (2) appropriately targeted to ensure that reliable service is delivered at the lowest cost, (3) are designed to exploit emerging opportunities for cost-effective energy efficiency.

2. Policy Design

Consider various strategies/models for acquisition of energy efficiency through alternatives, including an all-fuels efficiency utility.

Goals:

Based on results of the GDS study, an electric sector target of a 29% reduction relative to the reference case is recommended, to be achieved by 2028. This target, which was identified based on currently commercial technologies, is a lower bound on what can be achieved. The target thus should be updated on a periodic basis, to take into account the commercialization of new technologies and other factors affecting the potential for or desirability of energy efficiency.

The ESD-1 and ESD-2 goals have been established in light of their combined potential to reduce GHG emissions. The goals are defined with the explicit condition that they are to be met using efficiency measures, and not by measures that switch from electricity to more carbon-intensive fuels that ultimately increase GHG emissions. It is also explicitly recognizes that there may be measures that increase electricity consumption but decrease GHG emissions (such as shifting from conventional vehicles to plug-in hybrids), or that increase fuel consumption but decrease total GHG emissions (such as CHP). These types of measures should not be excluded from consideration.

- Efficiency improvements by 2016 that are sufficient to reduce consumption by 12% relative to the DPS reference projection.
- Efficiency improvements by 2028 that are sufficient to reduce consumption by 29% relative to the DPS reference projection. (Note the 2028 goal is a provisional goal to be updated in light of emerging efficiency opportunities.)

These targets are to be achieved through the combined impacts of ESD-2 and ESD-3 (see below). ESD-2 focuses on the DSM-related activities, while ESD-3 focuses on buildings codes and other connected activities.

Timing: As above

Parties Involved: Residential, commercial, and industrial consumers (primarily of fuels for heating)

Other: Not applicable.

3. Implementation Mechanisms

Efficiency Utility, coupled with other measures (as described in ESD-3).

4. Related Policies/Programs in Place

The explanation of related policies for ESD-1 here is included by reference.

Building codes, appliance standards, time-of-sale disclosure requirements, expanded weatherization assistance, and other policies directed at thermal efficiency from non-regulated fuels and other programs that could similarly reduce the demand for non-regulated fuels (excluding transportation fuels).

In response to legislative request, the Department of Public Service recently prepared an analysis of efficiency potential for non-regulated fuels, concluding that the potential for reduction was 12% by 2016.[2] The savings potential from an investment of roughly $150 million over 10 years would yield a net benefit $486 million. Savings opportunities for non-regulated fuels primarily center on thermal efficiencies for space and water heating and are associated primarily with # 2 heating oil.[3]

The Department concluded that were an efficiency utility program relied upon for delivery of the non-regulated fuel efficiency programs, that the annual investment requirement would be in the neighborhood of $14.9 million per year.

Vermont would likely need to start slowly with a program like this due to the need for additional service providers. It is unlikely that Vermont could effectively spend near the $15 million per year for a number of years.

[2] Oil prices have risen since the time that the last round of price projections were completed in December of 2005. The results of the analysis, however, are relatively insensitive to the oil price since there is little disparity between the “achievable potential” identified in the report, and the “cost-effective achievable potential” identified in the report.

[3] The DPS report used avoided cost levels based on 2007 oil that cost around $40 a barrel. In light of current prices of nearly $60 per barrel, this provides a seemingly conservative estimate of the cost effective savings available. The Department updates it fuel price projections on a biennial basis and should have new price projections in the summer of 2007.

5. Types(s) of GHG Reductions

Net reduction in CO_2 emissions

6. Estimated GHG Savings and Costs per $MtCO_2e$

Data Sources: The Department of Public Service Electric Efficiency Potential Study, prepared by GDS Associates.[4]

Quantification Methods:

This analysis builds on the recent comprehensive study "Vermont Energy Efficiency Potential Study for Oil, Propane, Kerosene and Wood Fuels" (January 2007) by GDS Associates, prepared for the Vermont Department of Public Services. This study identified a total technical potential for savings of fuel consumption in 2016 based on current technologies. It then assumed a maximum penetration rate (of 80%) and the slow stock turnover expected between the current year and 2016, which together limited the achievable potential, which was modestly reduced by cost-effectiveness considerations, given fuel prices projections available at the time of the study.

For this study, we have adapted these results using the following assumptions. First, we assume an ongoing DSM program up to the 2030 time horizon of the analysis, allowing much more time for stock turnover and implementation of efficient measures.

Second, we assume a more ambitious DSM program that incorporates more outreach, education, training, consumer incentives, etc, all of which enable deeper and more rapid penetration of the measures, but comes at the cost of a doubling of the program implementation costs (relative to the GDS study costs).

Third, we assume that the existing DSM program is complemented by other non-DSM efficiency measures such as standards, procurement requirements, building codes (see ESD-3), etc., which contributes to the deeper and more rapid penetration than would be available exclusively using a DSM delivery mode.

Fourth, we assume that as a result of these steps, the full technical potential is ultimately achievable. The GDS study included a modest reduction in each sector from the achievable potential to the cost-effective achievable, to eliminate measures that were not cost-effective. This leads to an overall efficiency target of 29% below the reference case. We assume this can be implemented over the 20 year period from 2008 to 2028.

Key Assumptions: As above.

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[4] http://www.publicservice.vermont.gov/pub/other/allfuelstudyfinalreport.pdf

7. Key Uncertainties

TBD

8. Additional Benefits and Costs

There are several additional benefits of energy efficiency that are not quantified here. As noted in the GDS report, these additional benefits include:

- improved electric sector reliability
- reduced building maintenance costs
- improved comfort and public health (e.g., elimination of mold due to better ventilation)
- enhanced worker productivity
- decreased local air pollution
- economic stimulus of increased discretionary income
- reduced electricity prices and price volatility
- improved energy services for low-income households
- increased in-state jobs in efficiency industry

9. Feasibility Issues

TBD

10. Status of Group Approval

TBD

11. Level of Group Support

TBD

12. Barriers to Consensus

TBD

ESD-3a. Improved Building Codes

1. Policy Description

This measures has two components. The first is a near-term option to allow for automatic updates of Vermont's Residential and Commercial Building Energy Codes based on updates to national energy codes (IECC or ASHRAE 90.1). The second a longer term measures to adopt a code to facilitate the greatly improved efficiency of buildings based on a set of targets such as, for example, the Architecture 2030 initiative[5].

