Vermont Comprehensive Energy Plan 2008

And Update to the 2005 Twenty-Year Electric Plan

EARLY 2011 STAKEHOLDER ENGAGEMENT DRAFT – UTILIZING 2008 PUBLIC REVIEW DRAFT

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Note to the reader: This is a working draft of the Comprehensive Energy Plan, utilizing the last Public Review Draft issued in 2008 with some factual updates through March 2011. Some sections have not yet been updated since the 2008 draft and therefore may not reflect current situations or priorities. We are now requesting assistance to make this a dynamic document that will serve as a guide for Vermont's energy future. The Department is embarking on a process to obtain feedback and new ideas from Vermonters, organizations, and institutions to incorporate into this plan. Please participate by attending one of our public meetings or submitting a comment in writing with your thoughts. Although this draft plan provides a framework for the Comprehensive Energy Plan, please don't feel constrained by the draft. If you have an idea that is outside of this framework, please let us know that too. For more information about the public hearings or how to submit written comments, please see our website at http://publicservice.vermont.gov/pub/state-plans-compenergy.html

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EXECUTIVE SUMMARY

UNDER DEVELOPMENT – TO BE ADDED PRIOR TO NEXT PUBLIC DRAFT RELEASE

SECTION I INTRODUCTION

OBJECTIVES FOR THE PLAN

This Plan reflects the challenges and initiatives at the time of its publication. The issues are complex and both the environment and the science surrounding these issues are changing rapidly. New challenges, new initiatives, and events that contribute to a greater understanding of the issues surrounding energy policy and climate change are occurring monthly, weekly, and even daily. This Plan attempts to provide a comprehensive look at these challenges and opportunities. It attempts to highlight policy priorities and opportunities and attempts to add details to efforts and initiatives in progress today.

This Plan attempts to accomplish three purposes. First, it helps to inform readers of the many challenges that Vermonters are facing in their efforts to maintain a safe, reliable, affordable, and sustainable energy supply. As both a policy-making and a reference tool, readers can use this Plan to learn more about the energy initiatives going on in the state and how Vermont's energy issues relate to regional, national, and even international developments. It attempts to raise public awareness and the awareness of policymakers of critical concerns related to energy issues.

Second, the CEP examines the current efforts taking place to address these energy challenges. Both federal and state legislations are evolving rapidly and are greatly altering the policy framework under which energy planning is occurring. This Plan discusses new initiatives, statutes, and laws that are impacting the way Vermonters obtain their energy and the way policymakers will move forward to reach new energy goals.

Finally, the CEP makes specific recommendations on ways in which the state can support, guide, expand, and/or take the critical next steps to help lead Vermont, the region, and the nation into a sustainable and affordable energy future.

Statutory Goals and Requirements

According to the Vermont Statutes (Title 30, Chapter 5: Powers and Duties of the Department of Public Service) the Department is required to produce a comprehensive state energy plan covering at least a 20-year period.[1] As § 202b states:

> *(a) The department of public service, in conjunction with other state agencies designated by the governor, shall prepare a comprehensive state energy plan covering at least a 20-year period. The plan shall seek to implement the state energy policy set forth in section 202a of this title. The plan shall include:*
>
> *(1) A comprehensive analysis and projections regarding the use, cost, supply and environmental effects of all forms of energy resources used within Vermont.*
>
> *(2) Recommendations for state implementation actions, regulation, legislation, and other public and private action to carry out the comprehensive energy plan.*

> *(b) In developing or updating the plan's recommendations, the department of public service shall seek public comment by holding public hearings in at least five different geographic regions of the state on at least three different dates, and by providing notice through publication once a week and at least seven days apart for two or more successive weeks in a newspaper or newspapers of general circulation in the regions where the hearings will be held, and by delivering notices to all licensed commercial radio and television stations with transmitting facilities within the state, plus Vermont Public Radio and Vermont Educational Television.*
>
> *(c) The department shall adopt a state energy plan by no later than January 1, 1994. Upon adoption of the plan, analytical portions of the plan may be updated annually. The plan's implementation recommendations shall be updated by the department no less frequently than every five years. These recommendations shall be updated prior to the expiration of five years if the general assembly passes a joint resolution making a request to that effect. If the department proposes or the general assembly requests the revision of implementation recommendations, the department shall hold public hearings on the proposed revisions.*
>
> *(d) Any distribution of the plan to members of the general assembly shall be in accordance with the provisions of 2 V.S.A. § 20. (Added 1981, No. 236 (Adj. Sess.), § 5; amended 1991, No. 259 (Adj. Sess.), § 2.)*

The Plan itself is designed to serve as an actionable framework for moving forward from the goals defined in statute. At the highest level are Vermont's statutory goals that include the following pursuant to 30 V.S.A. Title 30, Section 202a(1):

> *To assure, to the greatest extent practicable, that Vermont can meet its energy service needs in a manner that is **adequate**, **reliable**, **secure** and **sustainable**; that assures **affordability** and encourages the state's **economic vitality**, the **efficient use** of energy resources and cost effective demand side management; and that is **environmentally sound**.* (Emphasis added)

PLAN ORGANIZATION

As noted above, the goals for this Plan are to promote energy resources that are ***adequate***, ***reliable***, ***secure***, *and* ***sustainable***; *that assure* ***affordability*** *and encourage the state's* ***economic vitality***, *the* ***efficient use*** *of energy resources, and cost-effective demand-side management; and that are* ***environmentally sound.***

The individual **Sections** in the Plan are organized by **areas of focus** or broad headings that cover a grouping of potential strategies for advancing our statutory objectives. These focus on the traditional sector groupings that center on fuels and end-use sectors, (e.g., electricity, natural gas, and transportation). Energy efficiency has emerged as a central policy focus in the state that complements our goals and priorities; it therefore represents an area of focus that is given a

separate section heading. Given the wide breadth of activities and opportunities encompassed by it, however, we leave most of the energy-efficiency programs and activities that are peculiar to gas and electric utilities as separate strategies within those specific fuel sectors.

The **Strategies** pursued represent still a further delineation of activities within the Section groupings. Below the broad strategies are the specific **Recommendations** that follow. Below each recommendation are the **actions necessary** to implement the recommendation. Action items, as a rule, are designed to be measurable, actionable, and discrete.

Figure I-1 CEP Structure

As noted early in this document, the events surrounding energy and the environment are changing monthly, and sometimes even more frequently. As such, the Plan should be responsive to the changes that are taking place. Sectors that were formerly quite distinct are beginning to converge (e.g., electricity and transportation). Resources permitting, the DPS intends to continue to integrate the Electric Plan with this Plan and intends to update this Plan more frequently than in the past. Going forward, we intend to update this Plan on a 3-year cycle.

Evaluation Descriptions

Timing: The estimated implementation period.

- NEAR-TERM: Policy could be implemented within 0–5 years.
- MID-TERM: Policy could be implemented within 5–10 years.
- LONG-TERM: Policy will likely take over 10 years to implement.

Potential Emissions Impact: If the policy is successfully implemented, the greenhouse gas emissions reduction that could result over the long term (10 or more years).

- HIGH: A significant reduction in emissions could result from implementation.
- MODERATE: Some emissions reduction could result from policy implementation.
- LOW: Little or no reduction in emissions could result from implementation.

Potential Energy Impact: If the policy is successfully implemented, the overall energy impact that could result over the long term (10 or more years). Energy impact includes but is not limited to petroleum displacement, energy supply and security, affordability, reliability, and environmental impact of energy use.

- HIGH: The policy could displace a significant amount of petroleum, significantly enhance Vermont's energy security and/or reliability, and/or reduce the cost of energy supply.
- MODERATE: The policy could displace some petroleum, enhance Vermont's energy security and/or reliability moderately, and/or reduce the cost of energy supply slightly.
- LOW: The policy could result in little/no displacement of energy, enhancement of reliability and/or security, or reduction in the cost of energy supply.

Capital Cost: The estimate of policy cost.

- HIGH: The policy will have significant up-front implementation costs (>$20 million).
- MODERATE: The policy will have moderate up-front implementation costs ($5–$20 million).
- LOW: The policy will have low up-front implementation costs (<$5 million).

Cost Effectiveness:

- HIGH: The policy creates a net benefit even without monetized value for carbon or environmental impacts.
- MEDIUM: The policy creates low net benefits that are marginally positive without valuing carbon and environmental impacts.
- LOW: The policy likely creates a material cost apart from the monetized value for carbon or environmental attributes.

Funding Sources: Listing notable funding sources available to implement the policy.

ENDNOTES

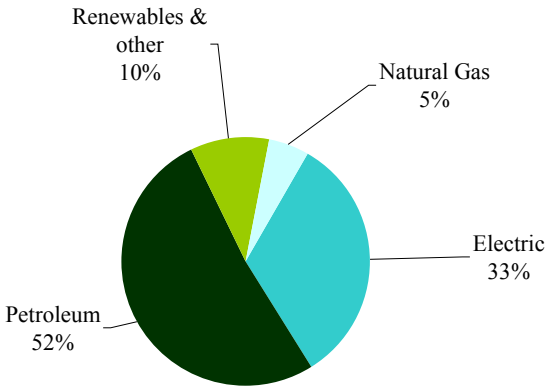
[1] Title 30, Chapter 5, § 202b. State comprehensive energy plan.

SECTION II ENERGY SUPPLY AND DEMAND

Vermonters obtain their energy from a variety of sources and regions. Whether it is from Canadian natural gas, wood from Vermont and neighboring state forests, or electricity from a solar panel, there is great diversity in the kinds of resources available in state. Section II of the Comprehensive Energy Plan discusses how these resources have been utilized. It will also present a forecast of Vermont's future energy demand and outline the kinds of resources that will need to be available to meet the state's requirements.

VERMONT'S ENERGY USE

Figure II-1 Vermont Total Energy Consumed by Source, 2007



About half of Vermont's energy demand is met by petroleum-based fuels. A third of the state's energy is consumed in the form of electricity, which predominantly comes from cleaner resources that are low-emitting or non-emitting sources of greenhouse gases. The remaining energy demand is met by natural gas- and renewable generating facilities. Figure II.1 provides a recent snapshot of Vermont's overall energy mix.

Demand for energy in Vermont is driven largely by the pressures of changes in population and economic growth. Energy demand is also closely tied to the travel patterns of both Vermonters and visitors to the State. Overall energy demand grew by almost 20% between 1990 and 2006.* During this 16-year period, real economic growth increased by 55%, population grew by 10%, and transportation vehicle miles traveled (VMT) increased by more than 31%.†

* Since 2003 with the rise in gasoline prices, vehicle-miles-traveled (VMT) have actually shown a modest 3.1% decline from the peak 2003 travel of 7,938 million miles traveled. In 2006, the Vermont Agency of Transportation reported VMT of 7,689 million miles. Please note that the basis or methodology for estimating VMT changed in 2001, making comparisons before and after this period challenging.

† Economic growth statistics are from the Bureau of Economic Analysis in constant 2000 dollars. http://www.bea.gov/regional/gsp/. State population estimates are from DOE/Energy Information Administration's State Energy Data System (SEDS).

Figure II-2 Vermont Energy Demand by Source, 1990–2007

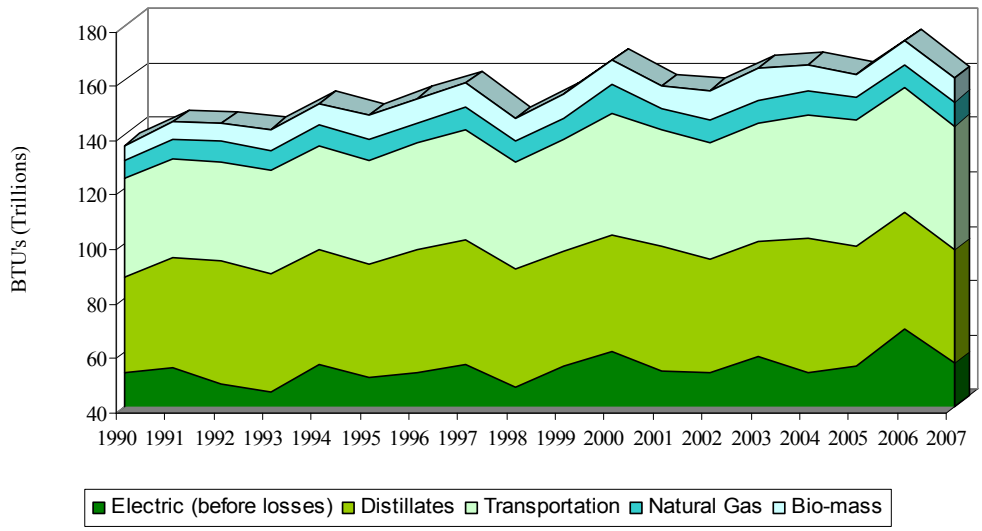
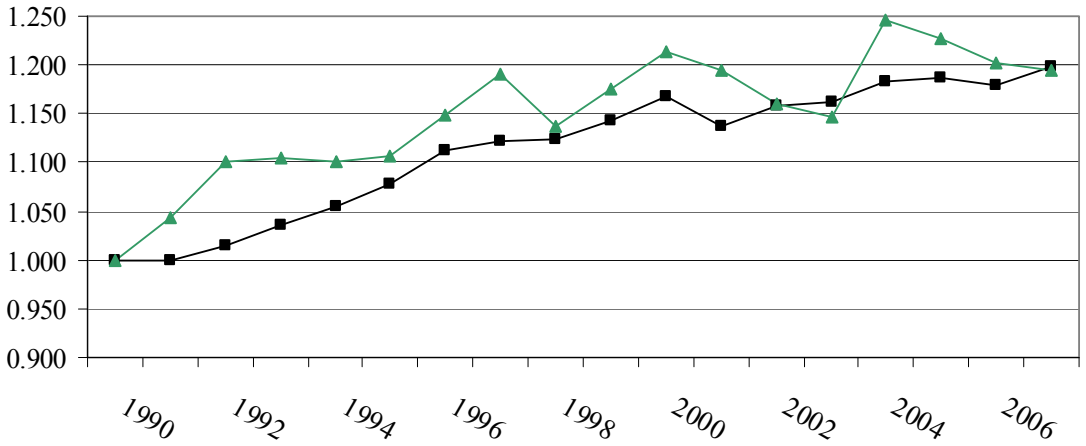


Figure II-3 shows changes in total energy demand compared to the US, indexed to 1990.

Figure II-3 Energy Demand, Vermont, US, 1990-2007
Total Btu's, Index 1990 = 1.0



Since 1990, total energy demand in Vermont increased 19.5% as compared to 19.8% in the US. Moreover, Vermont energy demand has moderated in the past three years, declining 1.5% in 2005, 2% in 2006, and .6% in 2007. Since 1990 Energy demand has increased in each end-use sector of the economy (transportation, residential, commercial, and industrial), but there were significant differences in growth among sectors.

Figure II-4 Residential Energy Demand, Vermont Total Btu's Index 1990 = 1.0

Residential energy demand increased a modest 9.5% since 1990, a growth rate of only .6% per year. Notable is the recent moderation in residential sector energy use since its peak in 2004.

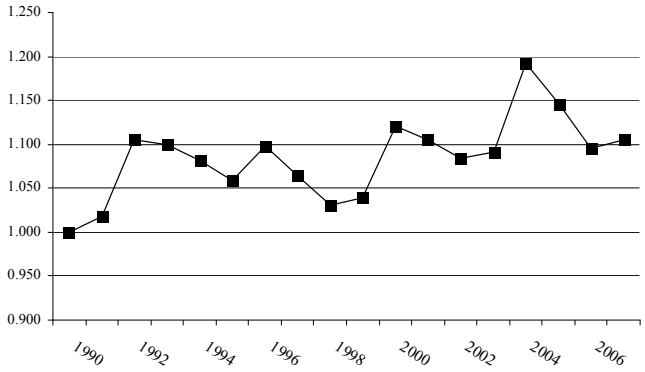


Figure II-5 Commercial Energy Demand, Vermont Total Btu's Index 1990 = 1.0

Commercial energy demand increased by 23% between 1990 and 2006, or 1.24% per year. This increase can be attributed largely to economic growth in Vermont's service sector.

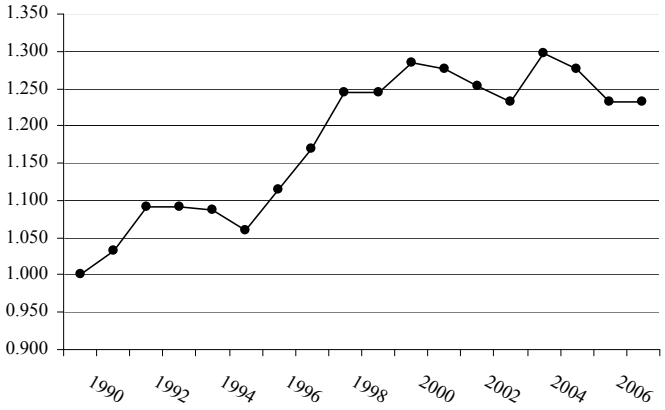
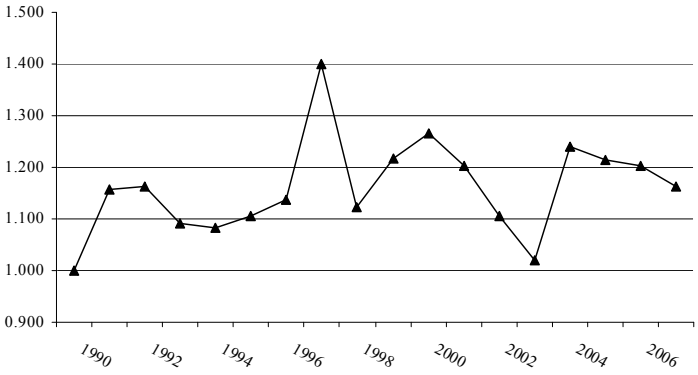


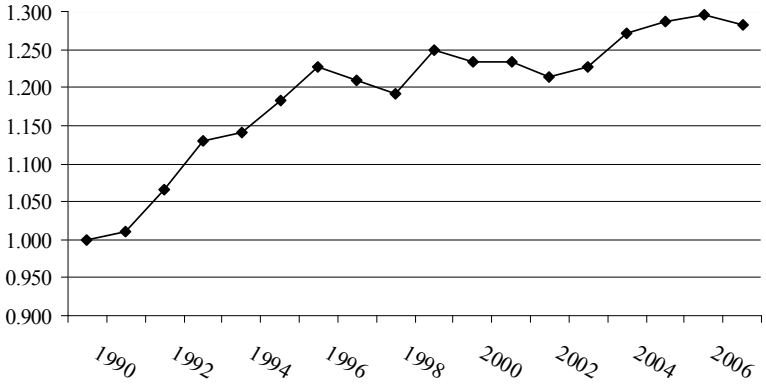
Figure II-6 Industrial Energy Demand, Vermont Total Btu's Index 1990 = 1.0

Energy demand in the industrial sector increased 20% since 1990, or .9% per year. The increase in energy demand occurred despite employment declines in Vermont's manufacturing and mining sectors.



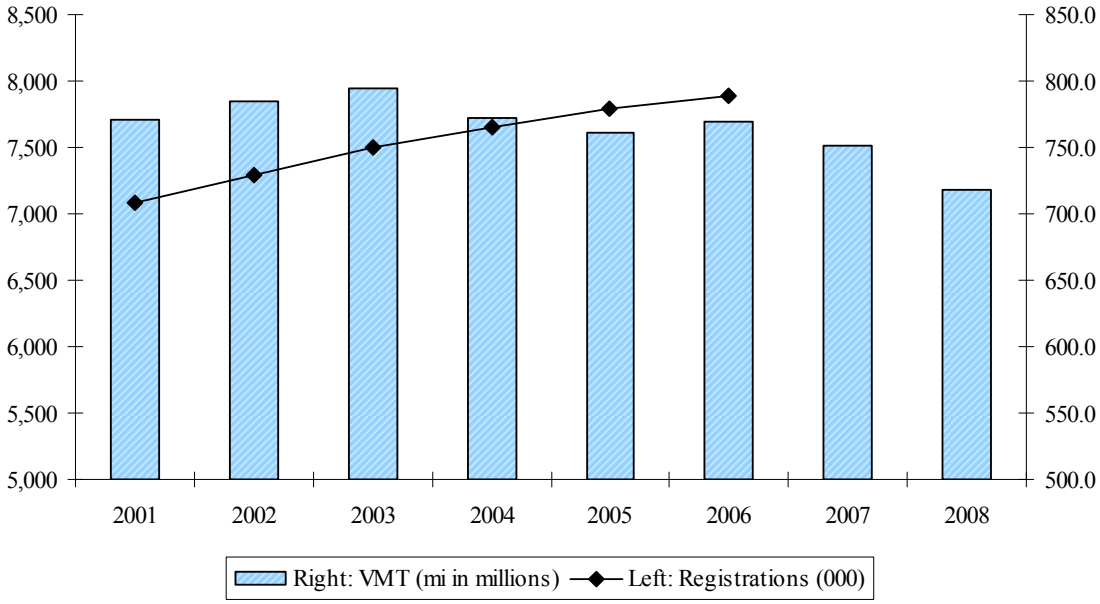
The transportation sector posted the largest increase in State energy demand, increasing 28% since 1990. Growing at 1.5% per annum, the transportation sector is Vermont's fastest growing end-use sector. Transportation sector energy is driven by vehicle miles traveled from both residential and travel related demand.

Figure II-7 Transportation Energy Demand, Vermont
Total Btu's Index 1990 = 1.0



Between 1990 and 2008, Vehicle Miles Traveled in Vermont declined at the annual rate of 1% between 2001 and 2008, while resident motor vehicle registrations increased by 2.1%. Figure II-8 below shows Vermont vehicle miles traveled along with new Vermont vehicle registrations since 2001.

Figure II-8 Vehicle Miles Traveled and Vehicle Registrations, 1990–2008

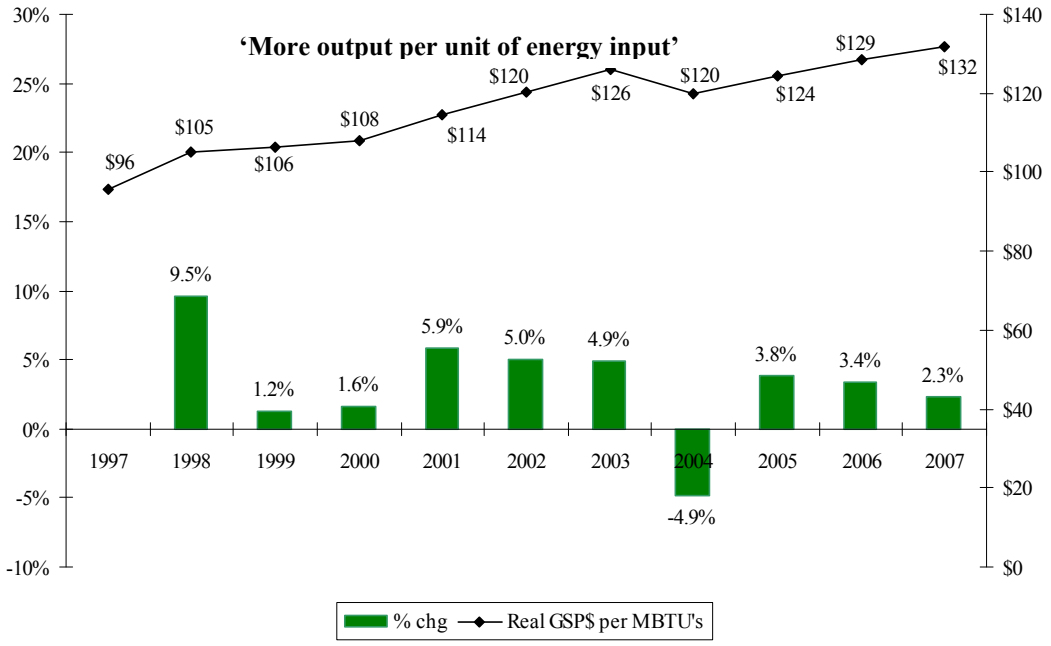


Energy Targeting

How efficient is the State of Vermont in producing goods and services with its limited energy resources? That is, how much energy is consumed in the process of generating the State's Gross Product, and how has the energy content changed over time.

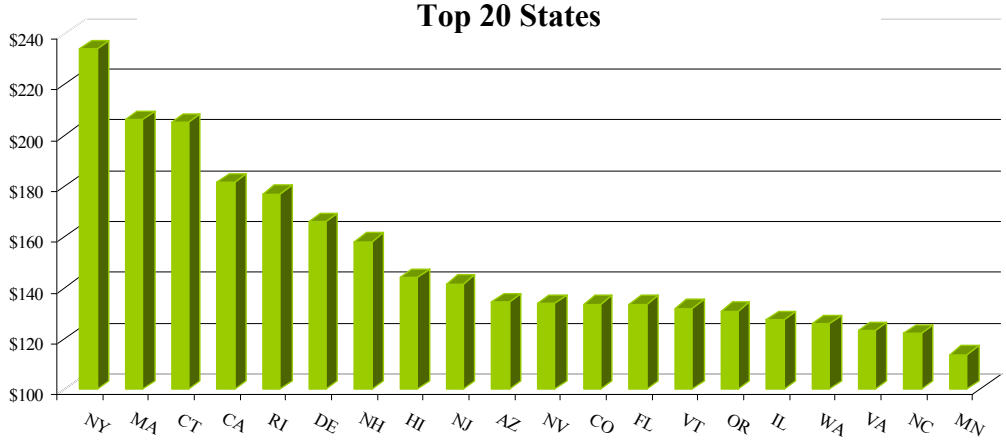
Inflation-adjusted economic growth (Gross Domestic Product, 2000$) in Vermont increased 38% between 1997 and 2007. Additional employment, industrial output, and higher wages typically increase the demand for energy resources. However, the Vermont economy has been able to accommodate additional (real) economic growth with relatively 'less' energy input. Figure II-9 illustrates the rising trend in Vermont real Gross Domestic Product (GDP) per million BTU's of energy. In 1997 Vermont generated $96 of GDP (2000$) per million BTU's. By 2007, Vermont was producing $132 of Gross Product per million BTU's, an annual growth rate of 2.9%. Notable has been the consistency of gains in real economic output per MBtu's. Vermont's GDP per unit of energy increased in 9 of the previous 10 years

Figure II-9 Vermont Real Gross Domestic Product Per Million BTU's



How does Vermont measure up against other states in energy use? Figure II-10 illustrates Vermont's rank among all states in Gross Domestic Product per million Btu's. In 2007 Vermont ranked 14th among all states in 'efficient' use of energy resources. Other New England states, Connecticut, Rhode Island, and New Hampshire, ranked in the top 10 nationally.

Figure II-10 Real GDP Per Million Btu's, 2007
Top 20 States



VERMONT, US, AND GLOBAL ENERGY DEMAND

As a state, Vermont's contribution to energy and environmental quality are small when considered on national and global scales. Primary energy consumption worldwide in 2007 was approximately 483.6 quadrillion BTUs and the United States consumed 21% of that at 101.6 quadrillion BTUs.* The U.S. is the largest national consumer of energy today, with China consuming roughly three quarters of current U.S. demand. U.S. energy demand is projected to grow at a pace of .5% annually through 2030, while that of China is expected to grow at a pace of 3.2%. This means that China should overtake the U.S. as the largest consumer of energy in the world before 2020. Global energy demand is increasing at a pace of 1.5% annually.

At present, Vermont energy demand stands at roughly 162 trillion Btu's and accounts for less than .2% of the total U.S. energy demand. Vermont consumes considerably less total energy than any other state, but has the 23rd highest per capita energy expenditure in the U.S.. Vermont is ranked 42nd among all states in energy consumption per capita.

VERMONT, REGIONAL, U.S. AND GLOBAL ELECTRICITY DEMANDS

Electricity has emerged as a leading source of energy demand, with increases in the saturation of household appliances and the emergence of new information technologies that rely on electricity, or where it has emerged as a preferred fuel.

Current forecasts of electric energy demand suggest that average energy demand is expected in the short term to remain flat or even decline. However, air conditioning loads continue to drive summer peak demands to new highs. Figure II-11 shows the trend in electricity demand in Vermont over time.

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* DOE/EIA, State Energy Consumption, Price, and Expenditure Estimates (SEDS), http://www.eia.doe.gov/emeu/states/seds.html.