2. Policy Design

Goals:

- Reduce the time it takes to update Vermont's Energy Codes to ensure they reflects the most up to date version of the national energy codes (IECC or ASHRAE 90.1).
- Ensure that the EnergyStar benchmarking, target finder and other valuable tools used to establish targets, goals and track progress are incorporated into everyday design.
- Develop a "Time of Sale" energy requirement for exiting buildings ensuring that at the time of sale, they will be brought up to an improved efficiency level to continuously improve building efficiency.
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Timing: Within three months after the national code update, Vermont's Energy Codes will be updated to reflect any increased efficiency requirements contained in the national update. Then three months after the Vermont update the new Vermont Energy Code will go into effect, in total six month update cycle from release of new national energy code.

Parties Involved: Vermont Department of Public Service, Efficiency Vermont, Vermont Gas Service, Burlington Electric Department, Architects, Engineers, Contractors, Builders, Mortgage Lenders, Legislators.

Other: Not applicable.

3. Implementation Mechanisms

Vermont's Energy Codes legislation should be revised to allow for automatic updates of Vermont's Residential and Commercial Building Energy Codes based on updates to national energy codes (IECC or ASHRAE 90.1). When a new national energy code (IECC or ASHRAE 90.1) is updated, within 3 months the Vermont Department of Public Service will update Vermont's Residential and Commercial Building Energy Codes to reflect any increased efficiency requirements contained in the national update. Then 3 months after the Vermont update the new Vermont Energy Code will go into effect, in total 6 month update cycle from release of new national energy code. An advisory board of regulators, architects, engineers and builders will guide the process as envisioned by the Commercial Buildings Energy Standards.

The Time of Sale energy requirement is currently on the books at the city of Burlington. The statewide requirement will be a part of the Vermont Energy Code to ensure that at the time of sale, existing buildings will be brought up to an improved efficiency level. The costs from the improvements can be borne by the seller (to improve the value of the building) or the buyer (to add as improvement costs in the mortgage).

[5] http://www.architecture2030.org/

This advisory board will also be tasked determining whether national codes (IECC and ASHRAE) are consistent with Vermont' GHG reduction goals. If not, this advisory board is responsible for conceiving a process for identifying and adapting codes that are consistent with Vermont's GHG reduction goals.

4. Related Policies/Programs in Place

Vermont's Residential Building Energy Standards 21 V.S.A. sec 266.

Vermont's Commercial Building Energy Standards 21 V.S.A. sec 268.

United States Environmental Protection Agency's EnergyStar Program.

City of Burlington Time Of Sale energy requirement.

Burlington Electric Department and Efficiency Vermont provide statewide energy efficiency services that are funded by an energy efficiency charge (EEC) on electric utility bills. Burlington Electric Department and Efficiency Vermont can provide technical assistance and incentives to help the industry meet or exceed building codes.

Vermont Gas Service provides technical assistance and incentives to help the industry meet or exceed building codes.

5. Types(s) of GHG Reductions

Reductions in GHG emissions primarily associated with the combustion of fossil fuels for heating buildings and generating electricity for consumption in buildings.

6. Estimated GHG Savings and Costs per $MtCO_2e$

Data Sources: The Department of Public Service Electric Efficiency Potential Study, prepared by GDS Associates.[6]

Vermont's Commercial Building Energy Standards 21 V.S.A. sec 268.

Burlington Electric Department and Efficiency Vermont provide statewide energy efficiency services that are funded by an energy efficiency charge (EEC) on electric utility bills. Burlington Electric Department and Efficiency Vermont can provide technical assistance and incentives to help the industry meet or exceed building codes.

Vermont Gas Service provides technical assistance and incentives to help the industry meet or exceed building codes.

Quantification Methods: See ESD-2.

Key Assumptions: TBD

7. Key Uncertainties

TBD

[6] http://www.publicservice.vermont.gov/pub/other/allfuelstudyfinalreport.pdf

8. Additional Benefits and Costs

TBD

9. Feasibility Issues

TBD

10. Status of Group Approval

TBD

11. Level of Group Support

TBD

12. Barriers to Consensus

TBD

ESD-3b. Building Commissioning

1. Policy Description

The State should assign an entity to develop and implement a comprehensive Building Commissioning, Building Recommissioning, Energy Tracking and Benchmarking program for builders, contractors, building managers, enforcement officials, and others.

2. Policy Design

Goals:

- To provide assistance to owners of buildings greater than 5000 square feet.
- To assist owners of buildings in reducing energy usage in their buildings by ensuring the buildings are operating at peak efficiency.
- To assist owners of buildings in benchmarking buildings' energy use; to identify high use buildings; and, to allow prioritization of funds to improve energy efficiency where it is most needed.
- To develop and implement an inspection for commissioning on a regular yearly or multi-yearly interval.

Timing: Policies could be implemented in a timely manner to place this option into operation.

Parties Involved: Department of Public Service, engineers and architects.

Other:

3. Implementation Mechanisms

This entity can develop and deliver trainings on its own, and work with other industry groups to assess ways to supplement or improve the training that already exists in the State.

The State should assign an entity to develop and institute a Building Commissioning, Building Recommissioning, Energy Tracking and Benchmarking program for builders, contractors, building managers, enforcement officials, and others.

4. Related Policies/Programs in Place

Efficiency Vermont provides statewide energy efficiency services that are funded by an energy efficiency charge (EEC) on electric utility bills. Efficiency Vermont can provide funding for Building Commissioning and Building Recommissioning.

5. Types(s) of GHG Reductions

Reductions in GHG emissions primarily associated with the combustion of fossil fuels for heating buildings and generating electricity for consumption in buildings.

6. Estimated GHG Savings and Costs per $MTCO_2e$

Data Sources: Efficiency Vermont provides statewide energy efficiency services that are funded by an energy efficiency charge (EEC) on electric utility bills. Efficiency Vermont can provide funding for Building Commissioning and Building Re-commissioning.

- **Quantification Methods:** See ESD-2
- **Key Assumptions:** TBD

7. Key Uncertainties

TBD

8. Additional Benefits and Costs

TBD

9. Feasibility Issues

TBD

10. Status of Group Approval

TBD

11. Level of Group Support

TBD

12. Barriers to Consensus

TBD

ESD-3c. Building Efficiency Codes, Training, Tracking

1. Policy Description

The State should assign an entity to develop and implement an energy efficiency training and education program for builders, contractors, building managers, enforcement officials, and others. The objectives are to delivery high quality training on various energy efficiency construction and energy management topics, and to develop trained building professionals to ensure energy efficient construction and on -going energy management in buildings.

2. Policy Design

See ESD_2

Goals:

Timing:

Parties Involved: Vermont Department of Public Service, Efficiency Vermont, Vermont Gas Service, Burlington Electric Department, Architects, Engineers, Contractors, Builders, Mortgage Lenders, Legislators, high schools, vocational schools, adult education programs.

Other: Not applicable.

3. Implementation Mechanisms

The State should assign an entity to develop and implement an energy efficiency training and education program for builders, contractors, building managers, enforcement officials, and others. This training and education program should be expanded to include non-electrical forms of energy which already have a program in place.

This entity can develop and deliver trainings on its own, and work with other industry groups to assess ways to supplement or improve the training that already exists in the State.

This entity can also be effective in assisting in the preliminary studies of energy optimization options in depth. This will provide support for the design team and the owners.

This entity will submit a report to the Department of Public Service on a yearly basis to outline what has been accomplished and the goals for the following year. The Department of Public Service will also perform random inspections to ensure compliance on the entity's part.

4. Related Policies/Programs in Pla

Many trade groups for builders, architects, engineers, electricians, plumbers, HVAC contractors, etc provide training sessions for their members.

Many High Schools or Vocational Centers offer building trades training programs.

Efficiency Vermont provides statewide energy efficiency services that are funded by an energy efficiency charge (EEC) on electric utility bills. Efficiency Vermont has provided training for contractors and builders on energy efficient construction.

5. Types(s) of GHG Reductions

TBD

6. Estimated GHG Savings and Costs per $MTCO_2e$

See ESD-2

Data Sources:

Quantification Methods:

Key Assumptions:

7. Key Uncertainties

TBD

8. Additional Benefits and Costs

TBD

9. Feasibility Issues

TBD

10. Status of Group Approval

TBD

11. Level of Group Support

TBD

12. Barriers to Consensus

TBD

ESD-4. Evaluate Potential for Contracting Nuclear Power

1. Policy Description

Nuclear power plants do not emit CO_2 during plant operation, and while there are carbon emissions during fuel processing, nuclear power emits considerably less carbon than fossil fueled power sources. By obtaining a contract for nuclear power Vermont utilities will be able to reduce CO_2 emissions form their generation portfolio. To the extent that additional power is produced from the Vermont Yankee which is not contracted to Vermont utilities, operation of Vermont Yankee will further reduce carbon emissions in the region.

Currently, Vermont's portfolio has heavy reliance on the single plant, to the point where Vermont's utilities have concluded that insurance is warranted for protection in the event of an outage. A new contract with Vermont Yankee would likely be significantly smaller than the current obligation. Options for increasing nuclear reliance would be to diversify the nuclear portfolio through additional contracts, trades or swaps. These options can be developed by the purchasing utilities or by Vermont Yankee as its contract offer to Vermont. Including outage insurance in the contract could also help to mitigate exposure.

2. Policy Design

Explore opportunities for engaging in replacement contracts with nuclear generating stations or their owners to the benefit of Vermont consumers.

- **Goals:** This option is examined in the form of two potential scenarios. In Scenario 1 nuclear continues to contribute to Vermont's electricity supply at a scale similar to today, and in Scenario 2 nuclear contributes roughly half what they contribute today.
- **Timing:** The current VY contract expires in 2012. Vermont Yankee must also renew its operating license by 2012. The Vermont General Assembly is likely to vote before 2010 on whether or not the Public Service Board issue an order to approve or deny a new license for Vermont Yankee.
- **Parties Involved:** Vermont legislature, Public Service Board, Vermont Yankee, Vermont utilities, the public, and the Nuclear Regulatory Commission (NRC).
- **Other:** Non applicable.

3. Implementation Mechanisms

To implement this recommendation, several steps are necessary:

- The Vermont Yankee plant must receive a license extension from the NRC.

- Per agreement, the Vermont legislature must approve the license extension.
- The Vermont Public Service Board must issue a certificate of public good for any continued operation of the facility.
- Vermont utilities must agree on contract terms that are acceptable to all parties and that provide sufficient benefit to justify continued operation of the plant.
- Each of these steps is a significant undertaking by itself. Taken in combination, they require significant regulatory, legislative and utility actions as well as acceptance by the public at each step.
- Currently, about one third of Vermont's electricity requirements are supplied by this one plant. The Department and others have long criticized our heavy reliance on one single plant. Should Vermont desire increased reliance on nuclear power above what is a reasonable amount for one plant to contribute, it will need to explore ways to mitigate this exposure. This can come through swaps with other nuclear plant owners (developed through efforts of the utilities or by Entergy) or insurance mechanisms.

4. Related Policies/Programs in Place

Integrated Resource Planning (LCIP)

NRC re-licensing procedures

Legislative directives and approvals.

5. Types(s) of GHG Reductions

Net reduction in CO_2 emissions from the electric sector, subject to interaction with the Regional Greenhouse Gas Initiative (RGGI).

TBD.

6. Estimated GHG Savings and Costs per $MtCO_2e$

Data Sources: NEPOOL Marginal emissions analysis. RGGI

Quantification Methods:

Two scenarios are considered:
Scenario 1: in which nuclear power continues to contribute to Vermont's electricity supply at a scale similar to today, implies generation of approximately 2000 GWh per year. Scenario 2: in which power nuclear contributes roughly half what it contributes today, implies generation of approximately 1000 GWh per year.

The reference case alternative to the purchase of nuclear electricity is to purchase electricity from the net emissions impacts are the difference in emissions between the lifecycle emissions arising from nuclear generation appropriate for Vermont, and the emissions associated with the avoided electricity purchases from ISO NE system. The nuclear emission rate is X tCO2/MWh, and the regional ISO NE system rate is 0.63 tCO2/MWh. Note, this figure is subject to all the uncertainties associated with the future expansion of the ISO NE electric sector. It may be higher or lower. However, since 0.63 is the emission factor that is consistent with the inventory and forecast, it is the correct figure to use when assessing the effectiveness of the measure toward reaching the Vermont GHG reduction goals.