Figure II-11 Vermont Seasonal Peak MWs, 1991-2008

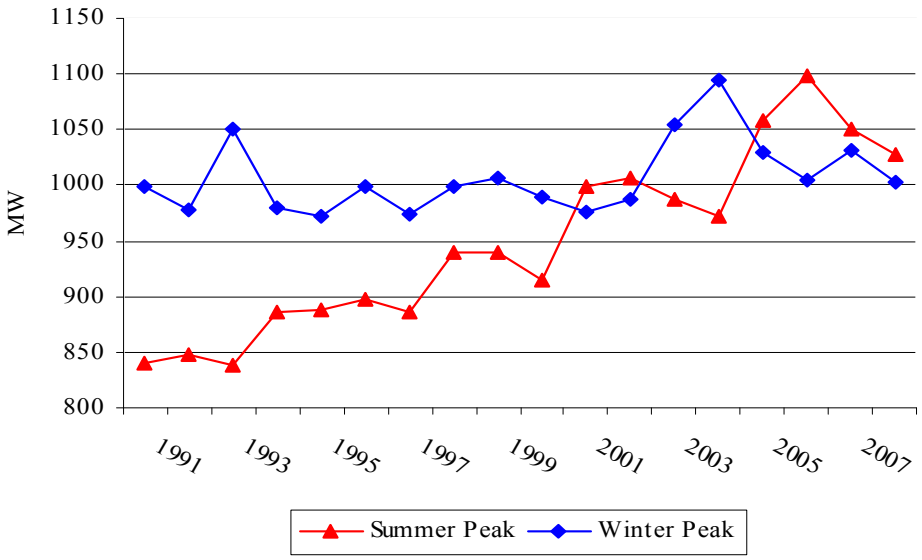
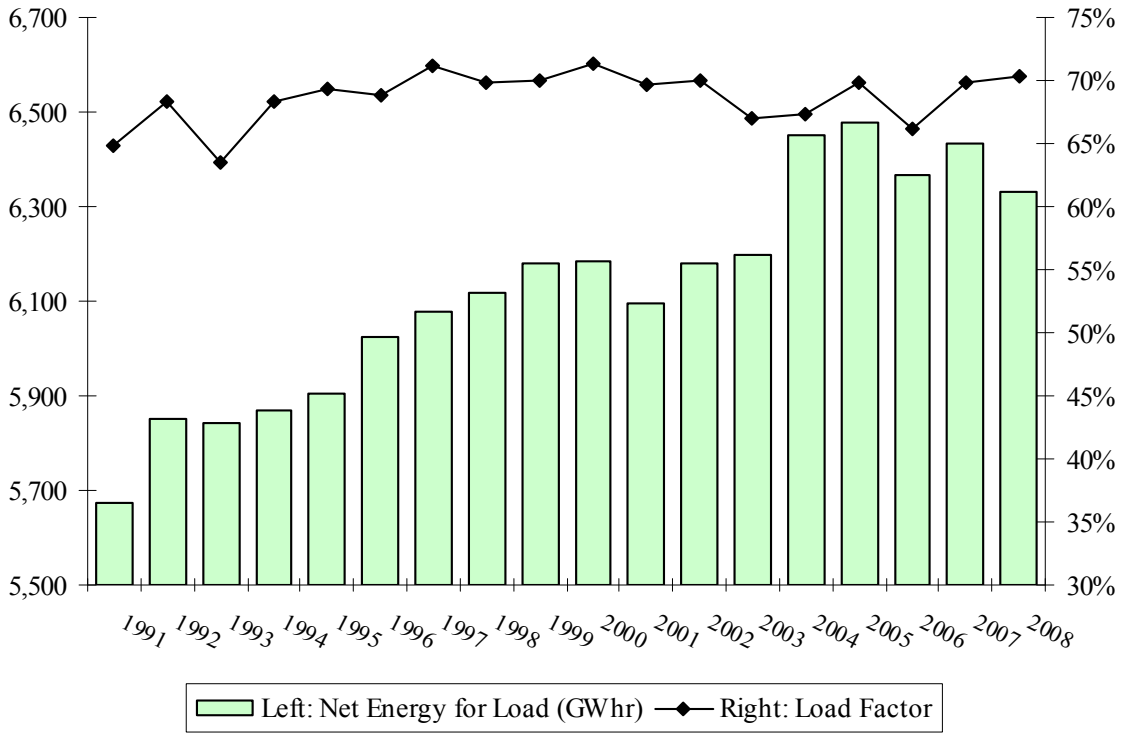


Figure II-12 Vermont Electricity: Annual Load Factor and Demand

[Load Factor = (Net Energy for Load) / (Annual Peak) X (# of hours in a Year)]



Also reflected in the Figure II-12 is the improving (increasing) load factor for energy demand in Vermont*. A portion of the improving load factor is due to stable winter peak demand amid growing summer peaks. In the future summer peak load growth is likely to exceed winter peaks and precipitate a declining load factor. However, new methods, technologies and policies to manage summer peak loads could mitigate declining load factors.

Vermont and U.S. Carbon Contribution

Vermont's energy mix remains relatively clean from the standpoint of carbon emissions. According to federal sources, Vermont has the lowest energy carbon footprint of any state in the U.S., at about 6.5 million tons emitted in 2007.† As one of the least populous states in the country, this would seem intuitive. However, Vermont remains one of the lowest, emitters even when adjusted for population.‡ This can be attributed to utility and regulatory energy policies encouraging cleaner sources, energy efficiency programs, and utility rate design. A significant share of the energy demand profile can be attributed to the historically high costs of energy in New England,§ and Vermont in particular. Vermont utility sector investment decisions in the 1960s (Vermont Yankee), independent power purchases in the 1980s and early 1990s, its historical heavy reliance on local hydro resources, and the purchase commitments from Hydro-Quebec in the early 1990s are the predominant low carbon factors.

When taking population into consideration, carbon emissions in Vermont ranked 2nd nationally in the least amount of annual emissions (Figure II-13). Similarly, all other New England states ranked in among the top 20 states. Rhode Island ranked no. 3 and the more densely populated states, Connecticut and Massachusetts ranked 6th and 8th respectively.

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* Load factor represents the relationship between peak and average loads or energy demands. Higher load factors correspond to more effective utilization of existing generation and wires (transmission) facilities.

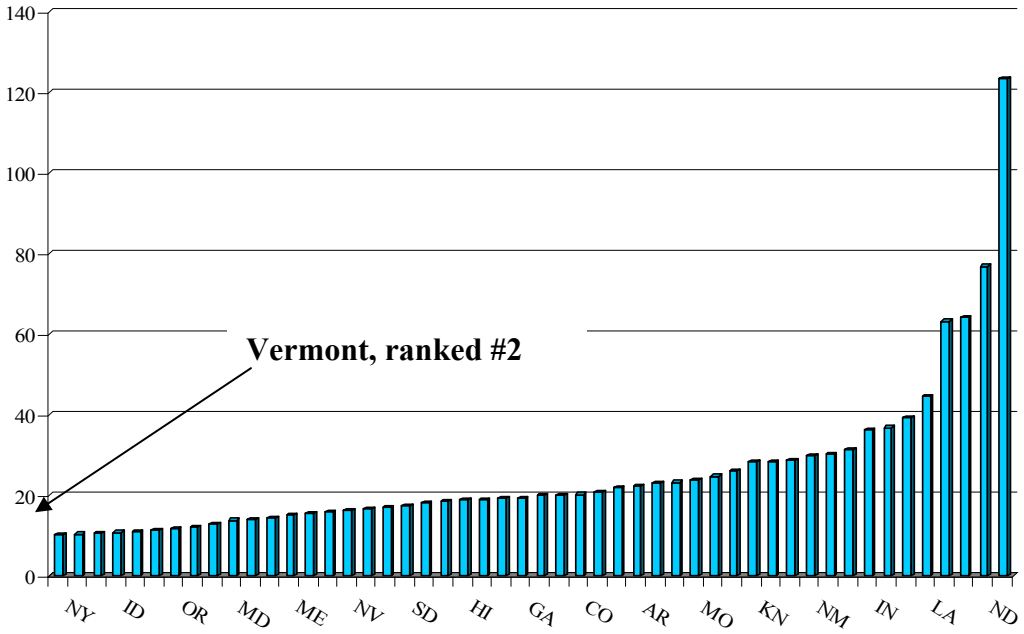
† Federal statistics rely on the geographic footprint of Vermont in the electric generation sector. However, Vermont utilities buy a substantial share of their energy from out-of-state sources. Vermont's carbon contribution ends up slightly higher if one includes emissions from contracts and out-of-state resources available to Vermont consumers, however, it remains lowest in the nation by a considerable margin.

‡ The greenhouse gas emission profile of Vermont is somewhat different than its geographic source footprint. Almost half of Vermont's electricity production is attributable to out-of-state sources, including contracts for predominantly hydro resources with Hydro-Quebec and New York Power Authority (NYPA) and system power contracts for predominantly fossil fuel energy merchant generators within the region.

§ Vermont, along with five neighboring states in New England and the state of New York, has the highest energy prices in the U.S. outside of Hawaii. These states are also among the most energy efficient states, with all ranking among the lowest 10 users of energy per capita in the nation.

While DOE and EPA reports Vermont's energy demand based on sources located in Vermont, Vermont's energy demands and carbon contributions are similarly small even if one accounts for sources of energy from outside the state. Vermont relies heavily on large amounts of hydropower from Canada.

Figure II-13 Carbon Emissions, By State, 2007
Metric Tons per capita



VERMONT, NEW ENGLAND, AND U.S. RENEWABLE ENERGY

Nationally, 7% of energy demand is met by renewable sources, an increase from 6% in 2004. Biomass provides over 50% of U.S. renewable energy, with hydro power contributing an additional 34%. Wind, the fastest growing renewable source, now provides 7% and solar 1% of U.S. renewable energy.

The New England region depends disproportionately on natural gas for electricity generation (40% of the regional energy and capacity is natural gas-based generation). Over 80% of Vermont's electricity demand is met by non-emitting sources and approximately 45% comes from renewable sources.* Vermont's relatively clean carbon emissions source mix should remain through the end of existing contracts with Entergy (nuclear) and Hydro-Quebec that are due to expire in 2012 and 2016, respectively. Only seven states in the nation receive a higher percentage of their in-state production needs from renewable energy and almost all of those depend predominantly on large hydroelectric projects for the greatest share of that contribution.

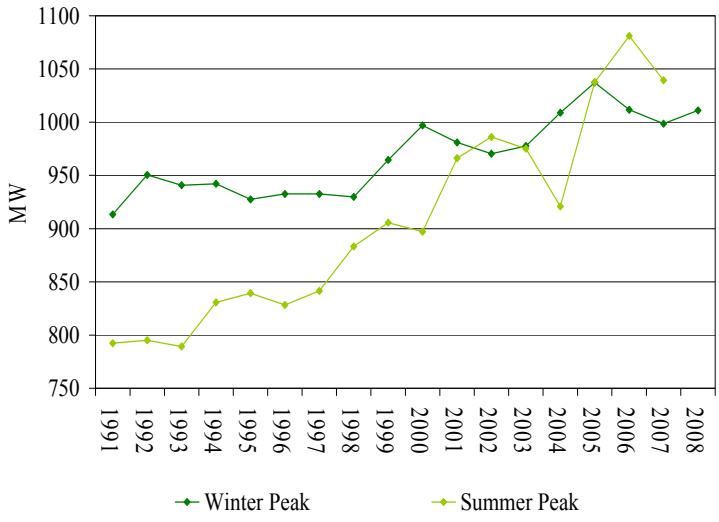
* Nuclear energy contributes to the carbon profile of the state through fossil fuel consumed during the extraction process; however, the contribution is similar to the upstream contributions of other fossil fuels.

Vermont's energy mix remains relatively clean, at least from the standpoint of carbon emissions. According to federal statistics, Vermont has the lowest energy carbon footprint of any state in the U.S., at about 6.5 million tons emitted in 2003. As one of the least populous states in the country, this would seem intuitive. However, Vermont remains either the lowest, or one of the lowest, emitters even when adjusted for population.* This can be attributed to utility and regulatory energy policies regarding cleaner sources, energy efficiency programs, utility rate design, and land use. A significant share of the responsibility can also be attributed to the historically high costs of energy in New England,† and Vermont in particular. Vermont utility sector investment decisions in the 1960s (Vermont Yankee), independent power purchases in the 1980s and early 1990s, its historical heavy reliance on local hydro resources, and the purchase commitments from Hydro-Quebec in the early 1990s are the predominant factors.

FORECASTS OF PRICES AND ENERGY DEMAND

Price Forecasts

In the spring of 2009, the DPS joined with the other New England states to prepare a forecast of avoided costs for use in screening Demand Side Management (DSM) programs. A subgroup of the DSM program administrators in the region solicited bids from consulting firms to provide these projections, which will support internal DSM program decision-making and cost-effectiveness screening.



This 2009 Avoided Energy Supply Component (AESC) study is intended to update prior studies conducted in 1999, 2001, 2003, 2005, and 2007, which were based on various methods including a survey of forecasts of market prices for electricity and fuels, production cost modeling, and actual experience in the energy markets (Vermont had previously only participated in the 2005 study). The 2003 AESC study revisited the estimation of marginal supply costs avoided by conservation savings, based on projected demand, available sources, and fuel prices for marginal supply sources, while also including the impacts of expected locational pricing. In 2005, the study group expanded its scope to include estimates of avoided costs for electricity, natural gas,

* The greenhouse gas emission profile of Vermont is somewhat different than its geographic source footprint. Almost half of Vermont's electricity production is attributable to out-of-state sources, including contracts for predominantly hydro resources with Hydro-Quebec and New York Power Authority (NYPA) and system power contracts for predominantly fossil fuel energy merchant generators within the region.

† Vermont, along with five neighboring states in New England and the state of New York, has the highest energy prices in the U.S. outside of Hawaii. These states are also among the most energy efficient states, with all ranking among the lowest 10 users of energy per capita in the nation.

fuel oil, and wood. In 2007, the study expanded its scope to include an estimate of emissions costs to use for DSM screening as well as the impact of RPS requirements on avoided costs.

Compared to the 2007 results, the resulting forecast showed a moderate increase in projected natural gas prices, which in turn, resulted in a commensurate increase in forecasted electric prices. The following tables show the comparative effects of the results.

Table II-1 Comparison of Levelized Avoided Costs of Natural Gas Delivered to Retail Customers by End Use: AESC 2007 and AESC 2009 (2009$/Dekatherm)

		Residential			Commercial and Industrial			All
	Non-Heating	Hot Water annual.	Heating 5-month	All 6-mon	Non Heating annual	Heating 5-mon	All 6-mon	Retail 5-mon
Northern & Central New England								
AESC 2009	$10.87	$10.87	$13.54	$12.68	$10.02	$12.05	$11.40	$12.03
AESC 2007(a)		$11.32	$12.35	$12.04	$10.19	$11.23	$10.92	$11.74
2007 to 2009 change		-3.95%	9.62%	5.28%	-1.65%	7.31%	4.40%	2.44%
Southern New England								
AESC 2009	$11.42	$11.42	$14.52	$13.52	$9.88	$11.83	$11.21	$12.26
AESC2007(a)		$11.62	$12.84	$12.48	$9.50	$10.72	$10.36	$11.65
2007 to 2009 change		-1.71%	13.09%	8.33%	4.04%	10.36%	8.25%	5.25%
Vermont								
AESC 2009	$9.75	$9.75	$12.51	$11.62	$8.05	$9.53	$9.07	$10.00
AESC 2007(a)		$10.43	$11.67	$11.31	$8.34	$9.58	$9.21	$10.37
2007 to 2009 change		-6.52%	7.22%	2.82%	−3.48%	-0.48%	-1.56%	-3.53%

Source: AESC 2007 and 2009 Levelized retail avoided costs. (a) Factor to convert 2007$ to 2009$ is 1.042.
Note: AESC 2007 levelized costs for 16 years, 2007–2022. AESC 2009 levelized costs for 15 years 2010–2024.

While Vermont prices are important for retail Vermont consumers, wholesale marginal electricity prices are dependent on the regional natural gas price. Since there is almost no gas-fired generation capability owned by Vermont utilities, the state's electric prices are relatively independent of gas prices.*

* Vermont utilities do, however, rely on system power contracts within the New England market. Most of Vermont's utilities rely on the regional market for shorter term contracts. Because the regional wholesale market price is largely

Table II-2 15-Year Levelized Avoided Electric Energy Costs–AESC 2007 vs. AESC 2009 ($2009)

	Winter Peak Energy $/kWh	Winter Off-Peak Energy $/kWh	Summer Peak Energy $/kWh	Summer Off-Peak Energy $/kWh
Vermont				
AESC 2007	0.100	0.073	0.105	0.072
AESC 2009	0.091	0.076	0.095	0.073
Change from AESC 2007	(0.009)	0.003	(0.010)	0.001
% Change from AESC 2007	-9%	3%	-9%	2%

The 2009 AESC avoided energy costs very similar to the 2007 AESC on an annual average basis. The major factors underlying those differentials are changes in projections of natural gas production prices and CO_2 regulation compliance costs.

The 2009 AESC projections of marginal electric capacity costs are much lower than those in the 2007 AESC due primarily to prices resulting from the Forward Capacity market ("FCM") auctions and the effects of the recent economic downturn on the demand for new capacity resources.

Prices for other, non-regulated fuels were forecast as well. These prices were developed by combining the natural gas and oil forecasts looking at the historical relationship between those prices and the price of a particular fuel.

As discussed above, the Independent System Operator for New England (ISO-NE) has implemented policies that are designed to ensure an adequate supply of electricity throughout the region. These regional policies have a relatively small effect on the ***price*** Vermonters pay for their electricity or the environmental footprint left by its use. To achieve price and environmental objectives which might be desired by ratepayers, it is incumbent upon the serving utility to contract or build resources that reflect those desired attributes

ENERGY DEMAND PROJECTIONS

Understanding Vermont's future electric energy needs is critical for planning its future generation requirements, transmission and distribution investments, and efficiency savings. Currently, each regulated utility in Vermont is required to produce and file with State regulators an Individual Resource Plan (IRP) for their service territory that includes an energy outlook as well as a plan to service that level of demand, however, there are a limited number of publicly available *statewide* energy forecasts. The following highlights and profiles the latest long term annual energy outlook by the Department of Public Service, ISO-NE (Independent System Operator – New England), and Efficiency Vermont.

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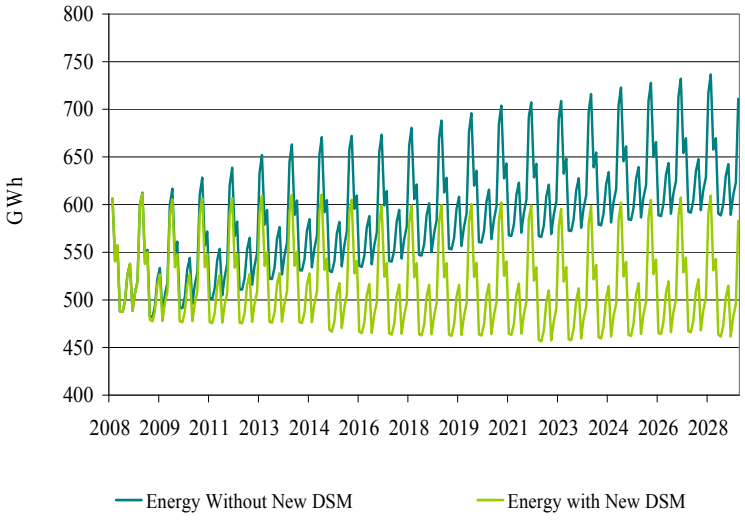
a function of natural gas prices, Vermont electric ratepayers do have some exposure to the variability of natural gas prices.

While each energy forecast is founded on similar demographic and economic expectations, they differ significantly in their assumptions and treatment of energy efficiency investments, and the 'expected' response to those investments. We recommend and caution interested parties carefully review and consider the underlying assumptions and research methodologies behind each forecast.

The DPS – the Department of public Service has performed a 20-year forecast of electric energy demand for Vermont that includes the impact of Vermont's efficiency programs. The electric forecast represents a baseline projection of energy demand given current trends, patterns of use, and current energy policy.

Figure II-8 Vermont Electric Energy Forecast



It should be noted that the DPS forecast was conducted before the impacts of the current recession were recorded in the historic data. Regardless, the DPS is projecting Vermont's electric energy growth to decline, compared to historical rates, over the upcoming 20-year period (see Table II-5 below). Overall the forecast anticipates energy growth to be slow, or negative over the entire forecast period (through 2028). Electric energy is expected to grow +.93% per annum without new DSM (Demand Side Management), or -.19% per annum with new DSM. This result is largely based on a significant and sustained level of Demand Side Management (DSM) over the forecast period. For purposes of this report, the DPS considered two future scenarios.

SCENARIO 1: FORECASTED ENERGY WITHOUT NEW DSM

The first scenario, labeled "Without New DSM," considers Vermont's future energy consumption if no new DSM programs are initiated after the current contract for Efficiency Vermont is retired in 2008. If there are no new DSM programs after 2008, energy consumption would be expected to rise, even in the absence of any increase in population or economic activity, simply because existing DSM measures decay over time and the load they were offsetting, returns. Thus, energy growth in this forecast scenario, approximately 0.93% on an annual basis over the period, is being driven by economic activity, demographics, prices and the return of load because of decay.

SCENARIO 2: FORECASTED ENERGY WITH NEW DSM

The second scenario, labeled "With New DSM," considers Vermont's future energy consumption if current DSM programs are expanded and sustained for the next 20 years. It uses the same underlying economic, demographic, price forecast as the "Without New DSM" scenario. In addition, this scenario anticipates new DSM savings of approximately 125,000 MWh each year – with 58% of the MWh allocated to the commercial and industrial sectors and 42% of the MWh to the residential sector. If these quantities of DSM are realized, then the DPS expects energy growth to decline by 0.19%, on an average annual basis, over the 2008 to 2028 period.

Table II-5 Vermont Projected Energy 2008-2028: With and Without New DSM

Year	Without New DSM (GWh)	With New DSM (GWh)
2008	6,356	6,356
2009	6,324	6,256
2010	6,436	6,243
2011	6,552	6,235
2012	6,685	6,242
2013	6,821	6,254
2014	6,925	6,253
2015	6,941	6,181
2016	6,977	6,131
2017	7,042	6,110
2018	7,123	6,107
2019	7,205	6,105
2020	7,293	6,113
2021	7,381	6,125
2022	7,370	6,046
2023	7,440	6,059
2024	7,516	6,089
2025	7,583	6,121
2026	7,634	6,146
2027	7,681	6,171
2028	7,648	6,120
	Average Annual Rate of Growth	
2008–2018	1.15%	−0.40%
2008–2028	0.93%	−0.19%

DSM in this Forecast

Vermont has been accumulating DSM savings over the past 18 years, however, DSM is inherently difficult to measure. In Vermont, the majority of published DSM savings were based on estimates before the programs were implemented. In other words, these numbers were not based on any type of assessment after the programs have been put in place. The reliability of these DSM savings estimates has a particularly strong bearing on this forecast because to the extent these estimates are high or low, it will cause the forecast to be low or high.

Decay

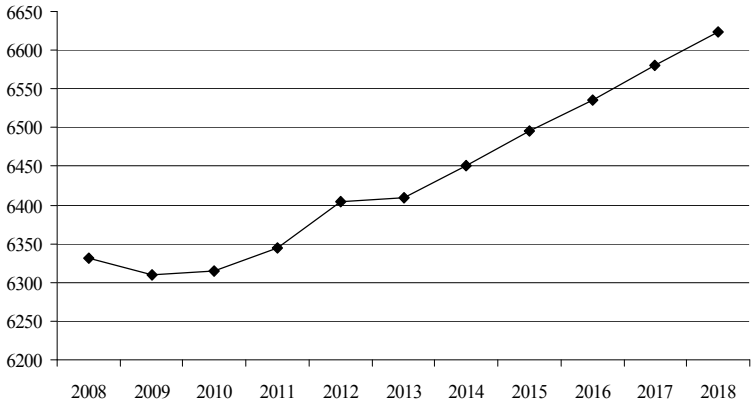
The decay of Vermont's DSM stock deserves special attention in this forecast. As the stock of DSM increases over time, a greater amount of new DSM savings in each year go to simply replacing old savings that have decayed. Furthermore, while DSM programs are typically described as having a 20-year life span on average, individual components actually decay much more quickly. For instance, compact fluorescent light bulbs (CFLs) have historically been Vermont's single largest source of residential energy savings in any given year. The CFL programs are typically expected to produce savings for about 4 or 5 years, whereas other residential initiatives such as the removal of electric space heaters, is expected to last for 20 years. Because some subcomponents decay faster than others and because some components contribute more to savings, DSM does not decay systematically over time but rather in irregular intervals.

ISO-NE Forecast - Since 1997, ISO New England (Independent System Operator) has been responsible for the day-to-day operation of New England's bulk power generation and transmission system. Central to that mission, ISO-NE manages a comprehensive regional energy planning processes that includes a long-run forecast (10 year) of Net Energy for Load (NEL) for each of the New England states.

The ISO New England Vermont forecast employs a different methodology from the DPS in their treatment of historic and future DSM. The ISO-NE forecast implicitly captures the historic trend of DSM program impacts, however, does not reflect the potential impact of future DSM programs. The ISO-NE CELT Report notes one exception to this standard in that the forecast includes estimates of the impact of new Federal Electric Appliance Standards. The 2009 ISO-NE Vermont load forecast appears below:

ISO New England (ISO-NE) Net Energy for Load Forecast (GWhr)

The ISO-NE forecast incorporates the impacts from the current recession and, as expected, the total annual demand for electricity in Vermont declines in the near term Following the recession, total demand is projected to return to previous trends, less the consumption which would have been attributed to lost economic growth. For 2008 to 2018 ISO-NE forecasts an annual long term Vermont growth rate of .57%.



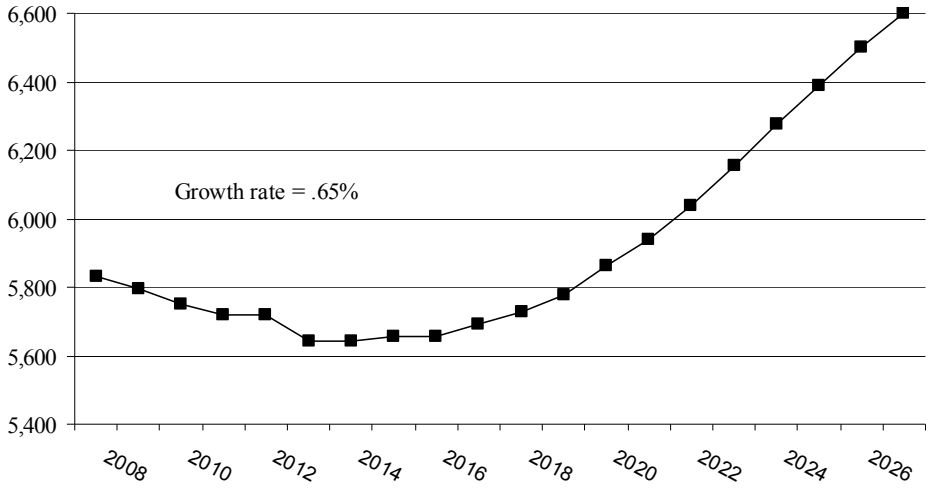
Source: Forecast Report of Capacity, Energy, Loads and Transmission (CELT) 2009 – 2018, ISO New England, 2009

EVT – Efficiency Vermont has conducted a long term analysis of electric energy demand including efficiency savings expected to be achieved from 2008 through 2027 resulting from the Vermont Energy Efficiency Utility's programs. Forecast 20 differs from previous forecasts in addressing total residential and non-residential efficiency savings by projecting market penetration rates over time for all the efficiency measures found to be cost-effective.

The analysis characterized the costs and performance of hundreds of energy efficiency measures applicable to residential and commercial and industrial customers. Thus, the resulting forecast represents the achievable potential for electricity savings from continued efficiency investments given the constraints of a fixed annual efficiency budget.

Efficiency Vermont expects electric energy (net of future DSM) to grow at an annual rate of .65% from 2008 to 2027. By continuing an annual investment in efficiency Forecast 20 expects to reduce Vermont's 2027 electric energy requirements from the baseline by over 14%.

Figure: II - XX Statewide Electric Energy Requirements With Savings From Energy Efficiency Utility Investment, (GWhr)



Source: Forecast 20, Efficiency Vermont, December 2009

The table below summarizes the mid and long term outlook for Vermont electrical energy demand by the DFPS, ISO-NE and Efficiency Vermont:

Table II- XX Growth Rate in Electrical Energy Demand (in GWhr)

	2008-18	2008-27
ISO-NE	0.45%	
Forecast 20	-0.18%	0.65%
DPS	-0.40%	-0.16%

ENERGY SUPPLY

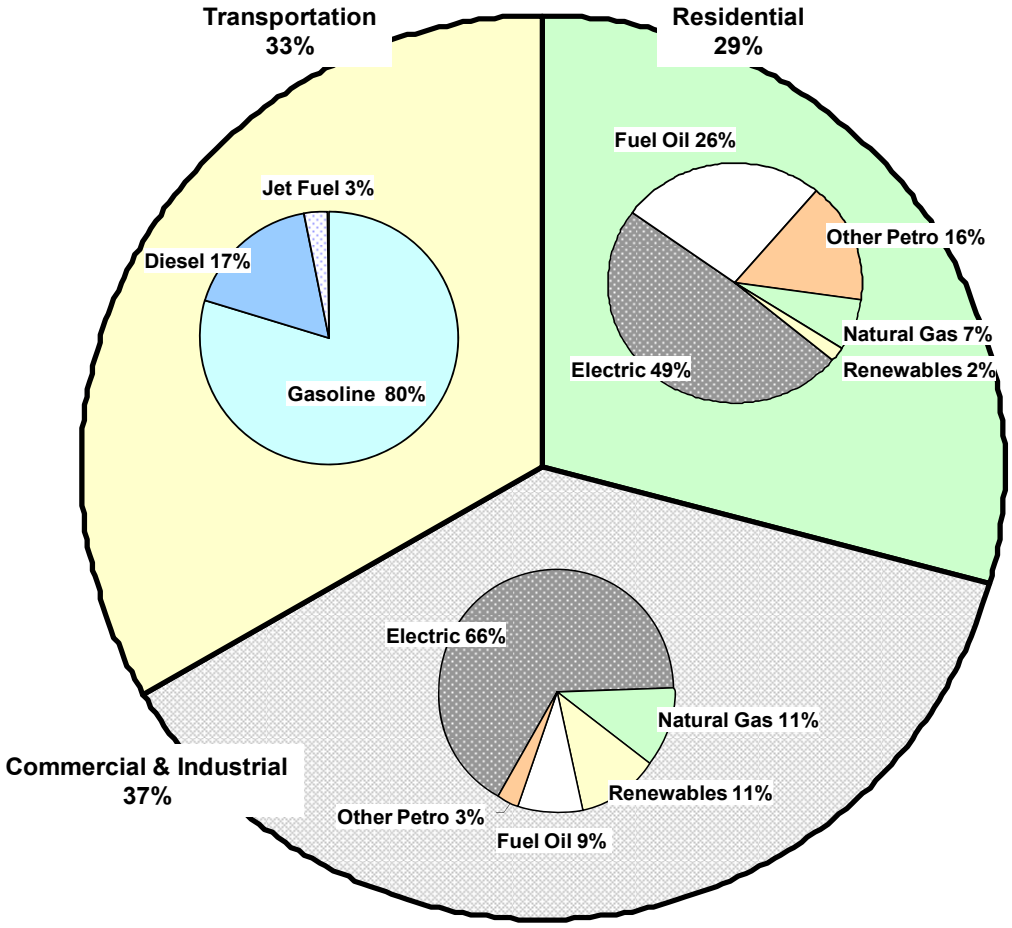
Energy, in the context of this Comprehensive Energy Plan, refers to the broad array of energy supply resources available to meet energy requirements. Energy supply includes all fuels, such as fuel oil, propane, kerosene and electricity (generated by all sources and fuels).

The commercial & industrial sector(s) consume the most total energy (measured in Btu's) accounting for 37% of the State's total. Transportation consumes 33% while households expend the remaining 29% of Vermont energy.

The end-use sectors derive 54% of their energy from petroleum, 5% from natural gas, and 5% form all other energy sources.

A graphic representation of these energy sources and end uses are shown in Figure II-15 below.

Figure II-15 Vermont Energy by End-Use & Source, 2007



The sources of energy provide a natural division point and the following sections of this Report are organized in this manner. Electricity supply considerations are discussed first followed by an analysis of the natural gas sector. Energy efficiency is discussed separately and includes strategies that relate to all fuels and permeates each aspect of energy supply.

SECTION III ELECTRICITY

Since the publication of the 1998 Comprehensive Energy Plan, Vermonters have had access to a relatively low carbon and stably priced supply of electricity. However, as the Vermont Yankee contract expires in March 2012, Vermont's utilities and policymakers are confronting a less certain electric market. Section III of the Comprehensive Energy Plan looks at the challenges that electric planners are facing in Vermont, and how the state, utilities, and regional partners are working together to bring clean and affordable energy to Vermonters.

ELECTRIC SUPPLY CHALLENGES

It has been more than ten years since Vermont last published a Comprehensive Energy Plan. During this time there has been a steady flow of significant events surrounding energy policy, fueling a mounting focus for policy solutions. Stimulating this flow are significant developments in energy markets, particularly natural gas markets.[*] Natural gas is the key driver of electricity prices in New England; the region learned how vulnerable it is to events higher up the pipeline when Hurricanes Rita and Katrina struck the Gulf of Mexico in 2005, greatly impacting natural gas supplies to New England. When infrastructure was damaged, the price of natural gas and in turn the price of electricity rose dramatically. The nature of electricity markets themselves has also changed significantly and the evidence of those changes is being seen largely in wholesale markets in New England, but also in recent increases in Vermont retail rates.[†]

The emerging gap between consumer demand for electricity and contracted or owned generation has emerged as a primary concern to the public and policymakers. Nearly one-third of our current electricity requirements are met through a power contract for generation with Vermont Yankee, due to expire in March 2012. When this contract ends, Vermonters will still have access to the vast resources inside New England and neighboring areas through the spot market or other contract vehicles. However, the state may be exposed to more price uncertainty and volatility associated with wholesale electricity. Vermont can manage its market exposure to the short-term market through investments in generation or new long-term contracts; however, these resource decisions present their own challenges and risks to Vermonters and the state's utilities.

The challenges and opportunities ahead are a result of Vermont's present circumstance and the events that led us here. In the late 1990s, Vermont resisted the movement toward industry restructuring and retail choice while the rest of New England and the northeastern U.S. moved toward a more competitive environment that increased exposure to short-term and spot-market prices. Recently, this has led to a sudden increase in retail prices among most of our immediate

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[*] Oil markets have only a marginal ef-fect on electricity, especially in the New England region where natural gas is often "on the margin," meaning it is fueling the next generator that is turned on when demand increases. This "marginal" generation is what sets the market price for electricity in each hour. Natural gas is on the margin and setting the price of electricity 55% of the time. As a result, retail prices consumers see at gasoline stations, while often the impetus for energy policy, have little influence on electricity.

[†] The rate changes experienced in Vermont, however, are small in comparison to sudden rate increases seen throughout most of the northeastern U.S. The reasons for the differences will be discussed further below.

neighbors. Under current market conditions, Vermont appears to have benefited by maintaining a vertically integrated structure, as the retail rate for electricity in Vermont is the lowest, on average, in New England.* Although this advantage may diminish with the expiration of the aforementioned contract with- Vermont Yankee, Vermont could have greater flexibility going forward to choose to directly invest in new generation or to rely on markets for purchased power.

Wholesale markets first emerged in New England in 1997 and were modified in 2003 to reflect a Standard Market Design that includes a day-ahead market, a real-time market, and a forward-reserve market. These markets were added to a pre-existing capacity market. Other Ancillary Service Markets are currently under design and the capacity markets are in the process of being redesigned. Designing capacity and other markets is a complex and involved process, as evidenced by the debate surrounding the Locational Installed Capacity (LICAP) proposal made by ISO-New England. The original proposal was widely opposed by interest groups and state agencies alike, including Vermont. The parties have subsequently settled their differences by creating a Forward Capacity Market (FCM). Early indications are that the FCM and other ancillary markets encourage the development of additional capacity, flexibility, and/or diversity in supply resources.

For the time being Vermont's decisions have helped to reduce exposure to price volatility in energy markets and the changing "rules of the game." Over time, our exposure will gradually increase. It is therefore important that Vermont continue to remain active in market development. At present, the region faces an apparent challenge to the development of adequate capacity, especially in certain constrained areas due to the threat of inadequate peaking capacity and challenges to the creation of fuel diversity. Vermont, by reason of its size, can provide limited direct impact on the regional mix, but can impact market design through regional advocacy.

Many other recent developments and challenges are confronting Vermont as well. For the most part, they present new challenges:

- Environmental risks and damage.
- The emerging supply gap.
- Wholesale electricity price volatility.
- Threats to system reliability and resource adequacy..

These topics are discussed in more detail below.

THE ENVIRONMENT

The threat of global warming and climate change has continued to gather attention worldwide, in the U.S., and in Vermont. A broad-based consensus has emerged among the scientific community

* As of June 2006, the average retail price of electricity in Vermont for residential, commercial, and industrial customers was 13.86, 11.92, and 8.41 cents per kWh, respectively. The New England average for the three sectors was 16.37, 14.76, and 10.53 cents per kWh. The only customer class in New England with lower prices than Vermont's equivalent class was Maine's industrial class, at 3.15 cents per kWh.

that global warming is real, and man-made sources of greenhouse gases are a major contributor.* Vermont, although it plays a small role due to its small size and population, contributes to the emissions of greenhouse gases through its home heating, transportation, and electric power demand.

The State initially responded to climate change through participation in the Northeastern Governors and Eastern Canadian Premiers Conference and the subsequent creation of a regional climate action plan. More recently, Vermont and other northeast states have established the Regional Greenhouse Gas Initiative (RGGI), which caps region-wide carbon dioxide (CO_2) emissions from the electric sector at 188 million short tons. Vermont's share of this cap is roughly 1.2 million short tons, of which it currently needs only a small fraction to offset the emissions from in-state generation.†

Among the major effluents from electric generation (mercury (Hg), sulfur dioxides (SO_2), nitrogen oxides (NO_x), and carbon dioxide (CO_2), CO_2 is the only effluent projected by the Department of Energy to increase, by 1.2% per year throughout the U.S. over the coming decades. The criteria pollutants (Hg, SO_2, NO_x) are limited under the EPA's Clean Air Interstate Rule and Clean Air Mercury Rule, cap-and-trade programs that should limit emissions growth, except that associated with leakage outside the boundaries of the program.[1] Vermont and the New England region have long been recipients of upstream pollution from Midwestern sources and have been impacted by the consequences of acid rain, ozone, and mercury accumulation in the biosphere; these rules attempt to mitigate future damage.

Additionally, in an effort to displace some of the fossil fuel-generated emissions with cleaner energy, neighboring states have established Renewable Portfolio Standards, and associated markets for renewable energy credits. These standards are generally met through the establishment of a targeted level of new renewable resources relying on environmentally friendly technologies. Vermont contributes to these standards through the sale of attributes from Vermont generators, such as wind and biomass. Through the sale of such credits or attributes, however, Vermont forgoes any claim to the associated green energy resources. In a parallel effort, Vermont developed the SPEED program, which encourages power purchase contracts between developers of renewable energy projects and Vermont utilities.

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* Vermont Governor Douglas, in Executive Order 14-03 requiring a Climate Change Action Plan for State Government Buildings and Operations, found first that the "scientific evidence . . . indicates greenhouse gases are accumulating in the Earth's atmosphere as a result of human activities." He reiterated this in Executive Order 07-05, where he created the Governor's Commission on Climate Change. Both orders are available at http://www.vermont.gov/governor/orders/executive-orders.shtml

† To put this figure in the broader context of the globe, the Energy Information Administration estimates that there were 25 billion *metric* tons of CO_2 emitted in 2003. EIA estimates that this figure will grow to 44 billion metric tons in 2030. Growth of CO_2 emissions is affected disproportionately by coal consumption and growth in currently less developed economies of the world, particularly in Asia. In 2003, CO_2 from OECD nations accounted for well over half of the 25 billion metric tons of emissions. By 2030, CO_2 emissions from non-OECD nations are expected to account for roughly 60% of the 44 billion metric tons of CO_2 emissions. Contributions from North America are expected to increase by 43% between 2003 and 2030.

The environment is significantly affected by state, regional, and national electric demand, as much of our power comes from fossil fuel generation plants with associated emissions. To effectively mitigate the damage, Vermont has participated in projects and initiatives that attempt to limit emissions from fossil fuel-based power generation, even though very little is located inside the State. Vermont's efforts in the broader context of the region will continue to ensure a healthy environment.

THE EMERGING SUPPLY GAP

The current contract with Entergy for unit-contingent power from Vermont Yankee at very favorable prices is due to expire in 2012. Demand continues to grow, albeit at a slower rate than most of the surrounding region. The emerging supply gap presents planning challenges to utilities, regulators, and citizens to ensure stable and reasonably priced service that meets Vermont's criteria for energy planning.

Public engagement efforts to address the resource gap were completed in 2007. The Vermont General Assembly, in passing Act 208, focuses a public engagement process on the "electric energy supply choices facing the state beginning in 2012." The DPS had initiated a Mediated Modeling process to provide an easy-to-use model of energy scenarios that will use agreed upon facts to inform this debate. Vermont utilities are also engaged in parallel efforts to examine the feasibility of alternatives through integrated resource planning (IRP) and other initiatives.

The replacement of these long-term contracts can begin before and end after these contracts end in 2012 through 2015. If Vermont intends to replace these contracts without a gap (i.e., exposure to shorter-term markets) by investing in new resources, time becomes a concern. However, there are a variety of reasons to move at a measured pace and consider new strategies for replacing these energy resources:

- First, New England enjoys a competitive wholesale market for electricity. This market can be relied on to help bridge any gaps in service; it can and undoubtedly will provide at least a portion of the Vermont electricity portfolio for the foreseeable future (almost all Vermont utilities rely on market purchases for a portion of their existing resource mix).

- Second, Vermont has historically relied on large single resource or supplier contracts in its resource mix. Although Vermont has benefited from this strategy, ongoing reliance on similar arrangements or strategies could present its own risks. Vermont utilities may need to break up some of their large resource contracts into smaller contracts whose start and end dates vary over time to create less exposure to prevailing market conditions during critical time periods.

- Third, the relative merits of a significant new generator in Vermont should ultimately be determined by careful consideration of its economics and risk. How much of a cost premium might Vermont be willing to pay to protect itself from exposure to the open market? And how well does the state understand the underlying economics of either building a generator or relying on the open market?

No single supply resource will be able to fill the gap; replacement contracts with existing suppliers will continue to enjoy favor. Greater consideration will need to be given to meeting our needs through a more diverse mix of resources. To meet the electrical needs of Vermonters, the emerging supply gap should be addressed with an informed dialogue and even-handed policy decisions.

WHOLESALE MARKET PRICE VOLATILITY; REGIONAL DEPENDENCE ON NATURAL GAS FOR GENERATION

The New England region saw unprecedented levels of wholesale electric price increases and volatility in 2005. Some responsibility is owed to the effects of Hurricanes Katrina and Rita, but the region's heavy reliance on natural gas to generate electricity also plays a large role. This dependence on one fuel source is a fairly recent phenomenon. In 1995, less than 10% of the regional energy mix was natural gas. Currently, roughly 40% of the energy sold on the wholesale market is from natural gas. Ninety-eight percent of the region's capacity additions since 1999 have come in the form of high-efficiency natural gas combined-cycle generation facilities. Natural gas now sets the market price of wholesale electricity in most hours.

Despite the increases in average prices between 2002 and 2006, natural gas remains a low cost source of generation. Although combustion of natural gas creates emissions far greater than renewable energy facilities, it remains less costly. Among fossil fuels it is by far the cleanest. Thanks to advances in combustion technology with the evolution of gas combined cycle generation, gas enjoyed an advantage over other fuels for fuel-conversion efficiency. Historically, natural gas has been delivered to the region via pipeline and has remained free of disruption from instabilities in overseas regions. In broad terms, it has offered both an inexpensive and relatively environmentally benign source of energy. However, the resulting demand increases early in the decade have culminated in concerns over the region's heavy dependence on the fuel and the risk for supply disruptions. As the region looks to imported liquefied natural gas (LNG) to supplement domestic and Canadian supplies, competition for this fuel assumes a worldwide marketplace. The limited number of suppliers of LNG and their political make up create a situation not dissimilar to the cartel like influence of OPEC on markets and prices.

In the near future at least, liquefied natural gas (LNG) figures to be an important source of fuel for Vermont. Continued low prices for natural gas depend on siting liquefied natural gas terminals in the region before 2011 and pipeline capacity from the McKenzie Delta in northwestern Canada in 2011 and from Alaska in 2015. There are approximately 40 applications with the Federal Energy Regulatory Commission (FERC) nationwide to construct new LNG facilities; however, it is expected that only about 12 will ever be built. For any new terminals to affect prices in New England at least one or two may need to be sited in or around the region to alleviate infrastructure constraints resulting from transporting the fuel long distances via pipeline. For purposes of the DPS forecast and analysis, it was assumed that one LNG terminal would be sited in the New England or Eastern Canada region.

As noted above, natural gas is not as environmentally friendly as renewable energy, but it is less expensive. It costs more than coal, but is a far cleaner resource than coal or other fossil fuels. In balance, natural gas generation has a competitive advantage to other fuels. However, exposure to

supply disruptions, the region's heavy dependence on a single fuel source, and CO_2 emissions associated with the fuel are causes for concern. The relation of natural gas to wholesale market prices is discussed further in Section 3.

THREATS TO SYSTEM RELIABILITY

The natural gas supply disruptions caused by Hurricanes Katrina and Rita did not only create high prices in wholesale markets, they also highlighted the risk facing the region with regard to delivery of reliable electric service during critical periods of peak demand for natural gas. In New England, this risk is amplified in the winter when electric generation competes with demand for natural gas as a source of heat. The cold snap that occurred in January 2004 resulting in concurrent regional winter peak electricity and space heating demands highlighted these emerging tensions.[2] At that time, New England's dependence on natural gas as the dominant fuel source for generation came under closer scrutiny. Today there is growing consensus that fuel diversity, even from single generators in the form of dual- or multi-fuel capabilities, has become a critical requirement for the region as a whole.

Threats to system reliability also were revealed in 2003 when a major power blackout affected portions of the mid-western and northeastern U.S. and eastern Canada. The power outage affected approximately 50 million people and 61,800 MW of electricity demand.[3] Power was not restored for portions of the affected area for 4 days. Estimates of the cost of the blackout range between $4 and $10 billion. A task force was created to determine the causes of the blackout and recommend policies to avoid a recurrence of the problem. System operational management inefficiencies were found to have caused the physical problems, but the root causes were found to be failures of outside utilities to perform effectively relative to the reliability policies, guidelines, and standards of the North American Electric Reliability Council (NERC). Deficiencies in the voluntary reliability standards themselves were also identified as problems. There were 46 recommendations to address the failures that led to the blackout; however, chief among the task force's recommendations was a suggestion that the U.S. Congress enact provisions to make compliance with reliability standards *mandatory and enforceable*. As discussed below, the Energy Policy Act of 2005 responded by creating policies to make reliability standards mandatory and enforceable with responsibility for such enforcement resting ultimately with the Federal Energy Regulatory Commission.

As demand grows in New England, the extra generation capacity needed to supply the power needed on peak demand days is becoming increasingly scarce. On August 2, 2006, ISO-NE reported record electricity demand, at 28,021 MW, an increase of approximately 4% from the 2005 peak of 26,885 MW. Since 2004, peak demand has grown from just over 24,000 MW to over 28,000 MW.[*] Five out of 6 of the highest electricity demand days were in 2006, and 9 out of 10

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[*] ISO-NE, "New England Consumers set record for Electricity Use" press release August 2, 2006 and "New England's Electricity Use Sets New All Time Record," July 18, 2006.

[*] In Figure III-1, System A power refers to generic power purchased from marketers without attributes and not produced by any particular plant. System B is power produced by renewable sources for which the attributes (RECs) have been sold and for which Vermont is no longer able to claim those attributes in its power supply.

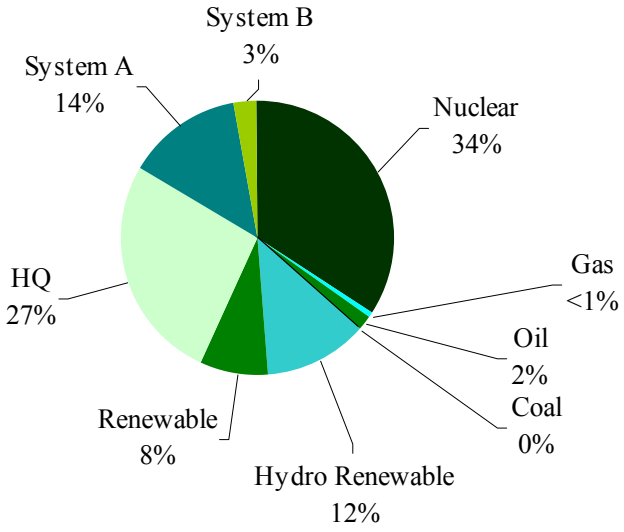
have been in the last 2 years. However, over the same time period little capacity has been added to the region, even though forecasts call for increasing demand and a continually increasing peak. While the recent peak was managed well by ISO-NE, concerns over capacity constraints threatening reliability lead to emergency actions and volatile prices have led to the development of Forward Capacity Markets (discussed in detail in Section III, page 82). These markets encourage the construction of capacity to ensure the region's electric system reliability.

VERMONT'S ELECTRIC SUPPLY

Vermont has 20 vertically integrated electric distribution utilities that operate within a fully regulated environment: two relatively large investor-owned utilities Central Vermont Public Service (CVPS) and GMP, one smaller investor-owned utility (VT Marble), 15 municipal utilities, and two cooperative utilities Washington Electric Cooperative (WEC) and Vermont Electric Cooperative (VEC). There is one bulk transmission company, Vermont Electric Power Company (VELCO) that is wholly owned by these utilities. One of Vermont's two largest electric utilities operates in an alternative regulation framework and the other large investor-owned utility has proposed a plan that is currently before the Public Service Board for review.

Vermont's primary bulk transmission company, VELCO, is regulated by both the PSB, primarily for sitting, and by the Federal Energy Regulatory Commission (FERC), mostly for ratemaking considerations. FERC also relies on the North American Reliability Council and on the New England Independent System Operator (ISO-NE), for establishing reliability standards and implementing additional oversight of the bulk transmission system. FERC also relies on the ISO-NE to design, establish, and oversee the markets for wholesale electricity and auxiliary services provided at wholesale rates.

Figure III-1 Vermont Electric Energy Supply, 2006



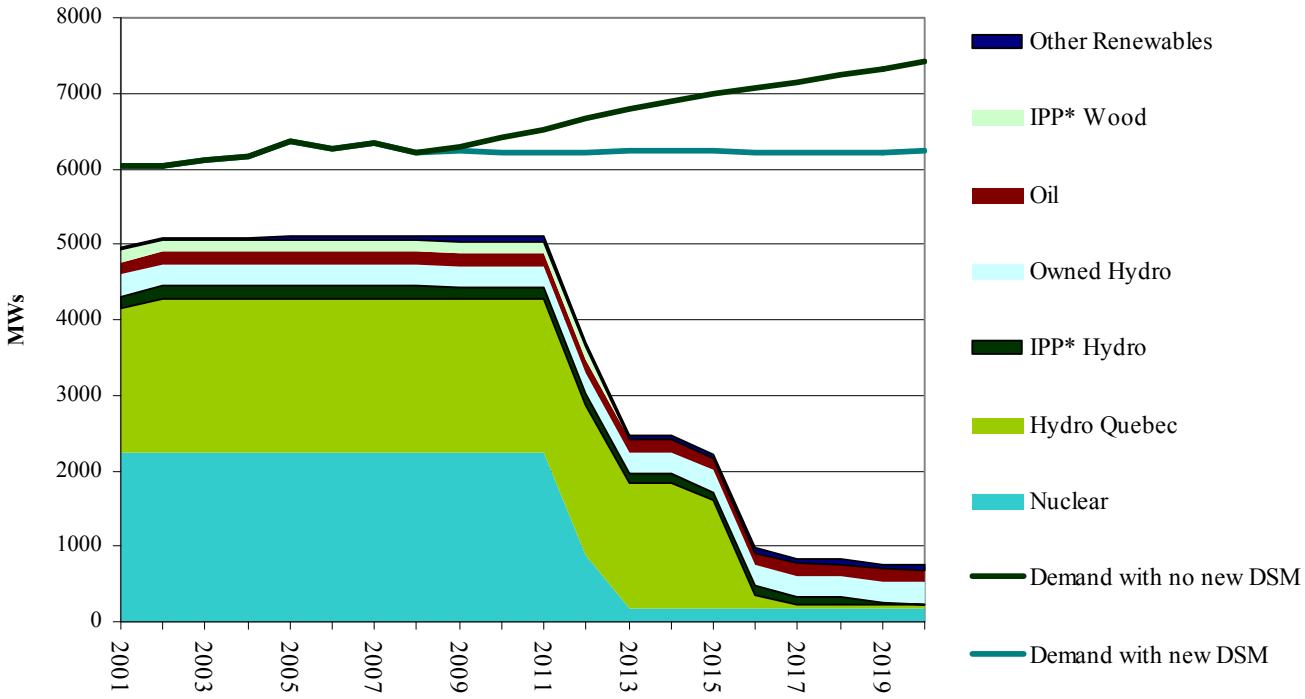
Two-thirds of Vermont's electricity supply portfolio comes from bilateral contracts with two resources. Vermont utilities have secured approximately a third of their energy requirements through a system power contract with Hydro-Quebec, and a third through a unit-contingent contract with Entergy, owners of the Vermont Yankee Nuclear Power Plant (each contract and the future of Vermont's relationship with these resources is discussed in greater detail below). The remainder of Vermont's mix is composed of in-state hydro (approximately 7% utility owned and 3% from contracts with independent power producers) and biomass (roughly 2.5% from utility-owned projects and 2.5% from independent contracts). Vermont also has a small number of fossil fuel generators used largely to supply peaking power. The remainder of Vermont's electricity is largely purchased as system power from the market. *Figure III-2 Committed Resources, 2006* shows Vermont's committed electric resources along with projections for peak energy demand. The discussions in

this section speak to the Vermont committed electric supply in aggregate. However, it is important to realize that each of the 20 distribution utilities has their own mix of resources which can be quite different from the aggregated mix.

Part of these resources are committed by means of contracts expiring in the next decade. The Vermont Yankee contract expires on March 21, 2012. The independent power contracts, which currently account for roughly 6% of Vermont's electricity needs, (but a much larger portion of the costs) begin to expire in 2008, with the remaining contracts expiring by 2021.

Figure III-2 Committed Resources, 2006 below shows Vermont's long-term committed resources in relation to forecasted energy demand. The expiration of the aforementioned contracts will not limit Vermonters to electricity supply from the wholesale market, but the State could be exposed to more price uncertainty and volatility.

Figure III-2 Committed Resources, 2006



* Independent Power Producer.

Utility Demand-Side Management (DSM) measures serve as an additional resource that offers significant opportunity to reduce energy needs, defer and/or avoid transmission and distribution upgrades, and avoid generation-related emissions. Demand-Side Management includes efficiency measures currently delivered by Efficiency Vermont, demand-response measures, rate designs, and other pricing schemes and other technological and administrative techniques designed to achieve comparable electric service while employing fewer resources. The forecasted demand shown in

Figure III-2 Committed Resources, 2006 includes consideration for efficiency measures at the currently budgeted levels into the future. Without these programs, Vermont would be forecasting energy growth of roughly 1.5% annually over the term of this plan.

Other attributes of power that are also important to Vermont include diversity of sources within the portfolio and diversity of sources within the region. The State contributes to regional diversity through its own purchases and investments. Vermont purchases and sells all of its energy in the ISO-NE markets. The prices set in the regional market are the result of trades that involve all electric generators in New England and all load in New England. Regional markets set the reference point for all contracts in New England and Vermont utilities make spot and short-term purchases from this same market. Most of the time, generation fueled by the volatile natural gas commodity sets wholesale prices, as roughly 40% of the energy and capacity in the New England region depends on this fuel. The dominance of natural gas in the New England market has resulted in a near complete correlation between price levels in the gas markets and prices in the electric market. Further, this excessive reliance on natural gas as a generator fuel creates cause for concern about fuel availability in peak winter seasons when demand from both electricity and heating fuel compete for scarce resources. Efficiency, renewable energy, and long-term contracting for power can help to diminish the negative implications of the regions "over-reliance" on natural gas.

Vermont remains, unlike its neighbors in the Northeast, a vertically integrated utility environment. The state continues to rely on both traditional regulation in an integrated utility environment and on the traditional planning tools and processes for encouraging investments. By virtue of Vermont having remained a vertically integrated utility environment, the state has more "tools in the toolbox" to guide the investment decisions of Vermont's load serving entities, our utilities.

The DPS demand forecast, projecting electricity consumption levels for the State through 2027, provides a starting point from which recommendations can be measured. As noted in Section II, electric electric demand if forecasted to remain relatively flat and potentially even decline going forward. What holds for energy, however, does not hold for forecasts of peak energy demands. Forecasts continue to show peak load growth resulting from to the influence of increasing air conditioning loads during the summer.