We do not make any assumptions about the relative cost of the nuclear power available to Vermont utilities. There are reasons to believe that Vermont utilities are in a good position to negotiate favorable rates with nuclear power generators relative to other potential sources of long-term contracted power. There are also reasons to believe that nuclear power might come with additional costs for ensuring high reliability and diversification. We thus assume that the net cost of the measure is zero relative to other options for meeting electricity demand.

Key Assumptions: See above

7. Key Uncertainties

TBD

8. Additional Benefits and Costs

TBD

9. Feasibility Issues

TBD

10. Status of Group Approval

TBD

11. Level of Group Support

TBD

12. Barriers to Consensus

TBD

ESD-5. Support for Combined Heat and Power

1. Policy Description

Identify and implement CHP where practical for meeting local heat requirements and generating power for local consumption and/or export to the grid.

Combined Heating, Cooling and Power (CHP) also known as co-generation, is a method of utilizing the thermal energy (heat) produced, when generating electricity (power) in a single, coordinated process. CHP is more energy efficient that separate generation of electricity at a separate central electric plant and production of localized thermal energy for the end user. This distributed generation resource allows for recycling the heat, which is normally wasted to cooling towers or surface water at centralized electric generating stations, to meet onsite thermally driven demand such as process and space heating, cooling and dehumidification. This option is possible at locations where there is a year round demand for heat, cooling and electrical demand, i.e., IBM, Fletcher Allen, University of Vermont, municipal district heating systems, and others to be identified.

2. Policy Design

The proposed policy would encourage the adoption of CHP through a combination of regulatory improvements and expanded incentives, adopt output based emission standards, and allow GHG friendly business arrangements, such as third party ownership of CHP based generation.

Goals: Increase CHP generation in Vermont by 60 MW by 2028. This target can be met through CHP systems for meeting local on-site heat demands as well as district heating systems for meeting municipal heat demands. CHP systems should be fueled only by energy sources that cause a net decrease in GHG emissions relative to separate electricity generation and heat production, given the characteristics of electric sector and fuel markets in Vermont.

Timing: As above.

Parties Involved: Pending

Other: Not applicable.

3. Implementation Mechanisms

Identify locations within Vermont that would be suitable for utilization of CHP. Allow energy service companies to sell CHP output to third party customers. Include consideration of CHP potential in decisions regarding expansion of natural gas in Vermont.

4. Related Policies/Programs in Place

The policy design statements point to key related policy and programs which already exist at the national level in states such as California, Connecticut, New York, North Carolina and Texas.

5. Types(s) of GHG Reductions

Use of CHP in Vermont could reduce the overall GHG emissions emitted by Vermont utilities and purchasers of fuel for heating requirements.

6. Estimated GHG Savings and Costs per $MtCO_2e$

Data Sources:

Combined Heat and Power White Paper, dated January, 2006, to the Clean and Diversified Energy Initiative of the Western Governors Association. (/www.westgov.org/wga/initiatives/cdeac/CHP-full.pdf)

A New Sustainable Energy Infrastructure For Brattleboro, (March 2007), Hervey Scudder and Morris A. Pierce.

Quantification Methods:

We assume that the new 60 MW (electric) of CHP displaces electricity that would have otherwise been purchased from the ISO-NE system. We assume that the electricity displaced has an emission factor of 0.63 tCO2/MWh, consistent with the other ESD measures that displace ISO-NE electricity. We assume the new CHP systems are fueled by a 50%-50% combination of natural gas and biomass. and that the heating fuel displaced is primarily fuel oil (90% of total) with the remainder being electricity and natural gas (5% each). Capital costs are $2000/kW and $2500/kW and non-fuel O&M costs are $16/MWh and $20/MWh for natural gas and biomass systems, respectively.

Key Assumptions: As above

7. Key Uncertainties

TBD

8. Additional Benefits and Costs

TBD

9. Feasibility Issues

TBD

10. Status of Group Approval

TBD

11. Level of Group Support

TBD

12. Barriers to Consensus

TBD

ESD-6. Incentives and/or Mandate for Renewable

1. Policy Description

This policy expands existing programs or adopt new incentives/mandates for expanding the role of renewable energy within the state and regional power mix. Currently Vermont's electric sector is only a moderate contributor to carbon emissions in Vermont. Roughly 45% of Vermont's energy is attributable to low-GHG resources that include contracts for system power attributable to large hydro resources. However, Vermont's entitlements to much of its low-GHG sources are due to expire in the coming decade. To the extent that fossil-based generators would be needed replace sources that are not renewed and to meet load growth, Vermont will need need new low or non-emitting sources if it is to maintain its profile as a low-emitter of greenhouse gas emissions in the electric sector.

2. Policy Design

This policy has three elements: (1) Expansion of voluntary green pricing programs, (2) continued reliance on or strengthening SPEED, accounting for interactions with other states renewable programs, and (3) establishment of a renewable portfolio standard (RPS).

This option is designed to enable Vermont to back off all fossil generation (including those from system purchases). This objective is considered in two scenarios: in Scenario 1 nuclear and large hydro continue to contribute to Vermont's electricity supply at a scale similar to today, and in Scenario 2 nuclear and large hydro contribute roughly half what they contribute today. (As per ESD-4 and ESD-10.) The size of the RPS is as shown below in the two scenarios.

Goals:

		Total RPS		
	Current	***2012***	***2028***	***2028 (GWh)***
Scenario 1	***15%***	***17%***	***30%***	***~1000 GWh***
Scenario 2	***15%***	***20%***	***45%***	***~2000 GWh***

Timing: As above

Parties Involved: Utilities, independent power producers, consumers, other states (via their renewables requirements)

Other: Not applicable.

3. Implementation Mechanisms

There are several implementatoin options for supporting renewable electricity:

Renewable Portfolio Standard: An RPS is one such mechanism to ensure a certain amount of renewable energy in the sources serving Vermont customers. An RPS generally requires that a seller of electricity in Vermont maintain a certain percentage of renewable energy in its resource mix (generally as a percent of sales). The renewable component is generally demonstrated by the retirement of a Renewable Energy Credit ("REC"), representing one MWh of renewable electricity generated. These credits are traded in the New England market through the NEPOOL GIS system. Under this system, Vermont could define its own standards for what constitutes a renewable generator and qualify those generators meeting that criteria.