PARTICIPATORY ENERGY PLANNING

Energy resource decisions in the future present challenges and risks to Vermonters and the state's utilities. Vermont has an embedded resource mix that is below the current market in terms of costs, but major portions of this mix are composed of expiring contracts. Vermont faces all the risks that market exposure can present. For example, some neighboring New England states have seen retail price increases in excess of 50% due to their market exposure. However, these choices also present significant opportunity to secure new long-term resource commitments that reflect the needs and aspirations of Vermonters for stable clean energy resources.

In response to concerns about the replacement of the major power contracts and other concerns discussed above, the DPS conducted a comprehensive, statewide public engagement process on energy planning. A summary of that process is attached as Appendix B. Vermonters have never before had an opportunity to weigh in on these resource decisions at such a scale. The process was

designed to educate the public about the energy supply challenges facing the state, to gather meaningful and informed public input about values and preferences of Vermonters regarding energy supply, and by doing so, foster a broader base of public support of the resulting choices.

The Department of Public Service worked with legislators and stakeholders to design the project. In the end, a series of proposals was selected that engaged the public through three separate vehicles—regional workshops, deliberative polling, and online conferences. An advisory committee for the project developed educational materials that provided a foundation for the discussions.

In the end, there was a high level of agreement on many issues across the three different processes (regional workshops, deliberative polling and online surveys). Coal and oil were the least popular energy options. Among fossil fuel sources, natural gas enjoyed the fewest objections. Nuclear energy from Vermont's only existing facility was among the most divisive issues, evoking both strong negatives and significant support during segments of the process.

Participants expressed broad support for sustainable resource options such as energy efficiency and renewable energy. In pursing demand resources it was concluded that (1) Vermont should continue exploring new avenues for incorporating energy efficiency into its portfolio through geotargeted DSM programs; (2) Vermont should pursue targeted programs to address transmission and distribution constraints in the future through the activities of the Vermont System Planning Committee and VELCO's long-range transmission plans; and (3) Vermont should periodically review the resource potential for further investments in energy efficiency programs and other strategies, including building codes and appliance standards.

Vermonters also continue to show strong support for purchases of clean electricity from Canada. With clean energy from Hydro-Quebec, Vermont already has one of the cleanest electricity resource mixes in the U.S. Almost 48% of our energy comes from renewable sources. Even without Canadian resources, however, Vermont enjoys more renewable-sourced energy, as a percentage of our mix, than any state in the Northeast other than Maine. Roughly 10% of Vermont's energy comes from in-state hydro resources, and roughly 5% from in-state biomass. A majority of consumers were also willing to pay significantly more for their electricity to know that it comes from renewable sources. As noted elsewhere in the Plan, Vermont should continue to look for new opportunities to invest in renewable energy within Vermont, recognizing the practical limits of resource availability, infrastructure, and competing environmental challenges.

The results of this survey have provided a clear indication of the values of Vermonters and their resource preferences. It will have a lasting impact, serving to validate many of the current commitments and directions, and will continue to inform all future commitments made on behalf of Vermonters by their utilities or otherwise sited in Vermont. *Vermont's Energy Future* provides a summary of the planning effort and the results of each segment of the process. A more detailed presentation of the results is available online at www.vermontsenergyfuture.info.

STRATEGY A MAKE EFFECTIVE USE OF ADVANCED GRID AND METER TECHNOLOGY

The Board, in the context of Docket 7307, is currently examining proposals which would require deployments of advanced metering technology and advanced time-of-use pricing programs known as "real-time" or "critical-peak-pricing" programs. Through use of advanced metering technologies, utilities are better able to communicate price signals to customers and thereby elicit a response from them. These responses can last several minutes or several hours and can be initiated remotely or by individual customers at their discretion. Vermont's traditional efficiency programs, over time, will inevitably change in response to changing market circumstances and new technologies, including opportunities presented by advanced metering equipment and advanced time-of-use rates.

Nevertheless, advances in metering technology and cost reductions are creating significant new opportunities for further encouraging efficient electricity consumption by Vermont consumers. One of the more significant barriers to consumers making efficient energy choices has been the effect of rate-making practices in Vermont and most other states that shield consumers from the effects of daily and seasonal variations in prices. Rates in Vermont, as elsewhere, are set on an average cost basis. This type of rate prevents the ratepayer from seeing the price of energy at the time they are using it—sending incorrect price signals to the consumer. Currently, more sophisticated rate designs (including many plans relied upon by Vermont utilities) typically vary that price signal among a subset of hours of the day to establish peak and off-peak rates. Even so, the full variability of the price signal is substantially muted. Sending more accurate price signals could have significant implications to electrical energy cost and emissions.

The Department of Public Service recently petitioned the Board to open an investigation into the opportunities for exploiting the advances in technology and the associated opportunities for rate designs. The Public Service Board opened Docket 7307 to consider the range of opportunities for Vermont utilities. The Department has retained a consultant to work with Vermont utilities to analyze the costs and benefits of advanced metering technology, both for the opportunities associated with the rate designs and associated with operational and service improvements for Vermont utilities. The results of that analysis and their implications for Vermont utilities will continue to be an issue for discussion and deliberation.

Vermont utilities have a history of encouraging efficient electricity consumption through advanced pricing practices that include traditional time-of-use pricing, seasonal rates, interruptible service, ripple control for hot water heaters, and other programs. The result of these rate designs is that Vermont's load profile is not substantially influenced by electricity used for heating, resulting in an improved load factor (average load divided by peak load), which is the best in the region. This load factor has helped, along with our past stably priced contracts, to make Vermont's rates the lowest in the region.

Inclining block rates have also been apart of Vermont rate history due in large part to the allocation of NYPA power to residential customers of municipal and COOP electric utilities. Act 92 of the 2007-2008 Legislative Session includes revisions to 30 V.S.A. § 218(b) directed the PSB to "approve rate designs to encourage the efficient use of natural gas and electricity, including

consideration of the creation of an inclining block rate structure for residential rate customers with an initial block of low cost power available to all residences." Economic efficiency is best served when the price of electricity reflects an estimation of the long-run marginal cost of production. We are unaware of any empirical studies that have shown the price efficiency of increasing block pricing on energy use or efficiency decisions and as such rate designs that reflect the daily marginal cost differences in peak and off-peak electricity should be favored over inclining or declining block rate structures

Vermont is one of several states in the region that are moving to consider the costs and feasibility of advanced metering technologies and associated opportunities for more advanced pricing (i.e., some form of dynamic pricing such as critical peak pricing). The long-standing concern within the New England region has been the general lack of price responsiveness that is exhibited in the region during periods of very high prices or at critical peak periods. Western states, particularly, some of the largest utilities in California, have been at the vanguard of these new pricing initiatives. While opportunities exist for Vermont to cost-effectively invest in new metering technologies, largely on the shoulders of efficiencies in service delivery and meter reading savings, opportunities for stimulating greater wholesale price response are probably greatest elsewhere in New England where air-conditioning loads are even more a driver of peak demands and high prices. Vermont ratepayers would benefit greatly from greater regional adoption of advanced pricing and deployment of advanced meters through the ensuing lower wholesale energy prices and reductions in New England peak summer demands that are currently driving unprecedented expenditures on costly transmission resources that are shared among all states in the region.

For a relatively comprehensive assessment of the opportunities in Vermont for advanced metering and rate design, review the Department of Public Service report on the topic from Freeman, Sullivan and Co. (FSC) on the Public Service Board's website.[*] Further development and study of the topic is required under Act 92 and is the subject of an ongoing Board investigation in Docket 7307. The parties to that Docket have signed a Memorandum of Understanding which will serve to guide future utility actions in deploying advanced metering and.

CVPS' current plans call for the specification, bidding and awarding of a contract for a Meter data management system in 2009, with installation and transfer of data occurring in 2010. Advanced metering technology would be deployed to customers beginning in 2011, with rate offerings and advanced service options becoming available at a later date. 30 V.S.A. Section 219a

Recommendation 1 Encourage advanced time-based rates, review rate designs, and spur appropriate use of advanced metering infrastructure.

Timing	NEAR-TERM
Emissions Impact	LOW (under current practice)
Energy Impact	LOW (under current practice)
Capital Cost	HIGH

[*] See http://www.state.vt.us/psb/document/ElectricInitiatives/SmartMetering.htm.

Cost Effectiveness	HIGH
Funding Sources	Electric Utility Rates
Relation to GCCC	ESD-1
Current Status	Under PSB Investigation and Legislative Review
Parties Involved	Legislature, VT Utilities, PSD, PSB

a) *To help improve metering technology, data management, and provide effective price signals, Vermont regulators should foster coordination, collaboration, and mutual assistance among Vermont utilities, especially the smaller utilities to realize scale economies necessary to render the technology more cost effective.*
b) *The PSB should establish minimum capability requirements for advanced metering infrastructure (AMI).*
c) *The PSB should establish guidelines for rate designs enabled through smart metering technology.*
d) *The PSB should review rate designs designed to encourage energy efficiency consistent with Act 92 and the goals for the Board's advanced metering investigation.*
e) *Vermont regulators should work with neighboring jurisdictions and regional associations to spur more price sensitivity and response to high wholesale prices through innovative pricing programs and the deployment of advancements in metering technology in the New England region.*

STRATEGY B FOSTER DISTRIBUTED RENEWABLE ENERGY RESOURCES

Fostering small-scale and distributed renewable energy by reducing regulatory barriers and providing targeted incentives should be a long-term objective for Vermont state policymakers. There are a number of reasons for encouraging the development of renewable energy, which are consistent with Vermont's statutory goals for energy planning, and include the following:

1. Renewable sources reduce harmful environmental emissions, contribute to the diversity of the resource mix in New England and Vermont, and promote use of more sustainable energy resources. In certain instances, renewable energy can contribute to the local Vermont economy by providing direct employment opportunities and lower costs. Renewable energy also offers the promise of price stability. For certain technologies, such as solar, such stability comes at a relatively high price. However, commercial-scale wind and biomass energy projects are also relatively stable resources and may hold the promise of stability even at close to current market conditions.

2. Ratepayer impacts of renewable energy policy can be quite different depending on the size of the resource to be considered. Small-scale renewables, at the residential or commercial customer scale, can help to stimulate awareness and support for fuel diversity. Large-scale renewables already provide a significant amount of power to Vermont—encouraging distributed networks of energy production—and should continue to receive support in the future.

3. Small wind, solar PV, small hydro (less than 500 kW), and farm methane projects have a number of incentive mechanisms already built into the policy framework in Vermont. Net metering, the Small Solar and Wind Program, the Clean Energy Development Fund, Nuclear Electric Insurance Limited (NEIL) program funds, Green Pricing Programs, and other state wind and solar tax incentives have all been important in encouraging small-scale renewable energy projects. However, these projects still account for considerably less than 1% of Vermont's total electricity supply. While these programs are unlikely to significantly displace commercial scale generation in the foreseeable future, they contribute to the long-term commercialization of these distributed technologies and generate public awareness and acceptance of the technological opportunities. They are presented here together because of their emphasis on a common set of smaller sources of renewable energy and their overlapping source of funding.

NET METERING AND WHOLESALE MARKET-BASED PRICING

Net metering provides end users with the ability to offset their use of utility-supplied system power with power that originates on the customer side of the meter produced from a customer-owned renewable source. The net power demand (and bills) of a customer is reduced by the amount of energy that is produced by the customer's net-metered system. This netting occurs on a monthly basis. As a result, a net-metered power system can slow or even run backward the utility meter, providing the customer with a credit or offset on their monthly electric bill. It is a source of distributed power that has some potential to affect the need for transmission and distribution investment.

While the primary cost of a net-metered project falls on the customer, additional support for these projects can come from the Public Service Department's Small Wind and Solar Incentive and the Clean Energy Development Fund; other incentives are provided through federal tax incentives and from other ratepayers. Net-metering technologies are not likely to be able to compete with commercial-scale generation in the foreseeable future. Despite the considerable subsidies, the renewable technologies used on the net-metering scale are still quite expensive from the standpoint of total resource costs, as negative economies of scale make the technologies costly.

Despite the relative success that Vermont has enjoyed with net metering over the 10 years utility programs have been in place, to date, the impacts of net metering have been fairly slight in relation to Vermont's energy requirements. Current installations represent 0.48% of Vermont's Energy requirement. This represents only .24% utilization of the permitted capacity under the recently rasied cap of of 2% of system peak. Recently enacted tax credits and incentives coupled with falling prices for solar PV equipment resulted in rapid growth in the number of installations during 2008 and 2009 .During these two years 384 installations with a capacity of 3354kw nearly doubled the installed capacity of the first nine years of the program (1999-2007)[*]. As of December 31, 2009 the number of installations stands at 818 with an installed capacity of 4911kW. With the exception of 123kW of methane projects and 15kW of hydro installations, most of the resources involved, are relatively low-capacity-factor resources, such as small wind and solar PV.

[*] From 1999-2008, 434 approved net-metering systems with a collective generation potential of 1,816 kW was installed.

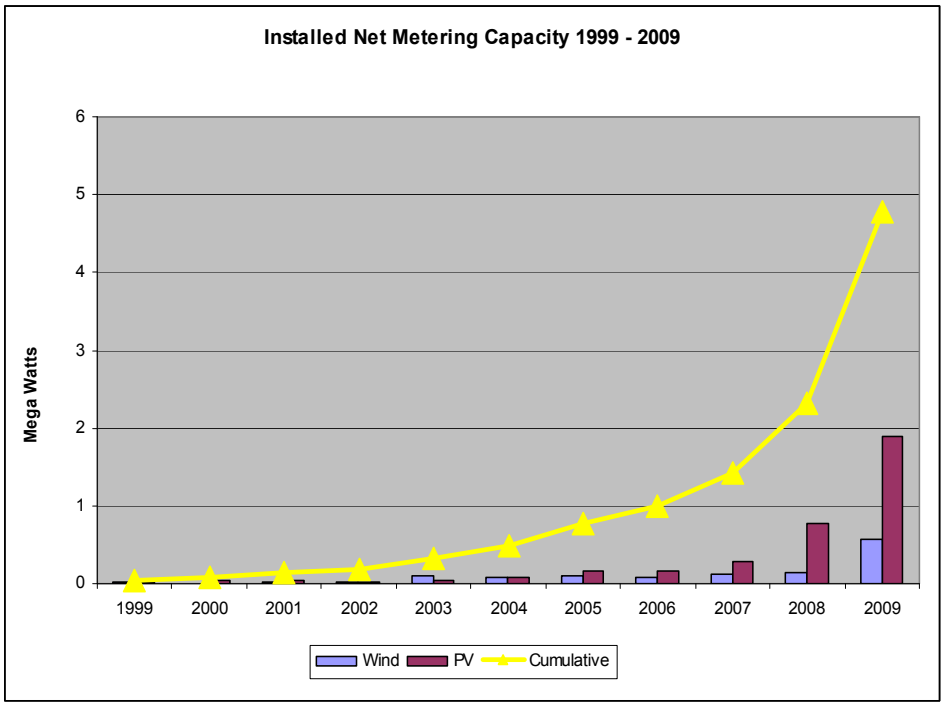


Figure III-3 Installed Net Metering Capacity 1999 - 2009

The net-metering statute (30 V.S.A. Section 219a) has been in place since 1997 and has undergone four legislative revisions, the latest being in 2008. Changes resulting from Act 92 (2008) and subsequent and revision of the Net Metering rule by the Board in April of 2009 expanded the reach of group net-metered projects that were not contiguous to projects other than farm generation, allowed for larger net-metered projects, and permitted installation up to 2% of the capacity requirements of a given utility territory with net-metered projects.

However, care should be exercised in further expansion of traditional net metering for at least two reasons. First, net metering can, and historically has, resulted in some implied ratepayer cross-subsidy.[*] A cross-subsidy will likely remain as long as the price of the last kWh consumed by most retail consumers is above its cost to the utility.[†]

A second consideration relates to the potential for future opportunities to better tie the value of electricity with market conditions. Innovative rate design (perhaps tied to developments in meter technology) seems likely to increase movement toward more market-based retail pricing of net-metered units. Such a move, given current price projections, could actually stimulate investment

[*] The forward-looking marginal cost of electricity is approximately 9 cents/kWh (including both capacity and energy). Pure marginal rates may be higher or lower for a given technology depending on the coincident nature of energy and capacity costs. Retail rates for commercial and residential customers are typically above 9 cents/kWh. The tail block residential rates at CVPS are approximately 11.4 cents/kWh, and at GMPare 11.8 cents/kWh. Statewide, the residential rate is closer to 14 cents/kWh. The difference between the tail block electric rates and the marginal costs are to be borne by other ratepayers.

[†] On a societal basis, the total marginal cost would include externalities and is likely higher than the utility cost, serving as a countervailing consideration.

and development of the technology. However, stronger linkages here could also dampen demand if wholesale market prices decline from current levels.

As noted above, the Public Service Board is currently considering the merits of advanced metering technology that would enable some form of dynamic and perhaps EVENTUALLY real-time pricing of services, effectively strengthening the relationship between wholesale prices and the retail price signals sent to consumers.* Resources like solar (in the summer) and wind (in the winter) have a high correlation between energy delivered and peak market prices. Such technologies, while intermittent, may actually benefit from changes that provide a stronger connection between retail and wholesale prices.

Recommendation 2 Revise interconnection and establish fair tariffs for customer-sited generation through net metering or wholesale market-based pricing.

Timing	NEAR-TERM
Emissions Impact	LOW
Energy Impact	LOW
Capital Cost	HIGH (per installation)
Cost Effectiveness	LOW (short term)
Funding Sources	Participating Customers, Electric Utility Rates
Relation to GCCC	ESD-6, ESD-8
Current Status	PSB Rules Implementing Recent Statutory Changes
Parties Involved	VT Legislature, VT Utilities, PSD, Renewable Energy Vermont, small-scale technology providers

a) *The Public Service Board will update the net-metering program to include contiguous customer clusters, measured departures from contiguous customer arrangements to promote community projects, and allow up to 2% of a distribution utility's capacity consistent with recent statutory revisions.*
b) *The DPS, with distribution utilities, should work to address and mitigate ratepayer equity concerns and administrative burdens on utilities associated with expanding net metering through appropriate rate designs.*
c) *The PSB should also update the net-metering rule to incorporate new fossil fuel or biomass combined heat and power systems that are already close to market.*
d) *Vermont should revise interconnection standards for small non-net-metered projects.*
e) *The DPS and PSB, through rate design, should foster the development of customer-sited projects which can be compensated for their energy production at market-based rates.*

* On, the same is true for more traditional time-of-use rates currently using existing meters, provided the timeframes match energy output to the higher-priced periods. These rates are often available but little understood and typically underutilized by at least Vermont's residential rate consumers.

CLEAN ENERGY DEVELOPMENT FUND

The Vermont Clean Energy Development Fund (CEDF) was established in 2005 by the Vermont General Assembly in Act 74.[4] The CEDF is funded primarily through proceeds of two Memoranda of Understanding between the State and Entergy Nuclear VT and Entergy Nuclear Operations, Inc. The proceeds amount to $4–7 million per year until 2012; these proceeds are managed day to day by the State Treasurer's office and funding decisions are directed by a seven-member investment committee.

The purpose of the CEDF is to promote the development and deployment of cost-effective and environmentally sustainable electric power resources—primarily with respect to renewable energy resources and the use of combined heat and power technologies in Vermont. Investments should provide environmental benefits, increased energy diversity, price stability, and a thriving clean energy market to enable clean energy businesses to develop and expand. According to Act 74, the CEDF shall be managed to promote:

- The increased use of renewably produced electrical and thermal energy and combined heat and power technologies in the state;
- The growth of the renewable energy-provider and combined heat and power industries in the state;
- The creation of additional employment opportunities and other economic development benefits in the state through the increased use of renewable energy and combined heat and power technologies; and
- The stimulation of increased public and private sector investment in renewable energy and combined heat and power and related enterprises, institutions, and projects in the state.

Fulfillment of the Fund goals will also support Vermont's greenhouse gas emission reduction targets as well as supporting the objectives set forth in 30 V.S.A. § 8004 to meet all incremental energy growth in Vermont between 2005 and 2012 through renewable energy generation.

Eligible renewable energy resources for CEDF funds include the following:

- solar photovoltaic and solar thermal energy;
- wind energy;
- geothermal heat pumps;
- farm, landfill, and sewer methane recovery;
- low-emission, advanced biomass power, and combined heat and power technologies using biomass fuels such as wood, agricultural or food wastes, energy crops, and organic refuse-derived waste, but not municipal solid waste; and
- advanced biomass heating technologies and technologies using biomass-derived liquid fuels such as biodiesel, bio-oil, and biogas.

The Clean Energy Development Fund's first grant solicitation resulted in approximately $2 million invested in clean energy projects in Vermont. Subject to receiving appropriate applications, the Clean Energy Development Fund (CEDF) intends to deploy substantially all available funds each

year. In the start-up phase the CEDF anticipates a heavier weighting to grant investments, with the balance shifting more to loans and equity investments over time. The challenges ahead will be to ensure that the funds are spent in ways that provide the greatest long-term benefit for ratepayers and the continued development of distributed renewable and CHP resources. On February 20, 2008, the Department announced a request for bids for an additional $2 million. In April 2008 the investment committee awarded $2.284 million in response to the February 20 Request For Proposal (RFP). Categories of assistance include Pre-Project Financial Assistance, Small-Scale Systems, Large-Scale Systems, and Special Demonstration Projects. There is a maximum award of $25,000 for Pre-Project Financial Assistance, $60,000 for Small-Scale Systems, and $250,000 for all other projects.

Recommendation 3 Leverage Clean Energy Development Fund (CEDF) to promote development of clean energy technologies in Vermont consistent with the CEDF strategic plan.

Timing	NEAR-TERM
Emissions Impact	LOW
Energy Impact	LOW
Capital Cost	HIGH (per installation)
Cost-Effectiveness	LOW (short term)
Funding Sources	Electric Utility Rates
Relation to GCCC	ESD-6, ESD-8
Current Status	Currently in place
Parties Involved	PSD, Clean Energy Development Fund Investment Committee, Renewable Energy Vermont, small-scale technology providers

a) *The Clean Energy Development Fund should be administered consistent with the Clean Energy Development Strategic Plan; the programs and funding approaches should be reviewed annually to ensure the greatest possible long-term impact from investments and grants.*
b) *The DPS and the Legislature should evaluate the ongoing effectiveness of the CEDF to determine whether to continue to seek revenue streams to sustain available funds for the CEDF beyond 2012.*
c) *In the course of its annual review, Vermont should explore opportunities to strategically direct funds in a manner that complements and leverages other regional resources available and federal renewable fund programs and initiatives for the greatest ratepayer long-term benefit.*

COMMERCIAL SCALE AND DISTRIBUTED RENEWABLE ENERGY RESOURCES

Vermont currently relies heavily on in-state renewable resources. In 2006 approximately 18% of Vermont's generation came from in-state renewable sources, almost entirely from commercial-

scale hydroelectric and wood biomass energy.[*†] Load supplied by large hydro[‡] is not considered renewable under Vermont statute for purposes of the SPEED programs, or most neighboring renewable portfolio standards. However, roughly 97% of the power from Hydro-Quebec is from large hydro resources. If this low-carbon resource was considered renewable, it would bring the Vermont portfolio total to almost 50% renewable sources.

In addition to net metering and the Clean Energy Development Fund, a number of other incentives and programs promote small-scale renewable energy technology in Vermont. These include the following:

The Small Wind and Solar Incentive Program provides grants to individuals, businesses, farms, schools, and municipalities for a portion (generally 20–25%) of the cost of installing small-scale solar and wind systems. Since its inception in 2003 the program has provided $1,373,920 in incentives to support the installation of 345 renewable energy systems. In 2007, the Solar and Small Wind Incentive Program received an additional $238,000 of incentive funds for solar electric and solar hot water systems from Central Vermont Public Service and Green Mountain Power for customers in their service territories from Nuclear Electric Insurance Limited (NEIL) refunds, (described further below).

Combined with money from the initial Small Wind and Solar Incentive Program, a total of $980,000 will be available for incentives. The new incentive funding is expected to support the installation of approximately 210 new renewable energy systems throughout the state, which could generate an estimated 425 MWh of electricity annually. Changes being made to increase effectiveness of the program include allowing farms to qualify for a larger wind incentive of $4.50/Watt up to a maximum of $20,000 (schools and local/state government are already eligible for this level of incentive). Also low-income multi-family housing buildings will be eligible for a solar electric incentive of $3.50/Watt up to $35,000. Continual refinement and improvement of incentives offered can ensure the most value for ratepayers and Vermonters investment. The Renewable Energy Resource Center (RERC) at the Vermont Energy Investment Corporation administers the Vermont Solar and Small Wind Incentive Program.[§]

As noted above, some of the funds for the Vermont Small Wind and Solar Incentive Program come from the Nuclear Electric Insurance Limited refunds.[**] In the Vermont Public Service Board's ("Board") Order approving the sale of Vermont Yankee Nuclear Power Station ("Vermont Yankee"), the Board required that, when Central Vermont Public Service Corporation ("CVPS") and Green Mountain Power Corporation ("GMP") received funds from Vermont Yankee Nuclear

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[*] Vermont utilities also own commercial scale wind and landfill methane projects. Most of the attributes from the landfill methane project were sold into neighboring Vermont markets and therefore cannot be claimed in Vermont as renewable energy.

[†] The percentage of energy from in-state renewable sources varies significantly from year to year, mainly due to fluctuations in river levels and the associated water availability for hydro generation. Wood biomass energy also varies from year to year based on market prices for electricity.

[‡] Large-Scale Hydro is above 200 MW, pursuant to 30 V.S.A. § 8002.

[§] For more information on the Small Wind and Solar Incentive Program, please see http://www.rerc-vt.org/incentives/

[**] Funds from the Clean Energy Development Fund have also been used for the Small Wind and Solar Incentive Program.

Power Corporation ("VYNPC") (other than the proceeds from the sale of Vermont Yankee itself), CVPS and GMP must submit a plan that ensures such funds will be used to benefit their respective ratepayers. The Board also directed that such a plan consider applying a significant portion of the funds towards the development and use of renewable resources. In 2005, the Board approved plans that established the following:

GMP:

- 55% of the NEIL refund to be used for GMP capital projects that create, preserve, or increase GMP renewable generation facilities or for conservation and load management projects designed to reduce peak demands of commercial customers.
- 35% of the NEIL refund to be paid to the Vermont Small Wind and Solar Fund, to be used to pay incentives to small renewable generators located in GMP's service territory; and
- 10% of the NEIL refund in connection with the development and implementation of a hedge-based renewables pricing program.

CVPS:

- 30% of the NEIL refund to be paid to the Vermont Small Wind and Solar Fund, to be used to pay incentives to small renewable generators located in CVPS's service territory; and
- 70% of the NEIL refund would be used to support the CVPS Renewable Development Fund and the related voluntary renewable pricing program often referred to as the CVPS Cow Power™ program.

GMP's Greener Mountain Power and CVPS's Cow Power™ are referred to as "Green Pricing Programs."* They allow customers to voluntarily pay a premium to ensure that the energy they consume or a percentage of that energy is from renewable sources. Legislation was recently passed that will require all utilities to offer similar programs to their customers.

The CVPS program has been particularly successful. In 2006, CVPS reported that the Cow Power program had 3,600 customers enrolled, just under 2.4% of the utility's 151,000 customers. The program is the nation's only direct farm-to-consumer renewable energy program, creating a market for farmers who want to process cow manure and other farm waste to generate electricity. CVPS customers can choose to receive all, half, or a quarter of their electrical energy through Cow Power, by paying a premium of 4 cents per kilowatt hour to participate in the program. The funds are used to fund participating farm producers, to purchase renewable energy credits when enough farm energy isn't available, or to fund the CVPS Renewable Development Fund. The fund provides grants to farm owners to develop on-farm generation. Farm producers are also paid 95% of the market price for the energy sold to CVPS. [5]

Green Mountain Power Corp. offered their customers a plan for green power in the first quarter of 2006. The rate plan enabled their customers to purchase 100% of their energy from renewable

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* On May 15, 2008, GMP also announces a companion solar net metered electric rate. www.greenmountainpower.com.

energy sources. The plan was distinct from the CVPS plan in that it did not specifically target one source of renewable energy. *Greener* Mountain Power has over 1000 participating customers that purchased 4 million renewable kWh in 2009, a 26% increase over 2008.