Individual state renewable portfolio standard targets in New England and the Northeast represent a potentially important reference point for Vermont. The market for electricity and the renewable resources needed to meet such a standard is primarily located in the region. Vermont is currently one of only two states in New England without an RPS.

States with an RPS have structured their targets in ways that differentiate embedded resources from new renewable resources. The target in Connecticut, for example, is 7% for "Class I" RECs on or after 2010. Massachusetts establishes a 4% standard for 2009, but allows the standard to grow by 1% each year until the an administrative agency determination halts it. New York set a target of 25%, but relied on approximately 19% of existing renewable resources when the target was established. Rhode Island's RPS is currently targeting 13% in 2017. Maine just recently established a 10% target for 2017. Like New York, Vermont already meets a significant portion of its demand − approximately 15% − with renewable electricity (including small hydro), and could use this as a starting point for a target. Vermont could set a target based on comparability to targets set by the region, or alternatively could establish a target based on a ground-up assessment of in-state potential with the recognition that it could be met with RECs should that prove more cost-effective.

Voluntary Purchase Programs: Under this type of program, individual consumers are given the opportunity to designate a portion of their energy sources as renewable. The serving utility fulfills this obligation through the purchase of RECs in the same manner as the RPS. However, under a voluntary purchase arrangement, only participating customers are charged for the renewable premium.

SPEED: Vermont could continue and expand the SPEED goals for Vermont utilities to engage in long term contracts SPEED resources.

Further considerations:

Cross-state interactions: It is necessary to assess how renewables programs enacted to meet a Vermont target interact with the renewables programs of other states. It will be necessary to ensure that renewable resources that are deployed for the purpose of satisfying a Vermont goal do not have the effect of displacing renewables development in other states.

Definitions of Renewable Resources: It is important that the portfolio of renewables resources that are eligible under the ESD-6 measures are clearly defined. As ESD-10 provides measures that are intended to support large-scale hydro, it is not seen to be necessary to also support large-scale hydro via the ESD-6 measures, which are aimed at reducing GHG emissions as well as facilitating markets for emerging renewable technologies and local renewable resources.

4. Related Policies/Programs in Place

Following Act 61, 74, and 208 of 2005 and 2006, Vermont has already embarked on a number of initiatives to encourage or reduce barriers to renewable sources of electricity including the establishment of new transparent and timely interconnection standards for small and renewable generation, the promotion of new contracts with renewable energy resources through the Sustainable Priced Energy Enterprise Development Program (SPEED), the establishment of the Clean Energy Development Fund, and through various modifications to the net metering programs in Vermont and related tax policy.

Vermont has already had some success with its green pricing programs. Both of Vermont's largest investor owned utilities have programs. The CVPS program "Cow Power" now has over 2% [*confirm this*] of its customer base participating in the program. The Vermont legislature is now considering requiring that all utilities establish similar programs and made them available to all consumers.

Other efforts to promote the construction or purchase of electricity from renewable resources could come from strengthening the role of the SPEED and/or create a renewable portfolio standard. At present, four of Vermont's New England neighbors and New York possess a renewable portfolio standard that requires that a certain percentage of sales are attributable to new renewable resources. Efforts are underway at the regional level for further harmonize the Renewable Portfolio Standards (RPS) requirements of states with an RPS.

Even beyond Vermont, the ISO-New England region, from which Vermont purchases the bulk of its market energy depends disproportionately on volatile fossil fuels. Efforts are underway to further diversify the regional resource mix, including strengthening transmission inter-tie capabilities between Canada and New England. The decisions that Vermont makes with respect to new resource contracts can, in turn, positively impact the character of decisions within the ISO-New England region.

5. Types(s) of GHG Reductions

Net reduction in CO_2 emissions from the electric sector (defined on a consumption basis).

6. Estimated GHG Savings and Costs per $MtCO_2e$

Data Sources: ISO-NE, Marginal Emissions

Quantification Methods:

Two scenarios are considered for quantification:

Scenario 1: in which nuclear power (as per ESD-4) and large-scale hydro (as per ESD-10) continue to contribute to Vermont's electricity supply at a scale similar to today. Given the extent of the assumed electricity DSM, this implies a fairly modest level of incremental renewable electricity above Vermont's present level.

Scenario 2: in which power nuclear and large-scale hydro power contribute roughly half what they contributes today.

For the purposes of estimating the cost of ESD-6, it is projected that the renewable requirement is primarily met with a mix of 40%, 20%, and 40% of wind, hydro, and biomass respectively.

The reference case alternative to the purchase of nuclear electricity is to purchase electricity from the ISO-NE system. The net emissions impacts are the difference in emissions between the lifecycle emissions arising from renewable generation, and the emissions associated with the avoided electricity purchases from ISO-NE system. The regional ISO-NE system rate is 0.63 tCO2/MWh. Note, this figure is subject to all the uncertainties associated with the future expansion of the ISO-NE electric sector. It may be higher or lower. However, since 0.63 is the emission factor that is consistent with the inventory and forecast, it is the correct figure to use when assessing the effectiveness of the measure toward reaching the Vermont GHG reduction goals.

Cost and performance characteristics are taken from the analyses by the Energy Information Agency of the US Department of Energy *Annual Energy Outlook, 2007* and the California Energy Commission's *Comparative Costs Of California Central Station Electricity Generation Technologies* (CEC, June 2007), as shown in the table below.

		Wind	Hydro	Biomass
Capital Cost	$/kW	$ 1,900	$ 2,955	$ 1,833
Transmission	$/kW	$ 80	$ 80	$ 80
Lifetime	Years	20	25	30
Capital Recovery Factor	%	8.5%	7.6%	7.0%
Levilized Cost	$/kW-yr	168.4	230.7	134.5
Fixed O&M	$/kW-yr	$ 27.6	$ 14.0	$ 50.2
Fixed Costs	$/kW-yr	$ 196.0	$ 244.7	$ 184.7
Capacity Factor	%	33%	50%	75%
LevCapCost	$/MWh	$ 67.82	$ 55.87	$ 28.12
Variable O&M	$/MWh	$ -	$ 4.00	$ 3.0
Fixed+Variable Costs	$/MWh	$ 67.8	$ 59.9	$ 62.7
Fuel Cost	$/MBtu			$ 3.16
Heat Rate	Btu/kWh			10,000
Fuel Gen Cost	$/MWh			$ 31.6

Key Assumptions: As above.

7. Key Uncertainties

TBD

8. Additional Benefits and Costs

TBD

9. Feasibility Issues

TBD

10. Status of Group Approval

TBD

11. Level of Group Support

TBD

12. Barriers to Consensus

TBD

ESD-7. GHG Cap & Trade and/or CO_2 Tax

1. Policy Description

This policy is designed to identify ways to constrain or internalize the cost of greenhouse gas emissions through complementary strategies to existing greenhouse gas emissions cap and trade structures.

This policy, then, addresses complementary mechanisms for internalizing the cost of greenhouse gas emissions beyond the large generating stations covered under the current RGGI structure and that participate in the Chicago Climate Exchange (see Related Policies, below). This includes transportation, home and commercial heating, and industrial processes that depend on sources of energy other than electricity.

2. Policy Design

The major policy design options include:

- Carbon tax for fossil fuel sources, with the revenue collected from a carbon tax targeted toward funding programs aimed at reducing the overall carbon footprint of Vermont.
- Create state level GHG cap and trade programs for other sectors of the Vermont economy with auctioning of permits, with the revenues targeted toward funding programs aimed at reducing the overall carbon footprint of Vermont.

The measure might also include strengthening linkages between state GHG reduction policies and other programs such as RGGI and CCX, and by recognizing more non-electric sector initiatives as RGGI offsets, or by allowing the trading of credits among RGGI certified state GHG cap and trade programs.

Goals:

The goals of this measures will be set so as to scale the revenues to be commensurate with the funding needs of the various measures included in the GCCC portfolio.

Timing: TBD

Parties Involoved: All major emitting sectors.

Other: Not applicable

.3. Implementation Mechanisms

The implementation mechanism would depend on whether a GHG cap or GHG tax mode is adopted. Further details are pending.

4. Related Policies/Programs in Place

Vermont is already part of the nine-state Regional Greenhouse Gas Initiative (RGGI) currently located only in the Northeastern US. Vermont was also the first state to establish legislation adopting the implementing framework for RGGI.

In implementing the framework, Vermont has already allocated 100% of the revenues generated from the program toward consumer benefit, including directing program funds toward energy efficiency programs covered by ESD-1 above or to be directed in ways that may reduce rates or foster non-emitting resources.

While RGGI is structured to permit and even encourage adoption by other states and regions, RGGI is currently limited in scope both geographically and to one sector of the economy. RGGI covers only the electric sector, and is limited to large commercial generating stations over 25 MW in size.

Not addressed through RGGI are the carbon emissions from transportation, home and commercial heating, and industrial processes that depend on sources of energy other than electricity. Some carbon emissions is also capped for a number of organizations through the voluntary Chicago Climate Exchange.

5. Types(s) of GHG Reductions

Net reduction in CO_2 emissions

TBD.

6. Estimated GHG Savings and Costs per $MtCO_2e$

a. Data Sources: RGGI, EIA, EPA EGRID

b. Quantification Methods:

For the sake of quantification, this measure is being modeled as a GHG tax, with the goal defined as generating a level of revenues that can contribute significantly toward meeting the funding requirements of the GHG reduction policies for which there are positive costs. Quantification will be completed with costs of other measures are calculated.

c. Key Assumptions: TBD

7. Key Uncertainties

TBD

8. Additional Benefits and Costs

TBD

9. Feasibility Issues

TBD

10. Status of Group Approval

TBD

11. Level of Group Support

TBD

12. Barriers to Consensus

TBD

ESD-8. Incentives for Clean Consumer Technologies for Electricity or Heat

1. Policy Description

This option focuses on incentives for clean consumer technologies for electricity or heat. Conceptually this would include incentives to encourage clean technologies such as solar water heaters, rooftop PV, and on-site wind generation, as well as support for switching to less carbon intensive fuels (i.e. conversions of coal or oil applications to natural gas or biomass). The RCI sector is the second largest emitter of green house gas emissions in Vermont, with heating fuels including oil, LPG, and kerosene being is the predominate source of emissions, to maximize the reduction of GHG from this sector the incentives should be designed to reduce RCI consumptoin of these fuels in favor of low-GHG options.

2. Policy Design

Goals: Establish incentives to reduce or displace the use of oil in the RCI sector through incentives to encourage clean consumer technologies and conversions to lower carbon fuels, including biomass, natural gas, and electricity as appropriate.

Timing: ASAP

Parties Involved: Residential, commercial and industrial applications.

Other: NA

3. Implementation Mechanisms

Potential design elements include:

- Incentives to support clean consumer technologies to displace oil usage include rebates, direct subsidies and tax credits.
- Incentives to support the conversion to lower carbon fuels targeted at:
    - Expansion of cleaner fuels in Vermont
    - Incentives for consumers to convert to lower carbon fuels

4. Related Policies/Programs in Place

Pending

5. Types(s) of GHG Reductions

Reductions of GHG emissions associated with combustion of fossil fuels in residential, commercial, and industrial establishments.

6. Estimated GHG Savings and Costs per $MtCO_2e$

Data Sources:

EIA Data at http://www.eia.doe.gov/emeu/states/sep_sum/html/sum_btu_tot.html will provide specific data regarding the current fuel usage in Vermont

EPA and VT ANR data provides emissions for various fuel types.

Quantification Methods:

The potential for GHG Savings and cost per $MtCO_2e$ from clean consumer technologies is quantified by analyzing two major options for reducing emissions in the RCI sector. This analysis is indicative, and the policy should be designed so as to allow other options to be deployed as well.

First, we consider the use of solar water heaters. Deployment of solar water heaters to augment water heats using fuels is already among the options considered in the GDS "all fuels" study (ESD-2), but not solar water heaters to augment electric water heaters (ESD-1). This measure considers the latter only. We assume a capital cost of $5300 per household, and displacement of 65% of water heating energy requirements, and a penetration of 80%of households that are heating water with electricity.

Second, we consider the GHG savings and costs of expansion of the natural gas infrastructure so as to displace oil and LPG in six localities: Middlebury, Rutland, Bennington, Brattleboro, Newport, and Montpelier. The heating fuel requirements in these localities are estimated, and a penetration of 45% for oil and 75% for LPG is assumed. The investments costs for each project are obtained from Vermont Gas (pending), and the avoided fuel costs are taken from the Avoided Energy Supply Costs (2005) study (as are other avoided energy costs in the analysis of ESD options.).