Vermont also offers a sales tax exemption for purchase of certain categories of renewable energy systems. The sales tax exemption applies to solar hot water, small hydro, solar-electric (PV) systems, wind systems, anaerobic digesters, and fuel cells fueled by renewable resources. Certain farm systems with a maximum capacity are also eligible.*

Recommendation 4 Encourage more renewable energy investments through established incentives and programs.

Timing	NEAR-TERM
Emissions Impact	LOW
Energy Impact	LOW
Capital Cost	HIGH (per installation)
Cost-Effectiveness	LOW (short term)
Funding Sources	Participating Ratepayers
Relation to GCCC	ESD-6, ESD-8
Current Status	Currently in place
Parties Involved	PSD, Clean Energy Development Fund Investment Committee, Renewable Energy Resource Center, Distribution Utilities

a) *Vermont utilities should offer pricing programs that empower customers through rate-differentiated renewable electricity tariffs.*
b) *The DPS, with Vermont utilities, should explore innovative ways to develop effective and efficient programs to encourage renewable energy by leveraging existing discretionary green-pricing programs and funds.*
c) *Vermont utilities and the Department should explore strategies for developing statewide green-pricing programs that can be marketed more effectively on a statewide basis.*

STRATEGY C CREATE OPPORTUNITIES TO CONTINUE AND EXPAND VERMONT'S PORTFOLIO OF LOCAL LOW-CARBON ELECTRICITY RESOURCES

INDEPENDENT POWER FACILITIES IN VERMONT

Commercial-scale renewable energy includes energy projects whose costs are already close to or below the cost of capacity and energy under existing market conditions. They include utility owned resources, such as small hydro projects in Vermont and biomass resources. For the most part, continued operation of embedded renewables is highly economic, and investments in new

* See, 32 V.S.A. § 9741(46).

renewable sources are generally close to market, and potentially below market, depending on the value of these resources placed in markets for renewable attributes (i.e., RECs).

For purposes of the discussion below, "independent power" refers to power projects that are by entities that are independent of Vermont's vertically integrated utilities. Historically, these were projects promoted via the Public Utility Regulatory Policies Act (PURPA) and the Public Service Board's Rule 4.100. In the current New England generation environment, most generation is in fact independent and is synonymous with "merchant generation." SPEED projects refer to a specific class of renewable generation that comes into service after January 1, 2005, that may be either independent power or utility-owned power projects. SPEED projects are renewable generation that is built within the state of Vermont during this timeframe. However, utility purchased power from out-of-state renewable projects also qualifies for the goals established for SPEED programs.

Vermont does not impose a Renewable Portfolio Standard (RPS) on retail sales made in the state in the same way that other New England states do. As such, the attributes of Vermont power projects may be sold to other New England states to meet their requirements for qualifying Renewable Energy Credits (RECs). However, in doing so, Vermont utilities' purchasing power from such projects, whether they be SPEED projects or renewable energy projects that did not qualify under SPEED, would no longer be eligible to claimed as "renewable energy." Canadian power purchased by Vermont would qualify neither as a SPEED resource (due to the large size of Canadian hydro power and its out-of-state nature), nor as renewable energy eligible for helping to meet the renewable energy goals in neighboring states, although this is a topic of ongoing discussion within the New England region, especially in light of the shortfalls expected by some in meeting goals for renewable energy in New England.

INDEPENDENT POWER

The Public Utility Regulatory Policies Act (PURPA) was passed by the U.S. Congress in 1978 in order to create a framework that allowed renewable projects and cogeneration projects access to the grid at prescribed market rates. Each state was left to implement PURPA on its own; Vermont's implementation of PURPA was through the Public Service Board's Rule 4.100. Rule 4.100 allowed renewable generators (20 hydro projects and one large wood project) to access stably priced long-term contracts. This rule also set up a central purchasing authority to purchase the output from Qualifying Facilities ("QFs") and allocate the costs and energy among the Vermont utilities. The rates for these contracts were established largely during the 1980s and early 1990s, on the basis of then forecasted future market prices. Those estimates proved to be relatively high compared to the market prices that have transpired since the late 1990s. While Rule 4.100 and PURPA were successful in bringing renewable energy and independent power to Vermont and much of the region, this approach to stimulating the market proved to be an expensive one. Two of the "PURPA" contracts expired in 2008. This creates an opportunity for Vermont utilities to replace contracts for renewable energy at the prevailing market price, which should be a substantially lower price than that embedded in current contract rates. Vermont utilities should continue to seek out opportunities for engaging in contracts for renewable power to ensure stably priced contracts and new renewable energy development.

Table III-1 VEPP, Inc. Producers

Project	*Annual Output(kWH)*	*Capacity(kW)*	*Contract Ending Date*
Barnet	1,814,000	490	Oct. 31, 2016
Comtu	2,367,970	460	December 31, 2018
Dewey's	6,903,800	2,790	January 31, 2016
Dodge	27,000,000	5,000	Dec. 14, 2020
Emerson	700,000	230	October 31, 2015
Killington	295,400	100	May 31, 2016
Worcester Hydro	400,000	170	Oct. 31, 2016
Martinsville	712,000	250	January 31, 2009
Moretown 8	2,519,000	920	Jan. 31, 2019
Nantana Mill	760,000	220	March 31, 2020
Newbury	1,096,268	270	Oct. 31, 2017
Ottauquechee	5,834,000	2,180	Aug. 31, 2017
Sheldon Springs	70,808,000	26,380	Mar. 31, 2018
Slack Dam	1,950,000	410	Oct. 31, 2017
Winooski 8	3,500,000	910	Dec. 31, 2015
Winooski 1	29,000,000	7,300	Mar. 31, 2013
Woodside	729,000	120	April 30, 2017
Ryegate	173,412,000	20,500	Oct. 31, 2012

Notes:
1) "Annual Output" is an estimate (provided by the Producers) of average yearly production.
2) "Capacity" listed is maximum capacity. In some months the capacities for some of the hydros decrease because of statistical water flows.

Recommendation 5 Vermont's electric utilities to replace the sun-setting Rule 4.100 contracts with stably priced contracts or acquire resources based on portfolio considerations.

Timing	NEAR-TERM, MID-TERM, LONG-TERM
Emissions Impact	HIGH
Energy Impact	HIGH
Capital Cost	LOW
Cost-Effectiveness	MODERATE
Funding Sources	Electric Utility Rates
Relation to GCCC	ESD-6
Current Status	Currently in place
Parties Involved	SPEED Facilitator/VEPP, Inc., Distribution Utilities

a) *Vermont's distribution utilities should explore opportunities to extend purchased power agreements with current Rule 4.100 contract holders at more favorable terms.*
b) *Vermont's distribution utilities should explore opportunities to purchase former Qualifying Facilities (QFs).*
c) *Vermont distribution utilities should rely on existing institutions, such as the SPEED facilitator, for efficiencies in acquiring and assigning costs and allocating energy through new contracts.*

SPEED AND VERMONT'S RENEWABLE PORTFOLIO

The Sustainably Priced Energy Enterprise Development Program ("SPEED") was established by the Vermont General Assembly through Act 61 in 2005 to promote the development of renewable energy by encouraging Vermont utilities to engage in long-term contracts for power from renewable sources. The SPEED Program is often confused with the establishment of specific requirements for renewable energy acquisition, which have been established in neighboring states and the region through a Renewable Portfolio Standard ("RPS"); a discussion of RPSs can be found below). The SPEED program, however, is a program that encourages power only contracts (for *electrons*) between Vermont utilities and renewable project developers. Developers remain free to sell the *attributes* of their output into markets for green-pricing programs and into neighboring state markets for eligible renewable resources (i.e., the REC attributes). (However, source mix claims by Vermont utilities follow the ownership or sale of attributes.) By law, contractual volumes under the SPEED Program must meet any increase in statewide load growth by 2012. If this goal is not reached, a Renewable Portfolio Standard takes effect.

In 2009, the legislature modified the SPEED program and created a Feed in Tariff program. Under a Feed in Tariff, developers of qualifying renewable generation projects are paid a fixed amount for their power. In order to assure a rapid development of the qualifying renewable technologies, the legislature mandated that rates paid through the program be reflective of the costs likely to be seen by the various renewable technologies. The program was directed at certain renewable technologies which had to be 2.2 MW in size or smaller. Included in the legislation was an initial set of rates which would be applicable to an initial round of projects (after a brief examination by the board) and a directive to the Public Service Board to develop more accurate rates to be published on January 15, 2010. After a brief, but intense stakeholder process followed by hearings, the Board issued a final set of rates on January 15, 2010. A comparison of the original rates (which will be paid to those projects selected in the first round) and final rates is shown below:

Initial rates developed in statute are as follows:
(a) for landfill methane projects, 12 cents/kWh;
(b) for farm methane projects, 16 cents/kWh;
(c) for wind projects (15 kW or less) , 20 cents/kWh;
(d) for wind projects (over 15 kW), 12.5 cents/kWh;
(e) for solar PV projects, 30 cents/kWh;
(f) for hydroelectric projects, 12.5 cents/kWh;
(g) for biomass projects, 12.5 cents/kWh.

Final rates approved by the Board after an investigation in Docket 7533 are as follows:

Annual Price Schedule ($/MWh)

	Levelized
Solar PV	240.0
Hydro *	122.6
Landfill Gas*	90.0
Farm Methane*	141.1
Wind 1.5 MW *	118.2
Wind 100kW *	214.8
Biomass *	125.0

- These are levelized rates whikch are equivalent to the rate schedule purlished in the Board's order which provides an increasing schedule of rates for these technologies.

As a practical matter, the queue established for the initial set of projects filled almost completely on the first day that applications were accepted. The following chart shows the composition of the applications received and the total applications and MW proposals received for each type of facility. It remains to be seen, but given the quantity of applications and the size of the queue, it is likely that the 50 MW cap will be met in the near future.

Although the Feed in Tariff represents a major source of SPEED projects, the success of the SPEED Program is not assured. Given the long lead times for project development, success will depend critically on actions taken by key implementing agents—utilities, developers, and the SPEED Facilitator. The Facilitator, who manages the program, serves under contract to the Public Service Board to promote the development of SPEED resources by bringing together SPEED projects and Vermont utilities seeking to purchase power. TheSPEED facilitator will also have a dritical role in assisting project defvelopers in rapid deployment of their resources. The SPEED Facilitator may also sell electricity products from SPEED projects to an out-of-state utility, the regional power market, or to Vermont utilities on a pro rata basis, and acts as a clearinghouse for information related to the purchase and sale of SPEED resources. The success of the SPEED Program also depends on the willingness of other states to accept RECs from SPEED resources as qualifying in their programs. The Board has hired VEPP, Inc. (VEPPI), to serve as the SPEED Facilitator. Given the growth in the State's expenditures on energy efficiency investment (discussed in Section V), there is expected to be little growth in electricity demand beyond 2008. The success of the SPEED Program depends in part on the success of efficiency programs in delivering on their program commitments, the success of VEPPI in encouraging project development, and the active implementation by Vermont utilities. The DPS and PSB will continue to monitor program activities, and recommend changes to the Legislature as circumstances warrant.

Vermont is the lone state in the Northeast region of the nation to have not implemented a Renewable Portfolio Standard. Vermont's existing commitment to a Renewable Portfolio Standard exists in connection with the SPEED Program. If existing goals for SPEED are not met by 2012, then, after a Board determination, Vermont utilities would be required to meet an RPS equal to the amount of load growth between January 2005 and January 2013. As noted above, the

goals for the SPEED program are similar to those of an RPS, that of promoting the development and retention of renewable energy in Vermont and the region. Both power contracts and contracts for renewable attributes can be bundled. As such, the SPEED Program can be viewed as a natural complement to an RPS program, or vice versa, and if Vermont does not meet the SPEED targets in 2013, both programs would likely exist side by side to encourage Vermont utilities to make arrangements for both the power and the attributes from the projects, although to date, SPEED contracts have been all inclusive (energy products plus attributes.

An RPS, like most other programs and policies that promote renewable energy in the region, can help advance regional objectives for fuel source diversity, meet environmental objectives, and meet demands for sustainable energy sources. Because market mechanisms are put in play through such an instrument, an RPS is viewed as an effective and efficient mechanism for promoting development of renewable energy at a commercial scale. The mechanism is competitively neutral and relies little on individual administrative determinations and/or subjective judgments. To the extent that there are subordinate or more detailed goals for renewable energy (i.e., goals for solar versus wind), they can be accommodated by attaching added layers to the goals or standards established.

However, the case for not moving ahead with a Vermont-based RPS centers on concerns for ratepayer impacts together with a preexisting portfolio that already includes a strong base of renewable resources. Vermont already enjoys considerable resource diversity and possesses a clean resource base not present in other jurisdictions in the Northeast. As noted above, Vermont already boasts a long list of programs and funding mechanisms specifically designed to promote the development of renewable energy. These programs already provide a considerable stimulus to the development of distributed energy and renewable energy that is arguably as aggressive as programs of most states in the U.S., including those with an RPS. The case for moving toward a Vermont RPS will be the subject of ongoing debate before the Vermont General Assembly.

Recommendation 6 Regulators and the SPEED Facilitator should work with Vermont electric utilities to fulfill their statutory responsibilities under the SPEED Program.

Timing	NEAR-TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	LOW
Cost-Effectiveness	MODERATE
Funding Sources	Electric Utility Rates
Relation to GCCC	ESD-6
Current Status	Currently in place
Parties Involved	SPEED Facilitator, PSB, PSD, Distribution Utilities

a) Vermont regulators and legislators should foster a stable and predictable regulatory environment for encouraging contracts and investments in renewable energy; the SPEED Facilitator should take appropriate steps to foster the development of contracts between Vermont utilities and new renewable energy producers, including standard contracts/terms and conditions, requests for proposals, and effective use of

the technology and the internet to facilitate contracts between prospective purchasers and sellers of SPEED resources.

b) *In 2012 the Public Service Board should evaluate whether Vermont electric utilities have met their SPEED obligations consistent with statutory obligations.*

c) *Consistent with Section V of this Plan, Vermont energy efficiency programs should be employed to help meet statutory objectives for SPEED programs.*

INTERCONNECTION STANDARDS AND INTERCONNECTION/BACKUP TARIFFS

Among the regulatory barriers that proponents of small distributed resources identify are those associated with uncertain costs and potential resistance of incumbent utilities to interconnect. The Vermont General Assembly responded to the concern to requiring the Vermont Public Service Board to establish rules that provide clear standards and a timeframe for responding to interconnection requests.

Act 61 mandated new Board rules (Rule 5.500) establishing requirements for utilities to respond in a timely basis for requests of potential interconnection. These rules followed similar rules for interconnection governed by FERC and ISO-NE. The rules are designed fundamentally to ensure timely response to a generator requesting interconnection and to quickly filter or distill material projects requiring significant analysis and review to distribution and transmission system impacts. Where additional facilities are required to ensure the integrity of the system, the requester is required to pay for the costs.

Despite the significant progress above in establishing fair interconnection standards and business response times, potentially stranded investments and appropriate pricing of backup service and interconnection service remain open issues. Most utilities in Vermont establish special contracts for interconnection services. Such contracts are subject to potentially costly and time-consuming case-by-case review and potential for negotiated rates varies between customers. Efforts are needed to standardize the rate and the approach to developing the rate that is reasonably consistent and can be fairly applied across Vermont.

Recommendation 7 Regulators should ensure that interconnection arrangements, business response timetables, and relevant tariffs are fair and nondiscriminatory.

Timing	NEAR-TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	LOW (to electric utilities)
Cost Effectiveness	MODERATE
Funding Sources	Electric Utility Rates
Relation to GCCC	ESD-6
Current Status	Currently in place
Parties Involved	PSB, PSD, Distribution Utilities

a) *The Department of Public Service should monitor utility activity and performance as they relate to interconnection.*
b) *Vermont utilities and the Department should work to establish guidelines or principles for fair and non-discriminatory tariffs.*
c) *Vermont utilities should propose backup service and interconnection tariffs consistent with the above guidelines.*

VERMONT-BASED HYDRO

Prior to the 1920s, Vermont relied on hydro resources almost exclusively for the generation of electricity. Currently, Vermont generates roughly 10% of its energy needs through in-state hydro electric resources, about half of which come from projects developed under PURPA (discussed above). The Agency of Natural Resources (ANR) suggests that Vermont could build out up to an additional 25 MW of electric generation in its renewable energy portfolio at some 44 sites where there are existing dams. Improving efficiency at the state's 78 existing facilities could generate another several megawatts of power.

It is somewhat instructive to consider the events following the last energy crisis and the renewed emphasis that followed toward the development of Vermont-based hydroelectric generation. In 1978, federal legislators passed the Public Utility Regulatory Policies Act (PURPA) with its economic incentives helping to foster renewed interest in development of small hydroelectric projects. In Vermont this took form as Vermont Public Service Board Rule 4.100. The Agency received some 70+ proposals for new projects over the next several years. Of those, 51 were authorized and 41 were constructed. In 1982, Vermont had some 62 operating hydroelectric facilities (all pre-PURPA). An ANR study found that flow regulation at three-fourths of the projects is having adverse effects on streams and rivers. In the late 1980s and 1990s, changing economics and other factors resulted in a sharp drop in proposals for new hydropower facilities. Six facilities developed in the early 1980s were later decommissioned. Beyond the early 1980s, ANR issued water quality certifications for 25 pre-PURPA hydroelectric projects, which included operational conditions aimed at ameliorating the impacts of these facilities on water quality, aquatic habitat, and other uses and values.

In the end, the PURPA initiatives added considerable energy to the Vermont mix (about 6%), but added considerably more to the cost of our energy. The average embedded power cost in 2006 was about 6 cents per kWh, while the average cost of PURPA power was approximately 15 cents per kWh.

In 2007, the Vermont General Assembly requested a study of the available hydro potential and the barriers or impediments to permitting.* The Agency developed the following findings and conclusions to help achieve the above policy direction.

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* During the 2007 legislative session, H.520 (*An act relating to Vermont energy efficiency and affordability*) required the Agency of Natural Resources to study a number of issues related to the development and permitting of small hydroelectric projects. The bill was ultimately vetoed, however the governor nonetheless directed the Agency to develop the report.

1. **Additional hydroelectric capacity:** There are opportunities to develop additional in-state hydroelectric capacity at existing but undeveloped dams. The total capacity is likely to be on the order of 25 MW, assuming new development is restricted to existing dams, but additional study is needed to develop an accurate estimate.
2. **Information for prospective hydroelectric developers:** A comprehensive guide to small hydropower development is needed. The target audience would be the developers of prospective projects, with the focus on those projects that do not exceed 100 kW of installed capacity. The guide would provide information to help prospective developers understand the economic and environmental issues associated with small hydropower projects, the regulatory system, and how to make a very preliminary assessment of whether a given site is economically viable. It could be a print publication, website, or both.
3. **Low-impact standard:** Agency policy should specify that any new hydroelectric power facilities meet a "low-impact" standard on the basis of the criteria developed by the Low Impact Hydropower Institute. This standard includes utilizing existing intact dams, so no new dams will be built for the purpose of hydroelectric power production. Preference should be given to dams that currently serve another purpose.
4. **Permitting process:** The existing permitting process, with FERC maintaining jurisdiction over hydroelectric projects, should be retained. Both state agencies and FERC are addressing concerns about timeliness and cost for permitting small projects. Federal and state agencies are working to scale the process so that it works better for smaller projects while at the same time providing a level of protection consistent with the importance of these public resources. Shifting the responsibility to the state would place a significant additional burden on the state's resources with little likelihood that the process would change sufficiently to justify the change.
5. **Prefeasibility assessments:** Subject to availability of resources, the Agency should continue its practice of conducting prefeasibility assessments for all public and private projects and resource assessments (e.g., electrofishing) for municipal/public projects. The prefeasibility assessments have been well received and they give potential developers a sense of a project's environmental feasibility early in the process. We will continue to refine this process on the basis of feedback from project proponents.
6. **Definition of small hydro:** A new definition of "small hydro" is not needed. There are existing definitions (mini-hydro, micro-hydro, and pico-hydro) that can be used, where necessary, in statute and rule.
7. **Increased production at existing facilities:** The Department of Public Service should work with Vermont utilities to investigate additional opportunities for increasing hydropower production at existing operating sites. Several of the assessments of undeveloped hydropower capacity note that there is untapped potential at existing hydroelectric facilities. This potential could be realized with more efficient turbines, small turbines at the dams that utilize bypass flows, and turbines that can operate efficiently over a wider range of flows. In many cases, an increase in production should be possible without changing the current operating requirements, essentially increasing energy production without additional environmental impacts. Further study is needed to determine the feasibility of this option. Vermont's utilities indicate that they have made some initial progress toward improving the operation of existing facilities in recent years. There are,

however, indications that further cost-effective improvements are available and deserve further study.

8. **Agency flow procedure:** The Agency should retain its existing flow procedure for establishing conservation flows at hydroelectric projects. The flow procedure defines an approach that is commonly used in the Northeast and provides a scientifically valid basis for setting flow requirements. Since the flow procedure is consistent with the U.S. Fish and Wildlife Service (USFWS) *New England Flow Policy*, conflicting flow recommendations between state and federal agencies are avoided. It has also been recognized as a generally accepted scientific practice compliant with FERC rules and Vermont water quality standards.
9. **Dam removal:** The Agency should commit additional resources to removal of dams that are not serving useful purposes and are unlikely candidates for hydropower development. Restoring stream and river connectivity and eliminating existing water quality and habitat impacts will help balance the cumulative impact of new hydroelectric development.[*]

The ANR report included two legislative recommendations:

1. **Funding for an updated study of potential hydropower sites:** Conclusion 1 points out that a better estimate of the developable hydroelectric capacity in Vermont is needed. The legislature should consider funding for the Agency, Department of Public Service, and Public Service Board to collaborate on an update of the 1980 New England River Basins Commission study to identify the most viable sites for small hydropower development at existing dams. This update is essential for identifying the best opportunities statewide, both ecologically and economically, for new hydropower development.
2. **Funding for a hydropower development publication:** Conclusion 2 identifies the need for better guidance for towns and individuals who are interested in developing small hydropower projects. The legislature should consider funding for the development of such a guide by the Agency, Department of Public Service, and Public Service Board.

Recommendation 8 Vermont electric utilities and developers should pursue environmentally and financially sound in-state hydroelectric projects and improvements to existing facilities.

Timing	NEAR-TERM
Emissions Impact	HIGH
Energy Impact	HIGH
Capital Cost	POTENTIALLY HIGH (to electric utilities)
Cost Effectiveness	MODERATE
Funding Sources	Electric Utility Rates
Relation to GCCC	ESD-9, ESD-10
Current Status	Currently taking place
Parties Involved	PSB, PSD, VT Utilities, VJO

[*] ANR, "The Development of Small Hydroelectric Projects in Vermont; A Report to the Vermont General Assembly," January 9, 2008.

a) *The ANR should continue to foster a predictable and environmentally sound process for issuing water quality certifications for hydroelectric projects by continuing to provide applicants with prefeasibility site assessments.*
b) *As resources, permit ANR and the DPS should update the 1980 New England River Basins Commission's study to identify the most viable sites for small hydro site development at existing dams.*
c) *ANR should examine ways to better integrate the FERC and state permitting process for small low-impact hydroelectric projects.*
d) *The DPS should work with Vermont utilities to investigate additional opportunities for increasing hydropower production at existing operating sites.*
e) *As resources permit, the Department of Public Service, the PSB, and ANR should develop better guidance for towns and individuals that are interested in developing small hydropower projects.*

COMMERCIAL WIND IN VERMONT

Vermont has considerable technical potential for the development of wind resources. A 2005 study for the Department of Public Service showed that there was approximately 7,000 MW of available wind resource potential. This study focused only on the highest wind regimes (Class 6 and 7) and on those areas within three miles of an existing transmission line. This available resource potential could change as sites are eliminated due to environmental considerations, visual issues, ownership patterns or other factors that could disqualify an individual site for further consideration. Improved technology or changes in the costs of wind facilities, or changes in prevailing opinions regarding future energy prices could also alter the mix of potential viable sites.

Much of the desirable wind turbine locations are owned by the state or federal government. In 2004, the state convened a working group to develop a policy on the use of state lands for wind development. What the group found was that much of state-owned land carried deed restrictions that limited any type of development on the land. Further, the group formulated a policy that determined that large-scale wind development on state lands was incompatible with the missions of the Agency of Natural Resources as steward of these state lands. The policy did acknowledge that if, in the future, it was shown that wind development was clearly in the public interest, the policy could be revised (see: http://www.vermontwindpolicy.org/).

Vermont has one operating commercial wind power installation. Completed in 1997, the GMP wind power facility in Searsburg consisted of eleven 550-kW turbines, or a total installed capacity of 6.05 MW. Recently, one turbine was struck by lightning and is likely permanently out of service due to lack of repair parts. At the time, the Searsburg project became the largest wind power facility in the eastern part of the country. This was the first commercial wind power facility installed in New England and the first to be owned by a utility. It was selected by the U.S. Department of Energy (DOE) and the Electric Power Research Institute (EPRI) for participation in their Utility Wind Turbine Verification Program, whose goal, in part, was to verify the performance of wind turbines in cold climates. Over 10 years of wind measurements at this site indicate the average wind speeds along this ridge are between 15 and 17 mph. In these conditions, the turbines produce about 12,000 MWh annually, enough to power about 1,700 homes.

There is considerable interest in developing additional projects in Vermont. Recently, UPC Wind received conditional approval from the PSB to install 26 turbines in Sheffield Vermont. This would be the first new wind project in Vermont since the Searsburg project. Several other projects are in various stages of development—an annotated list follows.

Table III-2 Wind Projects in Vermont

Name of Project	***Developer***	***Location***	***# Turbines***	***Turbine Output***	***Project Capacity:***	***Status***
Equinox	Endless Energy	Manchester	5	1.5–2 MW	7.5–10 MW	Proposed
Searsburg	enXco – Green Mountain Power	Searsburg	11	.5 MW	6 MW	Operating
Deerfield	enXco	Searsburg & Readsboro	30–45	1.5 MW	45–67.5 MW	Permitting
UPC Sheffield	UPC Wind LLC	Sheffield & Sutton	26	2 MW	52 MW	Permitted
Glebe	Catamount Energy	Londonderry	19	2.5 MW	47.5 MW	Dormant
East Haven	East Haven Wind Farm, LLC. Matthew Rubin	East Haven	4	1.5 MW	6 MW	Rejected by Board
Georgia Mountain	Harrison family	Milton	3	2 MW	6 MW	Proposed

Because wind projects must be sited in visually prominent locations, a proposed development generates considerable controversy. Opponents cite the visual intrusion posed by these projects and the uncertain impact on the local environment while proponents emphasize the environmental benefits of displacing fossil-fueled generation and regional fuel diversity. To date, the Public Service Board has rejected one application and approved one. Given this level of uncertainty regarding the ability of any specific project to receive the necessary permits, efforts to better define the impacts of this type of facility would aid in determining the possible future role of wind generation in Vermont.

Recommendation 9 Actively facilitate the review of local, Vermont-scale wind project development consistent with statutory framework.

Timing	NEAR-TERM
Emissions Impact	HIGH
Energy Impact	HIGH
Capital Cost	POTENTIALLY HIGH (utility investments)

Cost Effectiveness	MODERATE
Funding Sources	Electric Utility Rates
Relation to GCCC	ESD-9
Current Status	Currently taking place
Parties Involved	PSB, PSD, VT Utilities, VJO, ANR

a) *As resources permit, ANR and PSD should foster a predictable and environmentally sound process for locating wind by identifying areas that are likely to meet statutory requirements and permitting requirements.*
b) *As resources permit, the PSD, PSB, and ANR should develop better guidelines for towns and individuals that are interested in developing community wind projects.*

Recommendation 10 Encourage Vermont utilities to engage in regional wind project development.

Timing	NEAR-TERM
Emissions Impact	HIGH
Energy Impact	HIGH
Capital Cost	POTENTIALLY HIGH (utility investments)
Cost Effectiveness	MODERATE
Funding Sources	Electric Utility Rates
Relation to GCCC	ESD-9
Current Status	Currently taking place
Parties Involved	PSB, PSD, VT Utilities, VJO, ANR

a) *Vermont utilities should participate in regional and international wind projects through contract arrangements, equity participation, and/or the purchase of attributes.*
b) *Vermont should support the strategic expansion of the region's electric grid to gain access to lower-cost and more environmentally responsible resources and to further diversify the regional mix of generation resources.*

STRATEGY D EVALUATE OPPORTUNITIES TO CONTINUE AND EXPAND VERMONT'S PORTFOLIO OF LOW-CARBON ELECTRICITY RESOURCES

As indicated in this discussion of Vermont's electricity demand, energy efficiency and renewable energy have important roles to play in the state's electricity portfolio by reducing demand and supplying significant amounts of diversified, distributed, and clean energy. However, at least for the foreseeable future, energy efficiency and renewable sources of power alone cannot meet the state's entire electric demand. Vermont utilities must create sufficient options for future supply to be able to make informed choices, weighing all factors in that decision.