Key Assumptions: As above

7. Key Uncertainties

Future fuel and avoided fuel costs, and capital infrastructure costs.

8. Additional Benefits and Costs

Additional benefits and costs related to clean consumer technologies – TBD

Additional benefits from the expansion of natural gas to displace oil usage in Vermont include;

- Reductions in emissions from the transportation of alternative fuels.
- The availability of natural gas energy efficiency programs that reduce fuel use and further reduce emissions.
- The efficiency of natural gas equipment is higher than that of alternative fueled equipment. This reduces overall fuel usage and thereby further reduces emissions.
- Support of economic development in Vermont.
- Increased property tax to base.

9. Feasibility Issues

TBD

10. Status of Group Approval

TBD

11. Level of Group Support

TBD

12. Barriers to Consensus

TBD

ESD-9. Wind-Specific Support Measures

1. Policy Description

Financial and regulatory incentives that support wind generation in Vermont.

2. Policy Design

Goals: To stimulate new investment in wind generation in Vermont and, at the same time, provide incentives to owners of existing resources to maintain their presence in the energy portfolio. The specific goal is to stimulate incremental wind generation sufficient to help meet the goals of two scenarios described under ESD-6. This amounts to roughly the following schedule.

		Total Wind	
	Current	***2012***	***2028***
Scenario 1	***4 MW***	***30 MW***	***140 MW***
Scenario 2	***4 MW***	***60 MW***	***250 MW***

Timing: As shown above..

Parties Involoved: All developers of wind generating facilities would be eligible to receive payments and to develop projects under more expeditious regulatory and permitting regime, and receive credit under the RPS.

Other: Not applicable.

3. Implementation Mechanisms

In addition to the RPS, the following three mechanisms could be considered:

1. Add a premium to the allowed return on equity for utility investment in wind generation and/or to allowed return on equity to utility commitment to purchase non-utility owned wind generation, so long as the total of the added investment and/or purchase equals five percent of the utility's load.

2. Amendment to Act 250 permit and Title 30, Section 248 VSA provisions requiring wind generation permit and regulatory approval process to be completed within nine months of submission of application.

3. Utility investment in or contractual commitment to purchase wind generation, once approved by the Public Service Board, is deemed prudent and used and useful for ratemaking purposes.

NOTE: Similar incentives should apply to investments in equipment that allows existing wind generating resources to operate or that extends existing contractual commitments to buy wind generation.

4. Related Policies/Programs in Place

SPEED requirement that utilities commit to renewable resources

Federal tax incentives for investment in wind generating facilities

Ambiguous ratemaking precedent regarding recovery of power supply costs in rates after a supply resource commitment is made and approved.

5. Types(s) of GHG Reductions

Net reduction in CO_2 emissions

Every kwh of wind generation offsets a kwh of generation that would otherwise be purchased from ISO-NE, (most likely natural gas fired generation in the long-term). Currently, only 6 MW of wind generation is available in Vermont, out of a total generating capacity of more than 1100 MW in the state.

6. Estimated GHG Savings and Costs per $MtCO_2e$

a. **Data Sources:** Pending, (Department of Public Service and others may have data pertinent to this issue.)

b. **Quantification Methods:**

For quantification methods, including capital cost and performance characteristics, please see ESD-6.

c. **Key Assumptions:** TBD

7. Key Uncertainties

TBD

8. Additional Benefits and Costs

TBD

9. Feasibility Issues

TBD

10. Status of Group Approval

TBD

11. Level of Group Support

TBD

12. Barriers to Consensus

TBD

ESD-10. Hydro-Specific Support Measures (Continued Large Hydro)

1. Policy Description

Financial and regulatory incentives that support hydroelectric generation in Vermont and contractual commitments to purchase hydroelectric generating capacity and energy by Vermont utilities.

2. Policy Design

Resource strategies and incentives can be divided into two categories of hydro resource: smaller instate resource potential, and large hydro potential with Canadian partners. The barriers and incentives to develop these two categories of resources are distinct and can be encouraged in ways that recognize these differences. See details below.

Small Instate Hydro

Current estimates of additional hydro potential in Vermont vary considerably. Vermont currently relies on instate hydro resources for almost 10% of its energy from 73 dams, 20 of which are from merchant generators managed through VEPPI. There are, however, over 1000 dams in Vermont, however, this large figure belies the realizable potential; only a fraction of these are likely to be permitted given environmental permitting challenges and commercial viability. There have been many efforts to assess the additional hydro potential in Vermont. A recent survey of other studies concluded that 93 MW would represent a conservative estimate of potential. However, one respected veteran independent project developer estimates that there are only about 10 to 15 MW of commercially feasible projects left in Vermont.[7]

Vermont utilities are currently encouraged to invest in new small hydro resources or upgrades through legislative targets for SPEED resources or contracts with project developers. Small hydro resources also have access to the Vermont Clean Energy Development Fund and to incentives through net metering. Small hydro projects also have access to regional renewable portfolio targets in neighboring states and, potentially, to include Vermont as proposed under policy #6. The barriers to further development of hydro resources do not appear to be for lack of financial incentives.

[7] Vermont Council on Rural Development, The Vermont Energy Digest, April 2007 at 53 refers to estimates of John Warshaw.

One of the main concerns among the development community expressed at a recent ANR workshop was the high cost of environmental permitting and regulatory review. Projects that require FERC licenses or permits can take years and add considerably to project costs. One strategy for improving the development of these sites is to explore new ways to streamline the permitting process without undermining the basic environmental and other protections created through existing permitting.

Large Hydro.

While the resource potential for smaller hydro projects appear to be limited, large hydro (projects generally greater than 200 MW) are still considerable and exist and are in the planning and development stages beyond our borders. New projects are under development or in the planning stages by at least two Canadian provinces. The winter peaking loads of at least one northern complements our own summer peaking demand, allowing for power purchases by Vermont and other New England states during summer periods.

Vermont currently relies for roughly a third of its energy from large hydro facilities in Canada. Vermont also receives a small amount of electricity from the Niagara and St. Lawrence projects in New York. Currently, Vermont does not recognize large hydro resources above 200 MW as renewable energy in any of its goals for SPEED or an RPS. Yet large hydro exhibits the price stability and low-emissions profile of other renewables. By virtue of existing interties with Canada, New Hampshire, and New York, Vermont has the advantage of relatively good access to large hydro resources from our immediate neighbors. Through existing intertie capabilities with its neighbors Vermont may also have access to new large hydro resources in New Brunswick, and Labrador.

Even beyond Vermont, the ISO-New England region, from which Vermont purchases the bulk of its market energy depends disproportionately on volatile fossil fuels. Efforts are underway to further diversify the regional resource mix, including strengthening transmission intertie capabilities between Canada and New England. The decisions that Vermont makes with respect to its own new resource contracts can, in turn, positively impact the character of decisions within the ISO-New England region as New England explores its intertie capabilities with Canada and looks for new strategies to diversify its current dependency on natural gas.

Negotiations are already underway to explore opportunities for replacing existing contracts with new contracts for large hydro resources. These contracts can be encouraged through the establishment of a supporting public and regulatory climate toward the development of such contracts and recognizing the contribution that these resources can provide to Vermont's climate and economic performance objectives for electricity.

Goals: To stimulate new investment in wind generation in Vermont and, at the same time, provide incentives to owners of existing resources to maintain their presence in the energy portfolio. This option is examined in the form of two potential scenarios. In Scenario 1 large hydro continues to contribute to Vermont's electricity supply at a scale similar to toady. In Scenario 2, large hydro contributes roughly half what it contributes today. The specific goal also stimulates incremental hydro generation sufficient to help meet the goals of two scenarios described under ESD-6. This amounts to roughly the following schedule:

	Additional Hydro	
	2012	**2028**
Scenario 1	***8 MW***	***34 MW***
Scenario 2	***17 MW***	***70 MW***

Timing: As shown above.

Parties Involved: All owners and developers of hydroelectric generating facilities would be eligible to receive payments and to develop projects under more expeditious regulatory and permitting regime, and receive credit under the RPS.

Other: Not applicable.

3. Implementation Mechanisms

In addition to the RPS, the following four, similar to those noted above for wind-specific support, have also been suggested for small hydro:

1. Adding premium to the allowed return on equity for utility investment in new hydroelectric generation and/or the allowed return on equity for utilities committing to buy hydroelectric generation from another entity, so long as the total of the added investment and/or purchase commitment equals 25 percent of the utility's load.

2. Amendment to Act 250 permit and Title 30, Section 248 VSA provisions requiring hydroelectric generation permit and regulatory approval process to be completed within nine months of submission of application.

3. Utility investment in or contractual commitment to purchase hydroelectric generation, once approved by the Public Service Board, is deemed prudent and used and useful for ratemaking purposes.

4. State regulatory determination of water quality in Federal hydroelectric re-licensing proceedings must be completed within nine months of submission of application and must take into account economic and global warming impact of approving or denying water quality certificate.

NOTE: Similar incentives and regulatory streamlining provisions should apply to investments in equipment that allows existing hydroelectric resources to continue to operate or that extends existing contractual commitments to buy hydroelectric generation.

4. Related Policies/Programs in Place

Please provide text here

5. Types(s) of GHG Reductions

Net reduction in CO_2 emissions

Every kwh of hydroelectric generation offsets a kwh of fossil-based generation. In New England, this is most likely to mean that natural gas generation is displaced with renewable kwhs. Currently about 20 percent of Vermont's capacity and five to seven percent of its energy resources comes from in-state hydroelectric facilities, while nearly 40 percent of its supply portfolio is provided by out-of-state hydroelectric entitlements.

TBD.

6. Estimated GHG Savings and Costs per $MtCO_2e$

Data Sources: Please provide text here (any sources you know of that will help in the quantification)

Quantification Methods:

The analysis of hydro relies on existing studies of hydro potential in Vermont, particularly the "Hydro Power Resource Assessment" by the Department of Energy and, in particular, the Vermont portion of the analysis contained in the link to the "INL Hydropower Resource Economics Database , April 29, 2003, (2.6MB XLS)" at (**http://hydro2.inel.gov/resourceassessment/**). The identified hydro sites are listed in the table below.

This list is culled from a database of 27 sites totalling 150 MW of capacity, which is filtered down to 18 sites based on the following screens:

1. Nameplate capacity is greater than 1MW

2. An existing impoundment (i.e., would not be a new development)

3. No major environmental sensitivities or land use issues that would make development "unlikely" (as defined by study)

This leaves a total of 98 MW (of which 74 MW is from sites with >5 MW capacity, and 45 MW is from sites already with hydro power). This is not far off from the "conservative estimate" from the study "The Undeveloped Hydroelectric Potential of Vermont" recently commissioned by DPS.

Name	Stream name	Capacity (MW)	Total development cost ($/kW)
FAIRFAX FALLS	LAMOILLE R	1.1	$1,741
WEYBRIDGE	OTTER CR	1.1	$1,788
AMERICAN WOOLEN MILL	WINOOSKI R	1.2	$2,941
SAXTONS RIVER	SAXTONS R	1.2	$3,022
NEWPORT 1,2,3	CLYDE R	1.4	$1,592
MONTPELIER 4	WINOOSKI R	1.5	$2,809
WYOMING VALLEY	CONNECTICUT R	1.6	$2,772

GARFIELD	GREEN R	2.5	$2,534
GORGE 18	WINOOSKI R	2.7	$1,390
CHACE MILL HYDRO	WINOOSKI R	3.0	$2,345
PITTSFORD	EAST CR,OTTER CR	3.1	$1,398
ESSEX(GORGE)19	WINOOSKI R	3.6	$1,293
HARRIMAN	DEERFIELD R	5.2	$1,272
JAY BRANCH	MISSISQUOI R	7.3	$2,060
HART ISLAND	CONNECTICUT R	10.0	$1,942
EAST GEORGIA	LAMOILLE R	14.0	$1,826
BELLOWS FALLS	CONNECTICUT R	17.4	$1,640
VERNON	CONNECTICUT R	20.0	$1,013
		98 MW	

The presumed average capacity factor is 49.7%, as per the INL study.

Key Assumptions: TBD

7. Key Uncertainties

TBD

8. Additional Benefits and Costs

TBD

9. Feasibility Issues

TBD

10. Status of Group Approval

TBD

11. Level of Group Support

TBD

12. Barriers to Consensus

TBD