EXPIRING CONTRACTS

As noted above, Vermont faces the conclusion of two major contracts during the coming decade. The contract with Entergy is due to expire in 2012 and most of the contract with Hydro-Quebec is due to expire by 2016. The loss of these contracts challenges our current position of low prices in the New England region and future price stability. Further, the conclusion of these contracts represents a threat to Vermont's commitments to reducing its carbon footprint, especially goals set for 2012 and 2020. Recall that Vermont, pursuant to Act 168, has established a goal of reducing greenhouse gas (GHG) emissions by 25% from 1990 baselines by 2012, and 50% by 2028.[*] As reflected in the report of the Governor's Commission on Climate Change, the near-term goals appear unlikely to be achieved. These goals fail by a considerable margin without replacement of these contracts with similar low-carbon contracts or resources. Market generation available through standard market designs and liquid markets provide ready alternatives to bridge or replace portions of these contracts. Among the other options available for replacement and diversification of the current contracts are the following:

NUCLEAR POWER

Nuclear energy is one of the lowest carbon-emitting sources of energy and has the potential to help lower regional carbon emissions when used as a replacement for fossil fuel generated electricity.[6] Uranium, the fuel utilized in nuclear generation, requires significant processing before becoming functional in an electric plant. This processing activity does result in GHG emissions. However, even when the life cycle emissions are taken into consideration, nuclear generated electricity is one of the least GHG emitting sources of electric energy. Emissions from nuclear plants, even at their highest estimated levels, are well below fossil fuel emissions and tend to be lower than most renewable sources of electricity.[7] Vermont utilities have several options to increase the amount of nuclear-based energy in their portfolio even after expiration of the Vermont Yankee contract and license. An option is to look into a contract with a facility in New England.[†] A second option is to look to participate in new nuclear facilities being contemplated in the region such as the one under consideration in New Brunswick.

Vermont Yankee (VY)

The Vermont Yankee nuclear power station (VYNPS or VY) is located in Vernon and has been in operation since 1972. It is currently owned by Entergy, an independent owner/operator of nuclear facilities. Power is supplied to Vermont utilities and the other VYNPC owners through a purchase power agreement (PPA) executed when the plant was sold to Entergy in 2002. VY currently

[*] Vermont, as part of a regional initiative, has set a 2010 goal of reducing GHG emissions to 1990 levels and a 10% reduction from 1990 levels by 2020.
[†] CVPS owns a small portion of the Millstone facility in southern Connecticut.

provides roughly 35% of the electricity consumed in Vermont,* and is one of five operating nuclear plants in New England and one of five nuclear plants in Entergy's northeast fleet.†

Sale of Vermont Yankee

Prior to 2002, VY was owned by Vermont Yankee Nuclear Power Corporation (VYNPC), a single-asset entity which was owned in turn by eight New England utilities. Vermont utilities owned 55% of VYNPC and received 55% of the output of the VY station. In 2002, the plant was sold to Entergy Nuclear Vermont Yankee, LLC (ENVY), a subsidiary of Entergy Corporation of New Orleans, Louisiana. Entergy is the second largest nuclear plant operator in the U.S., owning ten nuclear plants, five in the South and five in the Northeast.

Up-Rate of Generating Capacity

In 2003, Entergy petitioned the Public Service Board (PSB) for an increase in generation, known as a power up-rate, at the VY plant by about 20%, from 510 MW to 620 MW. In March 2004, the PSB conditionally granted that request, subject to an independent engineering assessment of the facility. The Nuclear Regulatory Commission (NRC) approved the power up-rate in 2005. As a result, the plant was able to increase power by approximately 120 MW. This additional power is sold by Entergy into the New England market. As part of the proceeding before the PSB, Entergy agreed to a revenue-sharing provision related to its sales of up-rate power, and as such the DPS agreed that the power up-rate proposal was an economic benefit to Vermont. The funds from Entergy are used to support energy development in the state through the Clean Energy Development Fund.

Future of Vermont Yankee

Starting in 1998, the NRC began granting 20-year operating license renewals to nuclear plants. Currently, approximately one-fourth of U.S. nuclear plants have received license renewals, and it is expected that almost all existing nuclear plants will renew their operating licenses. In 2007, Entergy submitted its application to the NRC for a license renewal. In addition to its NRC application, Entergy submitted a separate license renewal application to the Vermont PSB on March 3, 2008, to renew its Certificate of Public Good ("CPG") that also expires in 2012. The PSB opened a docket for this purpose. As a condition of its purchase, Entergy is prohibited from operating the plant beyond March 21, 2012, without seeking approval from the PSB. Additionally as a condition of the approval to locate dry cask fuel storage at the existing VY site, Entergy agreed to seek approval for any license extension from the legislature as well as the PSB; the Legislature also passed an Act requiring its approval prior to PSB issuance of a Certificate of Public Good. ENVY has made several additional commitments to the Vermont Yankee Nuclear Power Corporation (VYNPC) regarding purchased power transactions should the plant receive an

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* This accounts for approximately 46% of the plant's total output. The other 54% is sold under contract to other states' utilities, or sold into the New England market.

† The other New England plants are Millstone 2 and 3 (Connecticut), Pilgrim (Massachusetts), and Seabrook (New Hampshire). The other plants in Entergy's northeast fleet are Pilgrim (Massachusetts), Indian Point Units 2 & 3 (New York) and James A. Fitzpatrick Nuclear Plant (New York).

extension to its operating license. These were the result of terms and conditions negotiated in the agreements made at the time of the sale of the plant in 2002.

ENVY's commitments do not obligate the company to sell to VYNPC any power from the Vermont Yankee plant should it receive an extension of the plant's operating license. ENVY is committed only to providing VYNPC with a commercially reasonable opportunity to negotiate on an exclusive basis for 30 days to purchase available energy and capacity resulting from a license extension. However, in order to receive approval under 30 V.S.A. § 248 and from the legislature, ENVY must show a benefit to the state. Even though ENVY's prior commitments do not obligate the company to sell to VYNPC any power resulting from an extension of the plant's operating permits, ENVY is obligated to share a portion of the revenues from the sale of VY power resulting from a license extension, whether the power is sold to VYNPC, another PPA customer, or into the market. Specifically, ENVY is committed to share 50% of any revenue received by ENVY above a "Strike Price" for the sale of energy and capacity with VYNPC for 10 years should operations continue March 13, 2012 (the day after the current license expires). The "Strike Price" is $61/MWh escalated on March 13, 2013, and each March 13 thereafter, by an annual "Escalation Factor" on the basis of changes in three cost indices: Employment Cost Index (ECI), weighted 60%; Gross Domestic Product Implicit Price Deflator (GDP-IPD), weighted 25%; and Nuclear Fuel Market Index (NFMI), weighted 15%.

There are other issues, including decommissioning and steps related to plant reliability, that would be addressed in any State CPG renewal, in addition to power purchase agreements.

The NRC, the Public Service Board, and the Vermont General Assembly must all approve the continued operation of the plant beyond its current license. However, the Public Service Board "may not issue a final order or a certificate of public good until the general assembly determines that operation will promote the general welfare and grants approval for that operation." 30 V.S.A. § 248(e)(2). In Spring of 2010, the Vermont Senate voted not to allow PSB consideration of Certificate of Public Good extension. This Plan will not take a position on whether the plant should continue to operate; that is the role of the three processes mentioned above. Instead, this Plan will focus on appropriate planning activities that should be followed by Vermont utilities so they are prepared for Vermont's energy future regardless of whether the plant ceases operation on schedule in March 2012. This Plan recommends that Vermont utilities should diversify their resource mix toward renewable energy and alternative low-carbon base load resources, even if VY remains in operation beyond its scheduled closure date.

Closure of the plant will mean that one option becomes unavailable and Vermont utilities will have to look elsewhere for that portion of their base-load energy supply. The money not spent on Vermont Yankee can go to purchase replacement contracts from marketers or to build or contract with alternate supply sources. The "Generation Feasibility Study" prepared by Concentric Energy Advisors ("CEA Report") for Vermont utilities discusses the many options available for replacement sources, should Vermont utilities decide to own a generation resource.

Vermont utilities have begun looking at the potential for and impacts of constructing new generation resources within Vermont. A report by Concentric Energy Advisors (CEA) looks at costs and performance characteristics of a range of generation technologies which could be built in Vermont. Several Vermont utilities, led by CVPS issued an RFP for supply. Part of the RFP requests contingent supply offering – one that may be accepted pending the outcome of the relicensing of VY. This action should give these utilities a distinct advantage should there be a need for alternate sources to VY.

Advantages

- Favorable electric power rates
- NEIL funds
- CEDF money
- Favorable emissions profile relative to other alternatives in the region
- Base-load power, already exists with transmission
- Revenue and community benefits

Disadvantages

- Nuclear waste
- Accident risk
- Over-reliance on a single facility
- Burdens to local communities
- Other health, safety concerns*
- Opportunity cost of dedicated use of existing site
- Burden on agencies and communities with oversight responsibilities

Recommendation 11 Should Vermont Yankee be relicensed and receives a CPG to operate beyond 2012, such continued operations must include a Purchase Power Agreement that confers material benefit to the State and Vermont ratepayers.

Timing	NEAR-TERM
Emissions Impact	HIGH
Energy Impact	HIGH
Capital Cost	Imputed debt implications for utilities by ratings agencies
Cost Effectiveness	HIGH
Funding Sources	Electric Utility Rates
Relation to GCCC	ESD-4
Current Status	Currently taking place
Parties Involved	PSD, VT Utilities, Entergy, Vermont General Assembly

* Includes concerns associated with radiation, groundwater contamination (e.g., tritium) and emergency preparedness.

a) Vermont electric utilities must manage portfolio risk and explore strategies for source diversification to reduce the exposure to ratepayers from a unit-contingent contract.
b) Vermont utilities should continue planning for alternatives to power from the facility, including utility generation projects, system power contracts, or through merchant power obtained through market solicitations.
c) Vermont utilities and agents that are party to the negotiations of major contracts should ensure that the smaller municipal and cooperative utilities gain access to those resource contracts on similar terms and conditions.
d) To the extent that the facility is licensed and certified for operation beyond its existing license, Vermont utilities should phase down their purchase commitments toward alternative forms of clean energy, including renewables.
e) In light of the challenges associated with VY's ongoing operation, Vermont utilities should, over time, diversify their resource mix toward renewable energy and alternative low-carbon base load resources

IN-STATE GENERATION OPPORTUNITIES

Historically, the Vermont electric grid has developed to function best as an importer of electric energy. While its ties to New England, New York, and the Canadian Provinces have served the state well, there are also benefits to in-state generation. In-state locally owned generation will allow Vermont utilities a strong voice in the operation of any facility. As a result of its dependence on imported power, Vermont pays the highest rates in New England for line losses created by the power demands in the state and the flow of power over long distances to reach Vermont. Increased imports also mean that load must be supported through expansion of transmission, which comes with its own cost and environmental impacts.

In addition to the obvious energy and capacity benefits offered by in-state generation, there are several ancillary benefits worth considering. Dispatchable generation within the state can serve a reliability function to defer the need for transmission investments. Base-load generation can serve to broaden the base and help diversify the state's current long-term commitments. With these two large contracts expiring in a short timeframe, there lies an opportunity to affirmatively restructure the power supply of the state. Since there is some uncertainty regarding the future availability of these two sources, it is wise to pursue replacement on many fronts so one can compare options. Construction of in-state generation is one of those paths to explore.

To that end, a consortium of Vermont utilities developed an initial set of planning documents to begin such a process. The CEA Report looks at different generation types and evaluates performance and cost characteristics, infrastructure requirements, and permitting issues. Additionally it looks at financing hurdles appropriate to Vermont utilities. While not a blueprint for success, this report will provide valuable guidance regarding the many options available to utilities. It will also serve as a valuable benchmark for negotiations with other power suppliers.

Consistent with the themes in this Plan, the study found that meeting Vermont's needs, while maintaining adherence to a least-cost framework will be challenging and will involve trade-offs among the various attributes of a generation portfolio.

As discussed above, the factors which make such a path a difficult and challenging one include:

- The size of the potential supply gap created by the expiring contract.

- The infrastructure constraints placed on such a development by the existing transmissions system and the inability to move large amounts of power around the state.
- Public concerns regarding fossil, nuclear, and many renewable technologies.
- A regulatory process which involves time, cost, and risk on the part of the proposers.

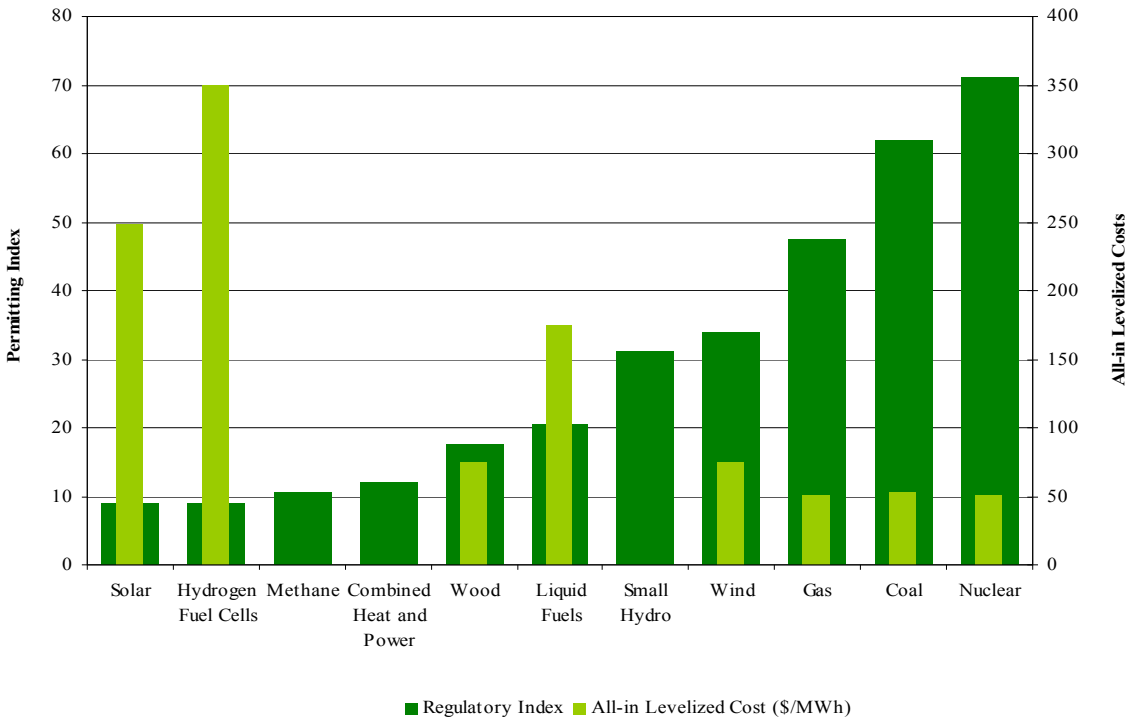
No new generation of significant size has been built in Vermont in the last 20 years. The construction boom seen throughout New England in the 1999–2004 period completely bypassed Vermont. This was likely due to the lack of infrastructure to support development as well as limited supply of natural gas. Permitting in Vermont can also be challenging, involving multiple regulatory agencies and potentially lengthy proceedings.

Siting of any new generation relative to the capacity of existing transmission will be crucial to avoid costly investment in upgrading facilities. Siting generation in constrained areas can possibly defer planned upgrades, if the generation is reliable and sufficiently sized. However, almost any new generation facility will require some degree of system upgrade and the ability to wheel the power could be constrained by the existing system.

The following graph, based on data from the CEA Report, shows the levelized cost of various generation sources along with a permitting index which estimates the costs and risks associated with permitting each type of facility.

As can be seen from the graph below, the generation technologies with the lowest costs, coal, gas, and nuclear, present difficult issues with regard to public acceptance, scale for Vermont, and financing for Vermont utilities. These technologies involve the use of nuclear fuel or the combustion of fossil fuels, which run counter to public opinion in Vermont and which present difficult environmental issues for developers. Infrastructure requirements of such large facilities also will limit their application in Vermont. Currently, Vermont has a significant dependence on a single facility the Vermont Yankee station. Construction of a large coal or nuclear facility to fill the gap would create portfolio problems unless sufficient partners were included to mitigate the risks.

Figure III-4 Characteristics of Generation Technologies



These large technologies also require capital investments which likely exceed the practical limits of the Vermont utilities. This suggests that to complete such a project, sufficient partners would also have to be included to make it financially feasible. This adds its own set of benefits and risks , not the least of which is the challenging fiscal environment currently limiting the ability to secure project financing.

Development of renewable technologies such as wood, wind, and solar would contribute to the goals set under the SPEED Program and be responsive to the wishes of Vermonters as expressed during the public engagement process. However, these technologies can be more expensive and, because they are generally in smaller increments, would require more time to shepherd individual projects through the development process than a single large facility. Given the preferences of Vermonters as revealed in the public engagement process, and the financial abilities of Vermont utilities, these smaller-scale renewable projects may offer the most potential for success. The recent SPEED summary report prepared by the SPEED program administrator paints a challenging picture regarding the ability to see SPEED projects come to fruition. Potential reductions in forecasted load as a result of the economic downturn could result in essentially zero load growth between January 1, 2005 and January 1, 2009. Further the lack of clarity in pricing, both from the SPEED program itself and within the regional marketplace, may not be sufficient to attract developers and the capital necessary to undertake such projects

Generation technologies considered in the CEA Report and the challenges associated with each are briefly highlighted below.

- Solar electric and fuel cells should pose few if any permitting challenges, but would be very expensive to develop and, in fact, could be cost prohibitive. However, once developed, these technologies would contribute to renewable sources and energy goals set by the state. The performance characteristics of solar cells share a coincidence with peak loads, resulting in potential reliability benefits as well.

- Methane, CHP, and wood represent relatively low to moderate development costs and permitting risks. These technologies all have the potential to contribute to the state's renewable energy goals and are reflective of general public interest in development of smaller-scale distributed generation that utilizes indigenous resources.

- Utility-scale wind generation and most hydro technologies face potentially difficult siting challenges that both increase permitting time and add a significant risk component to the project. Wind sites are typically in visually prominent areas and are at elevations where site disturbances raise significant issues. Because they are remote, suitable wind sites are often distant from interconnection points on the transmission system. Hydro sites involve disturbances to riverine habitat that frequently is invasive to species of fish.

- Combustion turbines should be relatively easy to site and the siting costs and regulatory risk should be low. The technology is known and the impacts are small. Additionally, they could burn multiple fuels, including biodiesel. However, these are only suitable to meet peak loads and capacity requirements.

- Larger-capacity plants, like combined-cycle plants, nuclear, and coal technologies, would involve large regulatory risks, in part, due to the need for transmission facilities to efficiently move the power.

- Large-capacity (600 MW) combined-cycle gas technology represents a low-cost option for meeting intermediate and base-load needs. This is the favored technology for most of the new generation built recently in New England. A plant of this type built in Vermont would compete with similar plants in New England with no apparent competitive advantage for a Vermont-based plant. Strategic siting of smaller combined-cycle combustion turbines (150 MW) could serve a dual role of offsetting transmission improvements and providing moderately priced energy to Vermont. Additionally a project like this could be within the financial capabilities of the Vermont utilities.

- Nuclear and coal technologies represent least-cost options looking at only the busbar levelized costs. However, they have the highest environmental impacts and they are more likely to generate public opposition. Their required size in financial terms makes it an unlikely project for a Vermont utility.

Recommendation 11 Vermont utilities must continue to develop options for local generation that complement Vermont's need for generation closer to loads to reduce losses and improve system reliability at lowest cost.

Timing	NEAR-TERM

Emissions Impact	MODERATE/HIGH
Energy Impact	MODERATE
Capital Cost	MEDIUM/HIGH (funded by utilities)
Cost Effectiveness	MODERATE
Funding Sources	Electric Utility Rates
Relation to GCCC	ESD-5, ESD-8
Current Status	Permitting One Project, Utility Feasibility Studies, Discussions with Merchant Generation
Parties Involved	PSD, VT Utilities

a) *Vermont utilities should work to develop options for generation located in Vermont.*
b) *Vermont electric utilities should look to partner with other load servers or other plant developers to add diversity to any proposal.*
c) *Vermont utilities should cooperate in developing in-state generation resources so smaller utilities can take advantage of economies of scale that are associated with large utilities.*
d) *The Public Service Board, along with the Department, Vermont utilities and interested stakeholders should evaluate the status of the SPEED program and propose necessary changes.*

COMBINED HEAT AND POWER

Combined heating (and cooling) and power (CHP), also known as cogeneration, is a method of utilizing the thermal energy produced for space or process heat to generate electricity and employ it for space or process heat in a single, coordinated process. The advantage of CHP is that it is capable of significantly greater achieved efficiency than if the generation of heat and electricity and production of heat were done using individual systems. The projects can be of varying sizes; for example, a CHP system at Vermont Marble has a capacity of approximately 7 MW, while other units are as small as 60 kW and residential units are becoming available in 5-kW sizes. In total, Vermont has roughly 21 MW of electric generation from CHP, at locations where there is a year-round demand for heat, cooling, and electrical demand. As noted in the Governor's Commission on Climate Change (GCCC) report, CHP projects should only be supported if they produce a net decrease in emissions relative to separate heating and electric generation. The Governor's Commission on Climate Change report proposes that CHP generation in Vermont be increased by 60 MW by 2028.

Historically, the main barriers to CHP development have included the following:

- Interconnection—Connecting the power grid to a CHP project has been a challenging task in the past. Complex interconnection standards and uncertain timeframes for utility responses have created barriers to new CHP projects.
- *Safety* A related issue to interconnection is the legitimate concerns associated with worker safety. If a distributed generator operates following an outage without isolating itself from the utility distribution lines, the energized line that the utility thinks is down can prove very dangerous. Appropriately installed interconnection equipment can minimize the hazard.

- *Tariff Rates* CHP typically requires standby power and interconnection fees to compensate the utility for services provided. However, discriminatory backup rates and high fees for interconnection can serve to discourage potential applications.
- *Customer Awareness and Feasibility Assessments* Customer awareness of the opportunities and the feasibility assessments for small projects can prove to be a barrier.
- *Initial Capital Costs* The high initial capital costs of a project can discourage an individual customer that is either short on capital or has high hurdle rates for justifying the commitment of significant capital.
- *Site-Specific Issues and Customer Confidentiality* The circumstan-ces that make a customer a candidate for CHP are site specific and therefore difficult to make effective generalizations. Nevertheless, customers in certain industries with sufficient heating or process loads may provide good candidates and may be attractive to Energy Service Companies (ESCOs) or third-party investors. Smaller customers, however, may not attract the attention of these companies.
- *Traditional Regulation* The strong link between profits and sales of utilities has historically diminished the enthusiasm of utilities toward distributed generation projects. (Alternative regulatory frameworks can help to break the link between profits and sales.) This can be compounded by inadequate statutory or regulatory guidance and direction. Also relevant here is inadequate awareness by some utilities of the benefits of distributed generation, including voltage support and reactive power.
- *Incentives* Incentives created in the marketplace may simply be inadequate to the task of overcoming the considerable volume of deterrents and barriers to warrant either third-party interventions or the barriers associated with customer ignorance.
- *Air Quality* To the extent that new CHP projects may cause additional harm to air emissions, the permitting of these projects may prove challenging. However, CHP projects should be viewed holistically to include the generation emissions that are also displaced on the electric generation side.

Vermont has responded to date to these barriers by establishing clear statutory frameworks supporting CHP, and permitting CHP projects to be net metered, even where fossil fuel sources may be involved. Vermont has adopted interconnection standards to address technical and safety barriers, as well as barriers caused by uncertain utility business practices.* Vermont has also reduced the barriers by creating opportunities for seed funding of projects through the Clean Energy Development Fund. Vermont has also helped to reduce the barriers caused by traditional regulation by permitting alternative regulation plans that help to break the link between profits and sales.

Recommendation 12 Encourage more CHP through technical assistance, targeted incentives leveraging, available funding sources, and through further efforts to reduce or eliminate regulatory barriers to cost-effective CHP project development.

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* Interconnection Standards (Institute of Electrical and Electronics Engineers Technical Interconnection Standard IEEE 1547), covers criteria and requirements for interconnection, including protection requirements at the interface (PSB Rule 5.500).

Timing	NEAR-TERM
Emissions Impact	MODERATE
Energy Impact	MODERATE
Capital Cost	HIGH (per customer)
Cost-Effectiveness	MODERATE
Funding Sources	--
Relation to GCCC	ESD-5
Current Status	Pilot for Micro CHP
Parties Involved	PSD, VT Utilities

a) *As resources permit, the DPS and Vermont utilities should identify sites where CHP is likely feasible, and encourage systems where appropriate. Locations should include those where CHP could be powered by natural gas supported by a possible expansion of pipeline or with ready access to appropriate transportation infrastructure for biomass (See also Strategy H covering natural gas).*
b) *Vermont electric utilities should annually review and strategically promote the development of power purchases from CHP projects within their service territories.*
c) *The DPS should work with Vermont utilities to strategically remove or mitigate remaining regulatory barriers to the introduction of cost-effective CHP projects.*
d) *The role of the Energy Efficiency Utility (EEU) should expand to allow provision of technical assistance and limited incentives for customers potentially interested in pursuing cost-effective CHP projects below a size threshold established by the Board.*
e) *The regulatory framework for Vermont's utilities should de-couple growth in sales from profits to ensure an alignment of interests between utilities and cost-effective customer-sited generation.*
f) *The DPS and Vermont utilities should establish nondiscriminatory rates for backup and interconnection (to be addressed in future rate design proceedings).*
g) *The CEDF should be leveraged to foster the development of CHP projects.*

STRATEGY E SECURE BALANCING-RESOURCE COMMITMENTS FROM LOW-CARBON REGIONAL PROJECT DEVELOPMENTS AND EXPLORE NEW OPPORTUNITIES WITH LONG-STANDING STRATEGIC PARTNERS

HYDRO QUEBEC AND OTHER OUT-OF-STATE HYDRO

In 1990 the PSB approved a 30-year agreement between a group of eight Vermont utilities, known as the Vermont Joint Owners (VJO), to purchase long-term base-load power from Hydro-Quebec (HQ) and to make it available at wholesale prices to the rest of Vermont's utilities. This HQ/VJO contract provided for increasing purchases of power from 51 MW in 1994 to approximately 310 MW in 2001. Part of this power was to replace a 150-MW contract with the DPS and other medium-term contracts signed between Vermont utilities and HQ in the 1980s. The remainder was intended to cover expected load growth. This contract is a take-or-pay arrangement, meaning that regardless of whether the Vermont utilities have the need for the power for which they have contracted, they must still pay for it (wholesale power markets provide Vermont utilities the

opportunity to resell excess HQ power). Currently the average cost of the HQ/VJO power is about 6.5 cents/kWh, which puts it somewhat below the cost of market alternatives in 2010. These contracts are the much discussed HQ contracts that begin to expire in 2012, with the bulk of the contracted power expiring by 2016.

HQ/VJO power is stably priced, immune to escalating fossil fuel prices and retrofit costs, and does not contribute to the air quality problems of our region.* Further, since the power is supplied from many generators, its reliability is based on HQ's total system reliability. The risk associated with the VJO 310 MW system purchase is considerably lower than the risk of purchasing an entitlement of comparable size in a single unit. However, the delivery over a few large interconnections does raise some of the same issues of size and risk associated with purchases of power from large generation units, but much of the risk is mitigated by the fact that transmission facilities generally have a much higher reliability than generation facilities, and the existence of surplus interconnection capacity on the HVDC (High Voltage Direct Current) line.

In addition to the Highgate and the HVDC interconnections, Vermont can, and sometimes does, utilize the interconnection between Chateauguay, Québec and New York to import power. The existence of this potential alternative path further reduces the risk of failure of one of Vermont's primary interconnections with Québec. Since each utility's level of dependence on this source varies, over-reliance may be a risk for some. Still, the ice storm of 1998 showed that transmission lines can be vulnerable as well. Events in the winter of 2004 further demonstrated that even this system power is not immune to reliability issues. Upgrades to transmission corridors between Canada and the U.S. are in progress between New Brunswick and New England. Further upgrades to the New England system and potentially Canadian transmission links are a matter of ongoing discussion between the New England states and the Canadian provinces.

HQ is a winter peaking system that potentially serves as a complement to the Vermont and New England summer peaking systems. Hydro-Quebec has 35,169 MW of installed capacity with about 167 TWh of domestic demand. Yet summer peak for the system is far below the HQ winter peak. The utility plans to develop a portfolio of hydroelectric projects totaling 4,500 MW and integrate 4,000 MW more of planned wind power by 2015. Projects now under construction—a portfolio totaling more than 1,400 MW that will add nearly 12 TWh in annual output—will increase Vermont's operating flexibility and strengthen the province's energy security.†

Other hydroelectric resources in Canada could be available for export to Vermont as well. Newfoundland and Labrador Hydro have plans to develop a new major hydro project called the Lower Churchill Development by 2015. The Lower Churchill Development located 200 km downstream of Churchill Falls would add another 2,264 MW to the electric grid. The Lower Churchhill Development includes the development of the Gull Island and Muskrat Falls project

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* All power purchased from HQ is system power that is not tied to any single unit. Ninety-seven percent of the HQ power is from hydro and 99.7% is from non-emitting sources. Hydro-Quebec, Sustainability Report 2006, http://www.hydroquebec.com/publications/en/enviro_performance/2006/pdf/rdd_2006_en.pdf.

† Hydro-Quebec recently completed the Eastmain Power Project (480 MW) in December 2006. Five other projects are under development and/or under construction. The projects under construction that total nearly 1,400 MW: Eastmain-1-A (893 MW), Chute-Allard, Rapides-des-Coeurs (193 MW), and Péribonka (385 MW) generating stations. The Romaine Complex is another project under study and promises to bring another 1550 MW some time after 2014.

sites. Newfoundland and Labrador Hydro are currently in the advanced field stages of project development and are exploring different options for bringing the remote power to the New England and neighboring markets.*

Since the late 1950s, Vermont has also obtained hydroelectric power from the New York Power Authority (NYPA) and its predecessor the Power Authority of the State of New York ("PASNY"). This power has been very inexpensive due to historical federal subsidies for hydro dam construction. Until July 1, 1985, Vermont received 150 MW of 0.2 cents/kWh energy from the St. Lawrence and Niagara hydro projects. As fuel prices soared in the 1970s, other states chose to take advantage of the low-cost NYPA power, and Vermont was forced to accept a lesser share. Under a decision by NYPA, Vermont's entitlement from the St. Lawrence project has gradually declined from 68 MW in 1985 to 1 MW by 1994. Vermont's entitlement to the Niagara project's power has also been reduced as a result of litigation; its year 2004 share is 11.2 MW. Even at this reduced level, the price continues to make this energy attractive to Vermont.

Recommendation 13 Vermont electric utilities should pursue opportunities for clean and renewable energy through long-term stably priced power contracts with neighboring provinces and power marketers

Timing	NEAR-TERM
Emissions Impact	HIGH
Energy Impact	HIGH
Capital Cost	POTENTIALLY HIGH (to electric utilities)
Cost Effectiveness	MODERATE
Funding Sources	Electric Utility Rates
Relation to GCCC	ESD-9, ESD-10
Current Status	Currently taking place
Parties Involved	PSB, PSD, VT Utilities, VJO

a) *DPS should continue to work with Canadian resources and neighboring states to ensure transmission capacity from Canada into the region.*
b) *Vermont utilities should explore the competitive opportunities for securing stable long-term power supply through purchase power agreements potentially available from Quebec, New Brunswick, Newfoundland, and/or marketers of clean energy products.*
c) *Vermont utilities should benchmark agreements against competitive market opportunities.*
d) *Vermont utilities should work to establish, as a goal, a carbon-emissions or intensity profile that is consistent with the performance under existing contracts.*

* Labrador Hydro continues to evaluate two potential market access options. These options include obtaining transmission service on Hydro-Québec's transmission system through Québec to neighboring markets, and secondly transmission via a sub-sea high-voltage direct current (HVDC) line through Newfoundland, connecting into New Brunswick's transmission system and providing access to New Brunswick and neighboring markets. http://www.lowerchurchillproject.ca/lcweb/lowerchurchill.nsf/PublicNews/C10AE5D80E536438A325732400493F7D?Opendocument&linkname=Default.

e) Vermont utilities and agents that are party to the negotiations of major contracts should ensure that the smaller municipal and cooperative utilities gain access to those resource contracts on similar terms and conditions.

STRATEGY F ENSURE ACCESS TO CLEAN, EFFICIENT, AFFORDABLE, AND RELIABLE ENERGY SUPPLY THROUGH REGIONAL COOPERATION AND COLLABORATION

The U.S. has one of the most expansive electric grids in the world. Electricity is sold in a regional marketplace and can move hundreds of miles before it reaches a customer. Vermont even receives nearly one-third of its power from Canada and is interconnected with its bordering states of New Hampshire, New York, and Massachusetts. There are several ways in which Vermont collaborates with regional partners to coordinate and facilitate electric and energy efficiency policymaking efforts that are taking place in the Northeast. Among these include (1) reducing barriers and constraints to effective regional trade, (2) the establishment of an effective and integrated marketplace for the attributes of cleaner resources, including Renewable Energy Credits (RECs) and regional greenhouse gas emissions (potentially through the Regional Greenhouse Gas Initiative), and (3) the establishment of effective markets for energy services that allow for integrated resource decision making (i.e., allow for greater substitution of resources for meeting energy and reliability needs).

REGIONAL ELECTRIC ENERGY TRADE

In August 2001, the New England Governors and Eastern Canadian Premiers established the Climate Change Action Plan. Among the objectives of that plan was to establish a comprehensive and coordinated regional plan for reducing greenhouse gas emissions. The region established goals of reducing regional GHG emission to 1990 levels by 2010, a 10% reduction by 2020, and 75–85% reductions below current levels over the long term. In 2007, the New England Governors and Eastern Canadian Premiers (NEG/ECP) adopted a resolution embracing Ministerial Recommendations to advance the regional GHG goals by reducing barriers to trade between New England and the Eastern Canadian Provinces. Improving energy trade and infrastructure improves Vermont's energy situation both directly and indirectly. Indirectly, improved trade regionally would promote more diversity and cleaner resources within the regional marketplace for energy that Vermont depends upon. At a regional forum on energy trade, the following issues and potential barriers were identified as promising areas for action:

Interconnection and Seams

Hydro-Quebec and New England Phase I and Phase II interconnections currently operate under a tariff structure that may artificially inhibit the transfer of electric energy between regions. The Northeastern International Committee (NICE) on Energy is working with the region's system operators to evaluate intersystem and interconnection rate structures that artificially inhibit energy flows.

Effective Use of Existing and Potential New Transmission Assets between New England and Canadian Provinces

Line upgrades and revised operating procedures for the greater New England and Canadian region can improve the capacity and the use of lines between Quebec/New Brunswick and New England.
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Long-Term Contracts

Some concern exists that with market reforms, the focus of market participants is on shorter-term contracts and the spot market. These shorter-term arrangements in turn focus attention on less-capital-intensive projects and proposals, including the abundance of large Canadian hydro or wind power that could be acquired by New England consumers (or sold into the Canadian marketplace during the winter). The NICE is proposing to explore mechanisms to facilitate and promote expanded use of long-term contract structures.

Resource Integration

Intermittent resources such as wind and hydro present unique operating characteristics and challenges. Intermittent resources may not be optimally integrated across the region due to the characteristics and procedures of the current operating environment. The NICE is working to develop a series of recommendations to improve the integration of intermittent resources in the region. Mechanisms under consideration include the following:

- Intra-hour schedule changes between balancing areas;
- Dynamic scheduling between balancing areas;
- Creation of larger balancing areas;
- Increased controllability of generation and loads;
- Opportunities for storage facilities; and
- Inter-area coordination of reactive supply and voltage support.

Recommendation 14 Work with neighboring states and provinces to foster strategies for acquiring imports of certain non-carbon-producing alternatives to New England fossil generation, including the development of new transmission corridors.

REGIONAL GREENHOUSE GAS INITIATIVE (RGGI)

Ten Northeast and Mid-Atlantic states, including Vermont, are creating a regional cap-and-trade program, initially encompassing carbon dioxide emissions from power plants in the region over 25 MW. Under a cap-and-trade program, total emissions in the participating states are capped through the issuance of a limited amount of emissions certificates to each state. Generators must purchase these certificates to emit carbon. The model rule, agreed to late in 2006, was the result of a 3-year process of collaboration between states to reduce greenhouse gas emissions in the region.[*] The agreement covers about 450 net electric generating units, which will have total CO_2 emissions

[*] Vermont, Connecticut, Deleware, Maine, New Hampshire, New Jersey, and New York were the initial states to sign onto the agreement. Massachusetts and Rhode Island, while full participants in the process, signed on in early 2007. Maryland, an observer to the process, signed on in April 2007. Pennsylvania, the District of Columbia, and the Eastern Canadian Provinces have been observers to the process.

capped at approximately 188 million tons. The cap will be fixed at this level for the period from then decline 10% by December 31, 2018. Should emissions fall below the cap due to actions related to this Plan or other emissions-reduction policies, credits would become less expensive. It would then be incumbent on participating states to lower the cap to achieve the desired effect of lowering emissions. Alternatively, RGGI may be extended to include other sources of greenhouse gas emissions and greenhouse gases other than CO_2.*

Each state is allocated a certain amount of credits on the basis of historical usage patterns to allocate to its utilities to meet the RGGI requirements. Vermont has been allocated 1.23 million short tons CO_2 for the years 2009 through 2014, or 2.2% of the cap on just the New England states.[8] This allocation was based in part on the potential for significantly higher emissions after 2012 and 2015, respectively, if the contracts for power from Vermont Yankee and Hydro Quebec are not renegotiated. Carbon-emitting generators are required to obtain certificates to match their emissions. Vermont will likely participate with the other states in the RGGI group to auction its allotment of certificates. Since the acquisition of these certificates effectively becomes a cost of doing business for generators, the cost of certificates will become embedded in the market price for electricity. Non-emitting resources will see their value increase because of this, but will not need to purchase certificates.

With respect to the Regional Greenhouse Gas Initiative, Vermont is in a unique position as it is the only participating state with vertically integrated and fully regulated distribution utilities. Market implications of the RGGI will flow through to consumers, but allowances granted to Vermont will buffer the price impact of the RGGI. Funds collected from the sale of allowances can be directed to consumers and projects that are consistent with the goals of the Initiative. Pursuant to Act 92, Vermont will use funds from the program to fund activities associated with the All-Fuels Efficiency Program. The next step in that process will be to establish the program and to appoint a Consumer Trustee to manage Vermont's participation in the regional auction of allowances and to manage the distribution of program funds.

Recommendation 15 Work cooperatively with neighboring states to ensure the success of the RGGI program through sound auctions, transparent and predictable markets, and an effective oversight of RGGI Inc.

Recommendation 16 The Northeast or U.S. should institute a sound multi-sector regional or national GHG cap-and-trade program, relying on RGGI as a foundation.

FORWARD CAPACITY MARKET (FCM)

The Forward Capacity Market (FCM) is a regional market established in New England, to ensure adequate installed capacity to meet future demands for electricity. As it is designed, installed capacity can be bid in during an annual forward capacity auction. The capacity that clears the market is then delivered (three years later) through either generation resources or energy efficiency load response resources. The 3-year window provides bidders with sufficient time to construct or develop the resources necessary for estimated peak day requirements. The FCM provides payment

* For more information on the RGGI program, see www.rggi.org.

to electric suppliers, such as electric generation plants, distributed generation resources and energy efficiency programs, to meet the projected electric demand. The first FCM auction took place in February 2008, during which 2,554 MW (out of 3,400 MW of qualified resources) cleared the auction. The auction was considered successful as it ensured that low-cost and reliable resources would be available to meet demand and that no new physical generating capacity would be needed in the near term. However, the capacity market will continue to require close evaluation by regional policymakers to ensure that there are enough (but not too many) suppliers and that there is long-term market stability.

Challenges for Demand Resources in the FCM

The ISO FCM was the first U.S. capacity market to allow demand resources to bid into the market. However, bidding demand resources into the FCM still presents challenges. Producing accurate forecasts which take into account the load-reducing impact of demand resources remains to be a challenge. First, forecasting techniques which incorporate demand resources are still being perfected. While forecasts of capacity requirements have historically been fairly accurate, incorporating energy savings as added capacity requires relatively new forecasting techniques, which will require further refinement. Accurately measuring the peak day saving produced by demand-side resources is an additional challenge for forecasters. Measuring these savings requires a sophisticated analysis and verification process that is being refined as more experience is gained. Less accurate forecasts in the short run could be problematic. If the forecast is too high, ratepayers bear the cost of paying for additional generation that is not needed; but if it is too low, not enough resources will be allocated and system reliability is threatened. While significant costs have been incurred to refine the measurement and verification methods used for efficiency resources in Vermont, revenues still far exceed these costs. Further, these refinements improve the reliability of the savings reported from efficiency resources, and improve the accuracy of future forecasts of efficiency savings

Previously, the commitment required for participation in the FCM is longer than efficiency resource planning cycles for in Vermont. Capacity commitments into the market go well beyond three years – the Energy Efficiency Utility contract structure only allowed for a 3 year period. The Public Service Board recently mitigated this issue to some extent, modifying the structure of the State's efficiency services to an "Order of Appointment." This Board Order and the Order of Appointment are discussed in more detail in Section V. Efficiency program participation in the FCM generates significant revenues for Vermont. Cooperation between providers of demand resources has also led to increased market synergies and regional cooperation among efficiency programs.

Recommendation 17 Vermont should continue to work with other New England states to ensure that demand-side resources are appropriately integrated into regional markets like the ISO-NE Forward Capacity Market (FCM).

a) *Vermont should continue to lead the region in the utilization of energy efficiency resources in the FCM.*
b) *Vermont and regional partners should continue to monitor and encourage a stable market design that delivers adequate capacity.*

c) Vermont should encourage regional adoption of a competitive market system (like the FCM) for the electric reserve and other electric supply resources.

d)

OTHER REGIONAL COLLABORATION

Vermont participates in a number of regional forums addressing a range of regional electricity and energy-related matters. One of the most active and important of these forums is the New England Governors' Conference. The New England Governors' Conference combines with the Eastern Canadian Premiers to form the Conference of New England Governors' and Eastern Canadian Premiers. The Conference has been very active in recent years and has been working closely to foster stronger ties on issues of energy trade and the environment.

New England Governors' Conference (NEGC) and the Eastern Canadian Premiers

The Conference of New England Governors and Eastern Canadian Premiers ("the Conference" or "NEG/ECP"), which first met in 1973, is a unique, interregional, binational organization. The annual Conference generally ranges over a variety of topics, but increasingly has focused on energy issues in recent years. In 2001, the Conference established formal commitments to reduce greenhouse gas emissions in 2020 by 10% and to further reduce emissions 75–85% subject to further scientific analysis of this target. 2007 meeting, the Conference participants agreed to a long list of detailed recommendations from the *NEG/ECP Ministerial Forum on Energy and the Environment* and directed its committees to begin implementation of these actions. Vermont agencies were active participants in the creation of the Ministerial Forum recommendations. The recommended actions covered four major areas: energy efficiency, energy trade, renewables, and transportation. Many of the recommendations made in this energy Plan refer to working in a regional context to achieve greater market power and penetration and to pool resources to a common goal. The Conference of New England Governors and Eastern Canadian Premiers convenes officials from neighboring jurisdictions to implement regional actions; Vermont will continue work cooperatively within this context to implement past recommended actions and to creatively ensure affordable, reliable, clean, secure, and safe energy supply for the region.

To ensure that a reliable and robust power system exists in New England there are several other initiatives and recommendations that Vermont policymakers should support. Several recommendations that were proposed in the ISO-NE Regional Plan provide an excellent reference point for state participation in regional collaboration.

Use of System Resources

Demand response and energy efficiency can be used effectively to manage not only load growth, but the shape of the load profiles within the region. Further improvements to the load profile may come through "valley filling" that may become possible as a plug-in hybrid vehicle fleet is developed and charged during off-peak hours. Increasing the system's load factor would result in fuller use of available electric infrastructure and reduce the average cost of wholesale and retail electricity.

Fuel Diversity and Availability

New England relies on natural gas generation for roughly 40% of its capacity and energy needs. Natural gas generation establishes the market clearing price for resources the vast majority of the time. New England's heavy reliance on natural gas presents concerns for price stability and, at times, reliability and availability of resources. The region has created incentives for developing resources through the establishment of the Forward Capacity Market and the Forward Reserve Markets. Some diversity and availability concerns are being addressed through requirements for dual-fuel, fast-start resources, especially important to constrained areas like parts of Connecticut. However, further diversity is needed through imports from Canada, and potentially New York.

Gas Supply

Diversity may also come through the development of additional natural gas imports to the region, to diversify the sources of natural gas. Currently New England electric generation is heavily dependent on gas from the Gulf region. Substantial imports from New Brunswick will greatly diminish our dependence on a potentially vulnerable supply of gas. The new LNG terminal in New Brunswick capable of delivering 1 bCF into the region is due to be completed in late 2008. Further expansion of LNF facilities in New England would only add further supply diversity to the New England mix.

Seasonal Availability of Natural Gas–Fired Resources

As noted above, on a cold January in 2004, the region's limited firm gas supply was stretched between heavy residential and commercial heating loads, and the heavy demands from natural gas-fired generation in the region. ISO-NE recommends that the region continue working with the Northeast Gas Association (NGA) to coordinate electric and gas system operations and planning activities and potentially refine ISO operating procedures to avoid a potential repeat. ISO-NE also recommends that we assess the arrangements for firm procurement and transportation of natural gas and expand the operability of dual-fuel units.

Regional Environmental Goals

As noted above, the region is committed to aggressive GHG targets. Even beyond the GHG emissions, however, the region faces aggressive goals for SO_2, NO_x, and mercury from the EPA Clean Air Interstate and Clean Air Mercury Rules that apply to non-attainment states, largely in southern New England. The developed zero- or low-emitting resources, such as renewable resources and "clean" demand-side resources, help ensure that the region meets national, regional, and state environmental and renewable resource requirements.

The Planning Process and Regional Planning Initiatives

The New England region needs to complete the formation of its own planning process to parallel the Vermont planning process that is necessary to evaluate least-cost provision of transmission and alternatives for meeting reliability needs. ISO-NE must implement requirements of FERC Order

890 and work with the New England States Committee on Electricity (NESCOE), once it is established, and other stakeholders must be established to parallel Vermont's own planning initiatives. The focus of these planning efforts should be on the incorporation of demand resources and renewable resources and on market efficiency needs of the region to reduce costs and use existing resources more efficiently. The planning efforts need to include coordination and joint planning efforts with neighboring systems.

Recommendation 18 Vermont should work with ISO and appropriate regional organizations to foster sound planning and planning processes within the New England region consistent with the Regional System Plan.

STRATEGY G ESTABLISH A UTILITY PLANNING AND REGULATORY ENVIRONMENT THAT COMPLEMENTS AND ENCOURAGES POLICY OBJECTIVES FOR COST-EFFECTIVE RELIANCE ON ENERGY EFFICIENCY, RENEWABLE ENERGY, AND CHP

INTEGRATED RESOURCE PLANNING AND DISTRIBUTED UTILITY PLANNING

All Vermont's distribution utilities are required to file Integrated Resource Plans (IRPs). Vermont's utilities are also required to engage in distributed utility consideration of alternatives via Integrated Transmission Planning.

Background

For many years, Vermont utilities relied on traditional cost-of-service regulation of its utilities to assure Vermont's regulators and ratepayers that rates were "just and reasonable."* The basic mechanism for assuring reasonable service was to hold utilities to certain standards of service and service obligations, and in exchange they were assured cost recovery for all prudently incurred costs that were deemed "used and useful." Longer-term planning requirements and considerations were addressed largely through the long-term planning requirements of utilities.

With the implementation of V.S.A. § 218c in 1992, each regulated electric or gas company was then required to prepare and implement a least-cost integrated plan. As the law still states, utilities must periodically file plans that meet the public's need for energy services, after safety concerns are addressed…

> *at the lowest present value life cycle cost, including environmental and economic costs, through strategies combining investments and expenditures on energy supply, transmission and distribution capacity, transmission and distribution efficiency, and comprehensive energy efficiency programs.*

Docket 5270 further required that utilizes consider demand-side resources in their planning process. Soon after V.S.A. § 218c was implemented, however, northeastern electric generation

* Under Vermont statute, the overarching standard for setting rates is one of "justness and reasonableness," pursuant to Section 225 of Title 30.

markets became deregulated and electric energy efficiency programs in Vermont became the responsibility of the EEU. This change caused utilities to examine their generation resources under a shorter-term planning process as long-term investments were no longer guaranteed. Furthermore with the adoption of the EEU structure in Vermont, utilities had reduced demand-side planning responsibilities. Nevertheless, the IRP process continued to be an important exercise and has facilitated joint efforts among utilities to bring the least-cost generation to Vermont ratepayers.

Vermont utilities remain very small in relation to the size of utilities in almost all states in the U.S. In relation to the size of transmission projects and generation projects, the size of Vermont's utilities can prove a challenge for delivering inexpensive energy. In many instances throughout Vermont's history, Vermont utilities have had to band together to construct and participate in major projects or contracts. This was true in forming the first U.S. transmission company (VELCO) and later in building Vermont's first nuclear facility, Vermont Yankee. Other major contracts and investments that involved similar joint efforts of Vermont utilities included the construction of the McNeil Biomass Generating Station operated by the City of Burlington, and the Hydro-Quebec contract through the Vermont Joint Operating (VJO) Group.

Vermont utilities continue to operate in a vertically integrated regulated utility environment. In this regard, Vermont is an island. Every other state in New England and the Northeast region of the U.S. has introduced retail competition. Additionally, wholesale market competition has substantially altered the environment for both Vermont utilities and the load-serving entities that serve retail customers throughout New England.
The marketplace that surrounds us has had a major impact on Vermont utilities in several ways. First, the marketplace itself has emerged as very volatile. Between March 1, 2003, when the Standard Market Design was established and 2007, the Day-Ahead Locational Marginal Price (LMP) has varied between $0 and $550/MWh and averaged roughly $63/MWh. Price levels in the last 6 months, wholesale price levels, have risen well above those historic levels and forward prices for the remainder of this year and into the next several are averaging above $100/MWh.

The IRP process, as it exists today, is fairly open, leaving utilities free to interpret the Vermont statute and prior orders related to the IRP process. This has resulted in significant engagement between utilities and the Department of Public Service, but has also required a significant investment of resources both from utility planners and Department staff. The IRP process could be better streamlined if the PSD provided utilities with more specific guidelines for IRP documents.

Recommendation 19 Continue to assist the long-term planning efforts of Vermont utilities and improve the overall planning process and review.

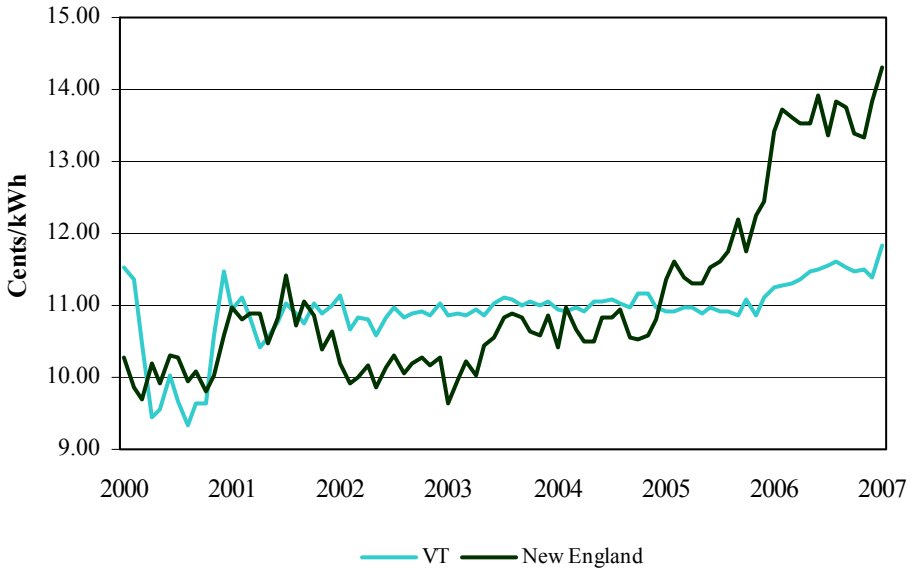
a) Vermont Department of Public Service should revisit the existing planning efforts of Vermont utilities and the associated regulatory review for improvements.

ALTERNATIVE REGULATION

The Vermont General Assembly recognizes the challenges facing Vermont's utilities. Roughly one-half to two-thirds of Vermont utility costs are comprised of generation costs from volatile power markets. Vermont utilities can manage the uncertainty in these costs to a certain degree by

acquiring the resources directly or by engaging in longer-term purchased power markets that are independent or relatively independent of the purchase power markets.

Figure III-5 Average Rates, Vermont vs. New England



Vermont's utilities have moved on both fronts to help manage their exposure to these markets. Even before the beginning of the wholesale markets, Vermont utilities had a relative advantage. Vermont utilities had made investments in hydro resources of their own, had established long-term contractual relationships with Hydro-Quebec, had contracted relatively inexpensive power from Vermont Yankee, and had established relatively high prices, albeit stably priced arrangements with Independent Power Projects under Rule 4.100. Then in the early 1990s, Vermont utilities engaged in long-term purchased power contracts with Hydro-Quebec for what came to be roughly one-third of our resource mix. Vermont utilities also sold their assets and obligations in Vermont Yankee for a stably priced replacement contract. The result has translated into relatively stably priced resources.

The second front in which Vermont utilities are moving is that of alternative regulation. Alternative regulation helps Vermont utilities by allowing them to engage in purchased power arrangements that can be passed through to consumers through a purchased power adjustment mechanism. Vermont regulators, however, have required that these mechanisms be designed in a way that will preserve utility incentives to manage these costs through share savings performance mechanisms.

The result, then, of these alternative regulation plans, together with the heavily hedged power contracting arrangements by Vermont's utilities is that Vermont utilities have established a fairly transparent and stably priced environment. Figure III-5 shows the impact of Vermont's investments on retail prices between Vermont and the region. As can be seen from the figure, Vermont's prices have historically been above the region, but more recently have been below rates among our neighboring states as price levels in those states have risen with the wholesale price levels to unprecedented scales.

Recommendation 20 Evaluate the performance of Vermont utilities under existing and proposed alternative regulation plans and modify plans to better serve the long-term interests of Vermont consumers.

Vermont utilities are still in the early stages of experimenting with alternative regulations plans. The plans will need to be closely monitored for their performance and goals, and modified as appropriate to ensure that the performance of these plans are consistent with statutory objectives, utility shareholder objectives, and the goals of the plans for sound regulation on behalf of ratepayers and Vermont.

TRANSMISSION PLANNING

Following Public Service Board concerns over the long-range planning process in relation to the Northwest Reliability Project, the Vermont General Assembly took action through Act 61 of 2005 requiring that VELCO publish a 10-Year Transmission Plan on a 3-year cycle beginning with July 1, 2006.[*] At roughly the same time, the Public Service Board opened an investigation into Least Cost Transmission Planning through its broadly framed investigation in Docket 7081. The purpose of the Board's investigation was to build on the legislative requirement to help ensure that there is better coordination between VELCO, the distribution utilities, the EEU, and potential merchant service providers to establish integrated least-cost service to mitigate potential reliability challenges. The process was also established to develop a framework for considering non-transmission alternatives to pending threats to system reliability. The process was also established to help foster greater transparency in the planning process and more meaningful public participation.

The investigation concluded with the establishment of the Vermont System Planning Committee (VSPC). The website for the planning process is at www.vermontspc.com and is open to the public to follow and stay informed about projects and the planning efforts of the VSPC.

The Vermont System Planning Committee is a unique entity that represents a collaboration of bulk transmission planners, distribution utility planners, Efficiency Vermont, the Department of Public Service, and various publicly appointed members, designed to help fulfill the promise of Docket 7081 and Act 61: addressing potential reliability concerns through the lowest cost combination of energy efficiency, demand response, generation, and bulk and subtransmission solutions.
The Vermont System Planning Committee has meets on a quarterly schedule. Most of the activities of the VSPC take place at the subcommittee level. The VSPC is composed of a number of standing subcommittees, including the Technical Coordinating Subcommittee (TCSC), the Energy Efficiency and Forecasting Subcommittee (EEFSC), the Generation Subcommittee (GSC), the Transmission Subcommittee (TSC), and the Public Participation Subcommittee (PPSC). There are also two temporary committees that were established to deliver short-term items. The Procedures Subcommittee (PSC) was formed to establish the rules of procedure and the Non-Transmission Alternatives Subcommittee (NTASC) was established to develop a screening tool to help distinguish reliability challenges or transmission projects that could only be served through a

[*] The VELCO 10-Year Plan is currently on its web site at www.VELCO.com.

transmission solution, and those areas for which an alternative may be available to address the need. The structure of the VSPC also contemplated the establishment of subgroups designed to permit substantive engagement on issues of affected utilities, consideration of alternatives, cost allocation, and other recommendations to the full committee.

Only one project subgroup has been established by the VSPC. At the December 2007 meeting of the VSPC, a subgroup was formed to address the reliability concerns associated with the coming summer and deficiencies in the system that could potentially be addressed by either the Coolidge Connector or the completion of several transmission projects in progress.

As adopted at the March VSPC meeting of the full committee, the following responsibilities/charter will apply to its subcommittees:

1. Technical Coordinating Subcommittee (TCSC)

The Technical Coordinating Subcommittee acts as a bridge among the various other subcommittees to explore cross-cutting and overlapping issues that may come before the other subcommittees and the full committee. The Technical Coordinating Subcommittee can serve as a microcosm of the whole process; it can allow something short of having to convene the whole VSPC to get some guidance and direction on an issue. The overall charge to this group is to coordinate and ensure that the standing subcommittees and project study groups are working in a coordinated and positive way.

A secondary role for this subcommittee is to cover cross-cutting issues that are not neatly placed in one of the other subcommittees. This subcommittee serves as an ad hoc filter for the work of other committees, assisting in framing issues for consideration by the VSPC.

2. Energy Efficiency and Forecasting Subcommittee

The Energy Efficiency and Forecast Subcommittee serves an advisory role to VELCO, the utilities, and project subgroups concerning the development of forecasts in relation to planning efforts and incorporating the impacts of energy efficiency and demand-side resources, particularly for NTA analysis. The Subcommittee worked with EVT in developing its 20 year forecast of energy efficiency resources, and is facilitating the development of integrated forecasts of load that use consistent, well defined assumptions for the treatment of efficiency, load management, and other resources that affect load.

3. Generation Subcommittee

The Generation Subcommittee is responsible for the following:

- Developing generic generation costs and market revenue estimates related to potential generation resources to be utilized in the detailed Non-Transmission Alternative (NTA) Analyses.
- Reviewing and assessing the reasonableness of the generation assumptions for new and existing resources in VELCO's load flow model.

- Acting as the entity that receives "open door" proposals within the VSPC, and provides VELCO and/or Lead DU's with recommendations (on the basis of the committee's evaluation of technical, economic, feasibility, or other considerations) related to inclusion of such proposals in future long range transmission planning assumptions and detailed NTA Analyses.

4. Transmission Subcommittee

The Transmission Subcommittee is responsible for the electric system modeling and advising the VSPC regarding transmission planning studies. The Transmission Subcommittee is also responsible for advising the VSPC on various detailed matters related to effective utility determinations and preliminary and detailed NTA determinations.

5. Public Participation Subcommittee

The role of the VSPC Public Participation Subcommittee is to act in compliance with the Docket 7081 MOU as a resource in the development, implementation and evaluation of public involvement with the Vermont System Planning Committee (VSPC). The subcommittee will provide its analysis and input to the full VSPC in all matters within the public participation arena.

The VSPC has been in existence for 7 months since first meeting. Most of the work associated with the VSPC has been early organizing and establishing the roles for the subcommittees and establishing procedures. Substantive work has begun to address the next transmission planning cycle. VELCO is preparing its next Transmission Plan, due on July 1, 2009. The VSPC Coolidge Bridge Study Group has also been active in developing effective demand-response resources for the coming summer reliability concerns.

Next steps identified by the respective committees include the following:

Technical Coordinating Subcommittee

- Establish timeframe for the list of Project Priorities and Coordinate Subcommittee/Study. Group work among the other Subcommittees to ensure timely treatment of all reliability concerns identified in or since the last Transmission Plan.

Energy Efficiency and Forecast Committee

- Help ensure effective and meaningful cooperation and collaboration between the EVT forecast of Energy Efficiency Program activities long term and the VELCO statewide long-range forecast plan for the 16 reliability regions identified in Vermont.
- Establish the various guidelines identified in its charter connected to the coordination of DSM with forecasts, accounting for forecast uncertainties, coordinating forecasts among the distribution utilities, and recommending data sources.

NTA Subcommittee

- The NTA Subcommittee is scheduled to complete a preliminary screening tool for projects by mid-July 2008.

Procedures Subcommittee

- Incorporate revisions to the Rules of Procedure from the March 2008 Committee meeting.

Coolidge Demand-Response Study Group

- Establish a strategy for Vermont distribution utilities and VELCO to employ for using demand-response resources cost effectively to manage the reliability concerns of 2008, 2009, and 2010.

The work to date has established a list of future reliability concerns. While the list is long, the following map attempts to identify the area where there appears to be the greatest overlap, and consequently the strategic location of generation or targeted DSM activities may have the greatest impact. The map was developed by VELCO staff for the VSPC and represents the "affected areas" impacted by reliability concerns associated with project areas identified in Appendix D. They include the following:

- Coolidge Connector Affected Area
- Middlebury Study Area
- St. Albans–Fairfax–Georgia Study Area
- Loss of One Essex 115/34.5 KV Transformer (East Avenue)
- Northern Vermont Low-Voltage Collapse
- Long-Term Loss of PV20 Underground Causeway Cable
- Williston to Tafts Corners 115 KV Line Loss
- Berlin to Middlesex 115 KV Line Loss
- New Haven/Williston Study Area
- Barre to Berlin 115 KV Line Overload
- Florence to West Rutland 115 KV Overload

Figure **III-6** shows the overlapping areas of potential reliability deficiencies that are described individually in Appendix D, from the VSPC 2008 Annual Report to the Vermont Public Service Board.[9] Areas with the most overlap reflect areas in which potential non-transmission solutions, such as targeted DSM or the addition of new generation would likely have the greatest impacts. Figure III-7 is a map of Vermont showing suitable locations for siting commercial scale generation projects. Figure III-7 also highlights the transmission corridors that would benefit from the addition of new generation and potentially help to defer the need from transmission upgrades to address potential future reliability deficiencies.

Figure III-6 Areas of Overlap for Major Reliability Concerns

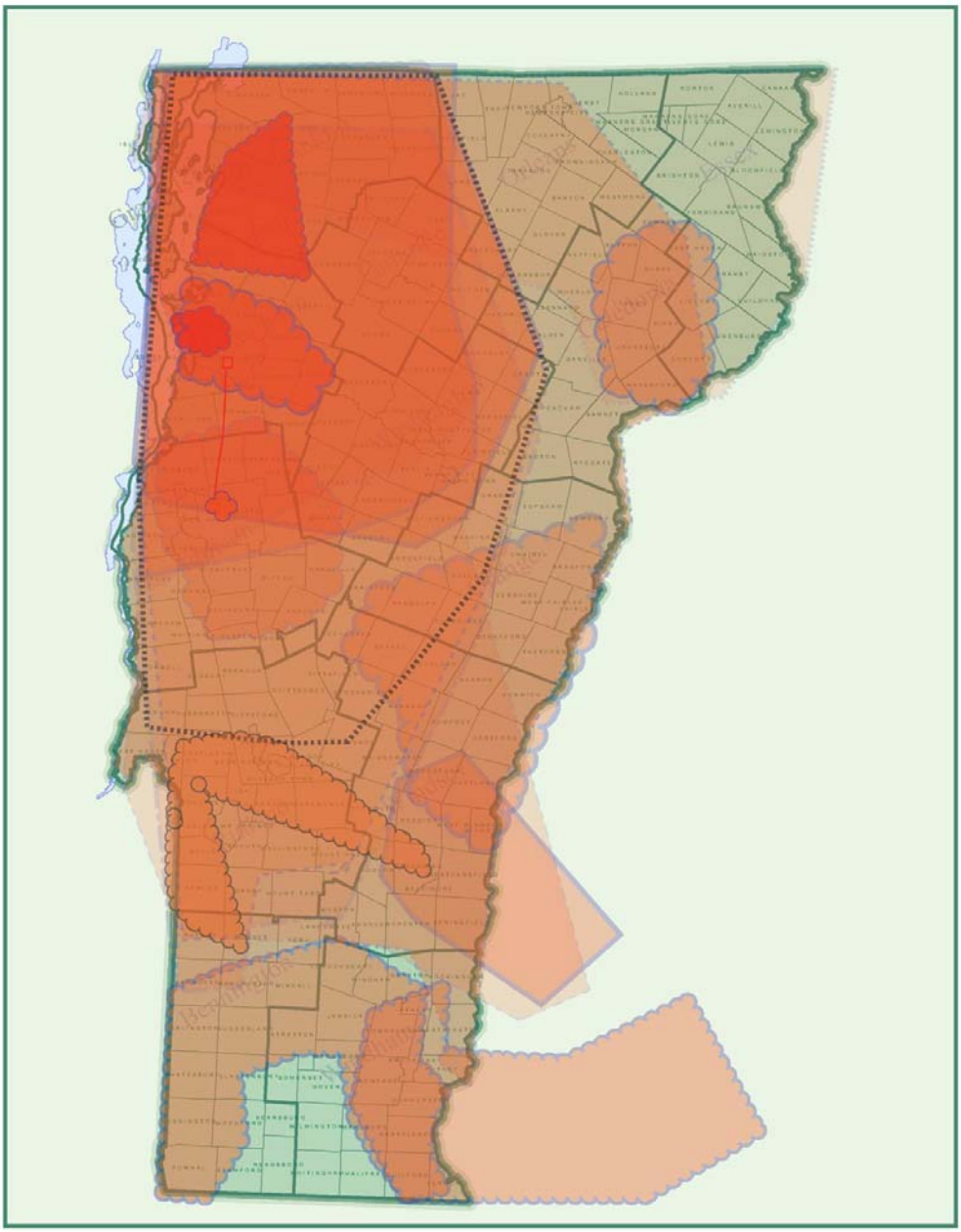
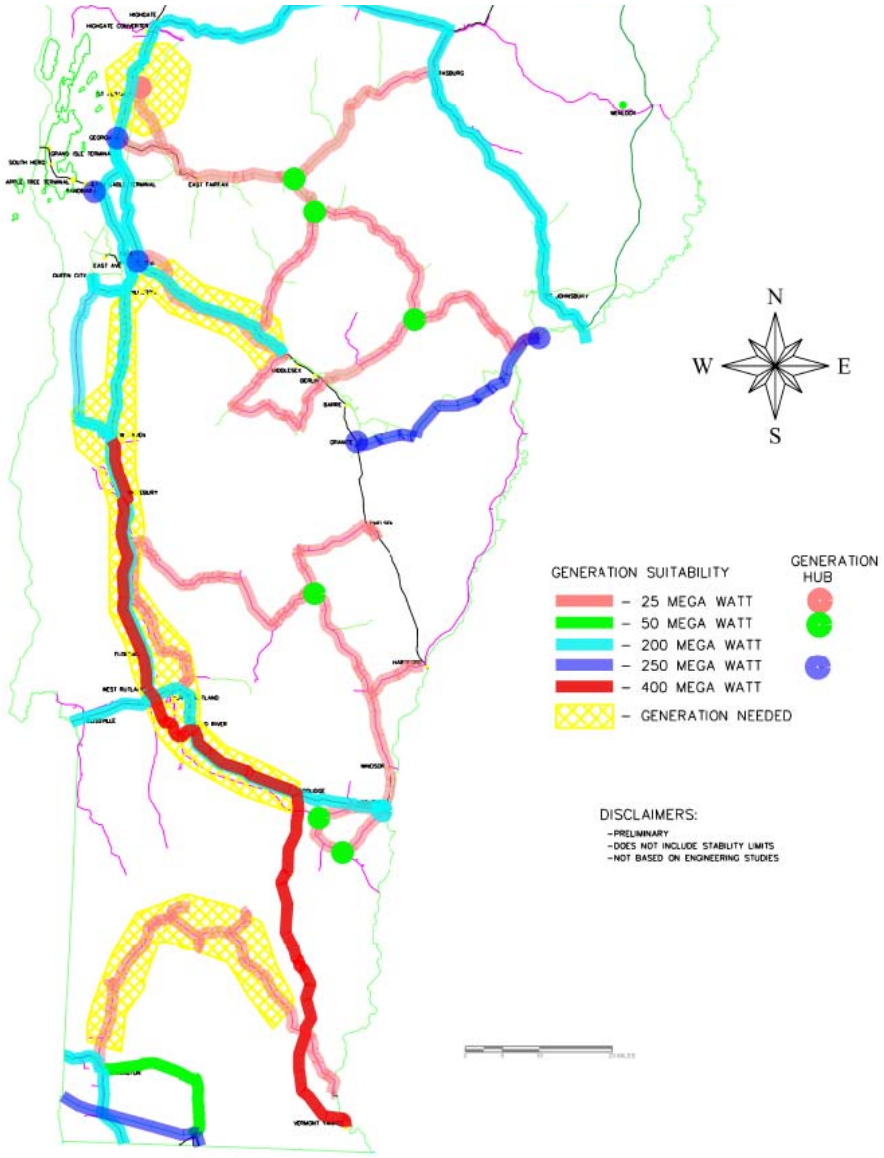


Figure III-7 Map of Suitable Generation in Vermont[10*]



Recommendation 21 Continue to build and foster the development of a transparent, comprehensive, and integrated planning framework for Vermont's bulk and subtransmission resources consistent with the goals established in Public Service Board Orders and Vermont statutes.

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[*] The graphic is from a draft of the Phase II generation feasibility study. The graphic provides a preliminary view of the areas that would be best suited for generation. Later refinements of this analysis may reveal addition issues and concerns with the locations identified for certain generation sizes.

a) *The VSPC should continue to make progress toward the establishment of an effective and transparent integrated transmission planning process in Vermont.*
b) *VELCO should continue work with the VSPC to establish a statewide forecast of peak load growth that integrates long-term projections of EVT efficiency programs.*
c) *Vermont utilities should work collaboratively with VELCO to ensure that demand-response capabilities are effectively utilized during the summer peak seasons from 2008 to 2010, to help relieve reliability concerns associated with Vermont and regional transmission projects in process.*
d) *The VSPC should establish and modify as appropriate the planning framework and committee/study group process to allow timely consideration of transmission and non-transmission alternatives in a transparent planning environment.*
e) *The VSPC should move to organize the study groups needed to support timely consideration of reliability concerns.*
f) *VELCO, Vermont utilities, and the VSPC should regularly update and review their strategic priority project list to provide timely NTA consideration for the growing list of reliability deficiencies and concerns.*
g) *VELCO, Vermont utilities, and the VSPC should establish implementation plans and schedules to ensure timely review of projects consistent with the priority list.*
h) *Vermont planners and utilities should strategically encourage the location of generation (merchant or utility projects) and geotargeting of DSM in areas of the state, and in seasons that are likely to create the greatest long-term project deferral or avoidance benefits.*

MANDATORY RELIABILITY STANDARDS

Largely in response to the August 14, 2003, blackout, the U.S. Energy Policy Act of 2005, signed into law on August 8, 2005, authorized the creation of an "electric reliability organization" (ERO) that would cover the U.S. and Canada, and that would develop and enforce mandatory electric reliability standards. On July 20, 2006, the Federal Energy Regulatory Commission (FERC) certified the North American Electric Reliability Council (NERC; now the North American Electric Reliability Corporation) as the ERO for the United States. On March 15, 2007, FERC approved 83 NERC reliability standards, and these standards became mandatory on June 18, 2007. Violation of the NERC standards will result in enforcement actions including possible fines of up to $1 million per day.

As one part of meeting the NERC standards, Vermont plans its high-voltage transmission system to the so-called N-1-1 (N minus one minus one) reliability standard. The "N" represents the total number of transmission facilities (such as transmission lines, substation transformers, etc., as well as generation units) on the transmission system under consideration (for example, within Vermont state borders—the VELCO transmission system). The first "–1" means that a critical generation or transmission facility is lost (for example, a tree falls on a transmission line and takes it out of service), and then the utilities have 30 minutes to reposition the transmission system before a second transmission facility is lost (the second "–1").* The transmission system must be able to withstand the loss of any two facilities without the uncontrolled loss of load (i.e., a blackout). The

* Other common terms are N–0 (all facilities in service), N–1 (the loss of one critical facility), and N–2 (the simultaneous loss of two critical facilities).

standard does allow the utilities to shed some load in a controlled fashion to avoid a larger, uncontrolled blackout. To ensure that the transmission system can withstand the loss of any two facilities, for planning purposes it is assumed that the two most critical facilities are lost. VELCO performs transmission system studies to determine the Vermont statewide peak load level (in megawatts [MW]) at which the existing transmission system could not meet reliability criteria, and it is at this statewide load level that a transmission system upgrade would be needed. For example, VELCO's Southern Loop Project proposes a second 345 kV line between Vernon and Cavendish, which VELCO has determined needs to be placed in service before a statewide load level of 1,155 MW is attained (predicted to occur in 2010).*

Figure III-8 Vermont Statewide Load on VELCO System shows the actual statewide hourly load level as measured on VELCO's system between June 1, 2007 and September 30, 2007. If we assume the hypothetical situation that the next transmission upgrade is needed at 1,000 MW, it can be seen that it is only a small number of hours (typically on the hottest days of the summer) that the load level is above the hypothetical 1,000-MW threshold for a transmission upgrade. Put more generally, it is typically the load level during only a very small number of hours a year that drives the need for transmission upgrades. If peak demand can be reduced on those hot summer days, transmission projects could at a minimum be deferred, or at best perhaps even avoided.

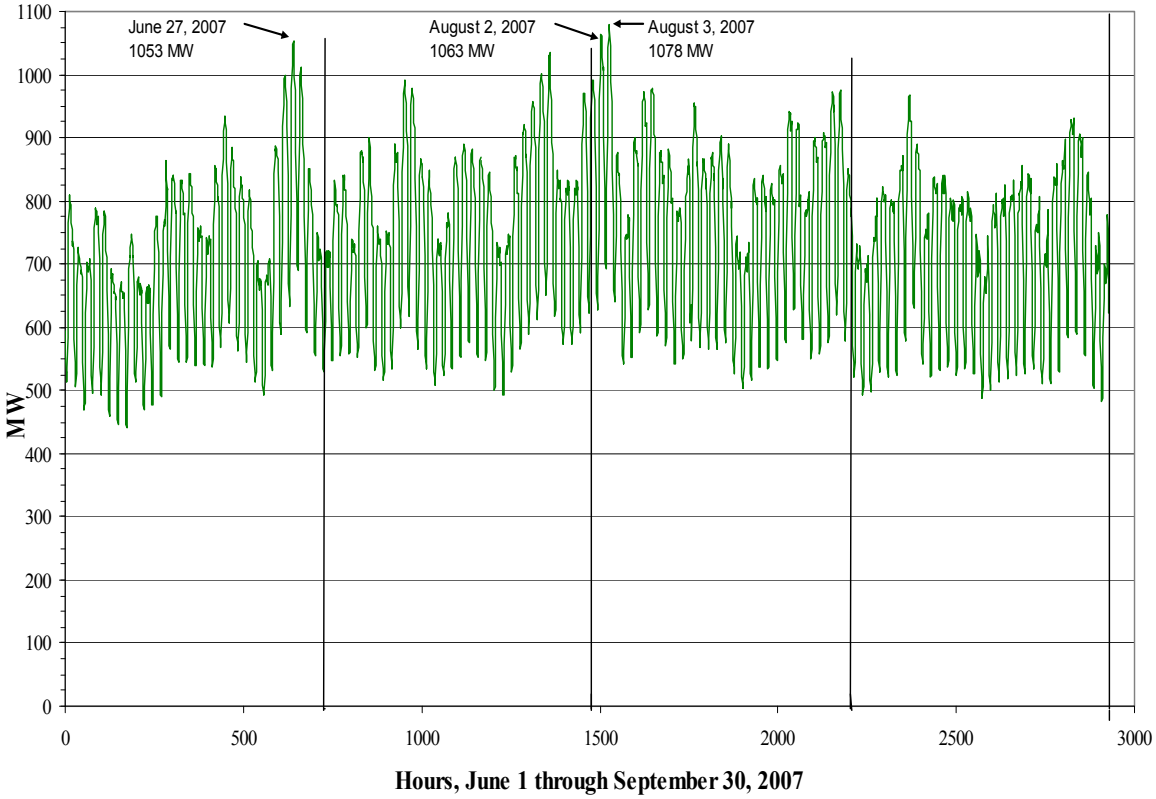
Conservation voltage regulation or conservation voltage reduction (both abbreviated "CVR") is the practice of maintaining the customer's minimum voltage at the lower end of the allowable range (114–126 V) as a technique to reduce overall electricity consumption for certain types of loads. CVR is discussed in detail on pages 5-23 through 5-25 of the 1994 Vermont Twenty-Year Electric Plan, and will not be repeated here, but is incorporated into the 2008 Plan by reference.

Recommendation 22 Electric utilities should implement Conservation Voltage Regulation where appropriate.

Timing	NEAR-TERM
Emissions Impact	MODERATE
Energy Impact	MODERATE
Capital Cost	LOW
Cost-Effectiveness	MODERATE
Funding Sources	Electric Rates
Relation to GCCC	--
Current Status	Currently in place for portions of Vermont electric utilities
Parties Involved	VT Utilities

* This assumes that the Northwest Reliability Project and other upgrades in New Hampshire are in service.

Figure III-8 Vermont Statewide Load on VELCO System



ENDNOTES

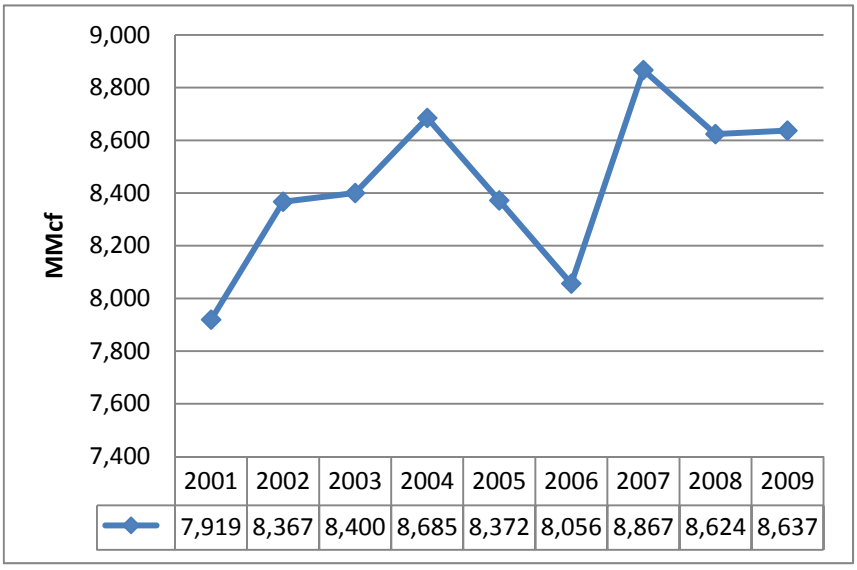
[1] Annual Energy Outlook with Projections to 2030, Report no.: DOE/EIA-0383 (2006) February 2006, http://www.eia.doe.gov/oiaf/aeo/emission.html**.** Vermont is among the states that are not impacted directly by the rule because pollution from the state does not contribute to down wind non-attainment for ozone and particulates. Further information on these rules can be found in Section 2, subsection A-2. Leakage pertains to shifting sources of gases, either outside the geographic boundaries of the area for which the cap applies, or within the area through shifts between regulated activities, or sources under the cap and unregulated activities or sources outside the cap. Leakage is caused by the pressure toward lower cost production associated with activities and sources under the cap.
[2] See, ISO-NE's report, "Northeast Natural Gas Infrastructure Assessment", April 1, 2005, available at http://www.iso-ne.org/pubs/spcl_rpts/2005/cld_snp_rpt/7_northeast_natural_gas_infrastructure_assessment.pdf
[3] Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations, April 2004. https://reports.energy.gov/BlackoutFinal-Web.pdf
[4] Act 74 (10 V.S.A. § 6523).
[5] Rutland Herald, 6/26/06.
[6] EIA/DOE (2001) "Impact of U.S. Nuclear Generation on Greenhouse Gas Emissions." p.4.
[7] IAEA (2000) "Bulletin" 4/2 p. 21.
[8]RGGI MOU (2005) http://www.rggi.org/docs/mou_12_20_05.pdf p.3.
[9] VSPC, www.vermontspc.com
[10] Central Vermont Public Service (CVPS).

SECTION IV NATURAL GAS

Natural gas is a significant source of energy for portions of the state. Vermont Gas Systems (VGS) is the state's sole provider of natural gas at retail. Natural gas provides Vermonters with space heat, process energy, and, at times, electric generation. Natural gas is an odorless, colorless gas that consists mostly of methane, but also contains ethane, propane, butane, and pentane. The exact mixture of gas received by distribution companies varies, as natural gas is a fossil fuel that is extracted from different places all over the world. However, most natural gas contains added sulfur to give it the characteristic smell that allows for the easy detection of leaks. In Vermont natural gas is available only in the northwest corner of the state in portions of Franklin and Chittenden Counties. Vermont has a single natural gas distribution company, VGS, which, as of 2010, serves over 43,000 customers.

VGS obtains its natural gas from Canadian supplies in Alberta, where it is transported to Vermont via the Trans-Canada pipeline. VGS has also contracted with Gas Supply Resources, Inc, for liquid propane gas (LPG) supply for use in VGS' propane air facility during seasonal peaking periods. The LPG is mixed with natural gas during the peak periods when demand is greater than the natural gas pipeline can supply. This allows VGS to supply more customers without costly contracts or expansion of its pipeline. Advantages of natural gas use include lower levels of almost all emissions compared to other fossil fuels, efficient delivery through pipelines (instead of delivery trucks); and efficient technologies to utilize natural gas in homes, businesses, power plants and even cars.

Figure IV-1 Natural Gas Delivered to Consumers in Vermont (MMcf)



Natural gas is also viewed as an economic development tool in those communities that can offer this service to the public. Disadvantages include the need for additional infrastructure in Vermont to bring natural gas to new customers. Natural gas suffers from the same issues faced by liquid fossil fuel sources, including concern for its long-term supply sustainability and high price volatility though being a tariff service, the volatility of natural gas retail price is dampened modestly vis-à-vis oil and propane. Because long term sustainability is a concern, natural gas may appropriate be viewed as a bridge to a more sustainable long term energy future. Once

pipeline infrastructure is in place, natural gas that is consumed will displace other fossil fuels that are traditionally delivered by truck, thus reducing wear and tear on Vermont's roads and reducing vehicle emissions. And while not as clean (from a life-cycle emissions standpoint) as most renewable sources of energy; natural gas is considerably cleaner than other fossil fuel sources.

In 2009, Vermonters consumed 8,637 MMcf of natural gas, accounting for about 6% of the state's total delivered energy use. The residential sector consumed about 36% of the state's total natural gas, while the industrial sector consumed 33% and the commercial sector 31%. The electric power sector consumption accounted for less than 1% of statewide usage. The residential sector uses natural gas primarily for space and water heating, with an estimated 11% of Vermont households using natural gas as their primary space-heating source and 14% as their primary water-heating source during the heating season.[1] Natural gas consumption has remained close to 8,400 MMcf per year over the last 8 years. Figure I1, Natural Gas Delivered to Consumers in Vermont (MMcf), shows the demand for natural gas over the last 9 years.

NATURAL GAS CONSUMPTION IN THE U.S. AND NEW ENGLAND

Natural gas is one of the most important fuels in the U.S. economy, accounting for approximately 24% of the total energy consumed nationwide in 2007.[2] U.S. natural gas use was 22,839 TBTU in 2009, up from 19,752 TBTU in 1990, with 28% of the total use occurring in the industrial sector, 21% in the residential sector, 14% in the commercial sector, 27% in the industrial sector and nearly 30% in the electric power sector.[3]

Statewide natural gas use in Vermont, New Hampshire, and Maine is lower than in much of the rest of the country, due largely to the limited availability in the area. In 2009, New England used only 3.5% of the total natural gas consumed nationwide. Nevertheless, natural gas accounts for 22% of the region's total energy consumption[4] and is an important fuel in New England's electric market. New England will remain heavily dependent on natural gas as a primary fuel for generating electric energy for the foreseeable future; natural gas plants currently represent 41% of the region's capacity and provided about 42% of the system's electrical energy in 2009. Recent improvements to the regional and interregional natural gas infrastructure have helped expand and diversify natural gas sources to meet New England's increasing demand for natural gas to produce electric power.[*]

The majority of new electric generation capacity in the region since 1999 (almost 10,000 MWs) has been gas fired. This trend will likely continue as natural gas-generated electricity is projected to grow due to the ease of siting gas-powered generating plants and its relatively clean environmental characteristics when compared to other fossil fuels. Natural gas will, therefore, continue to be a critical fuel in New England and Vermont over the planning horizon and drive electric prices in New England.

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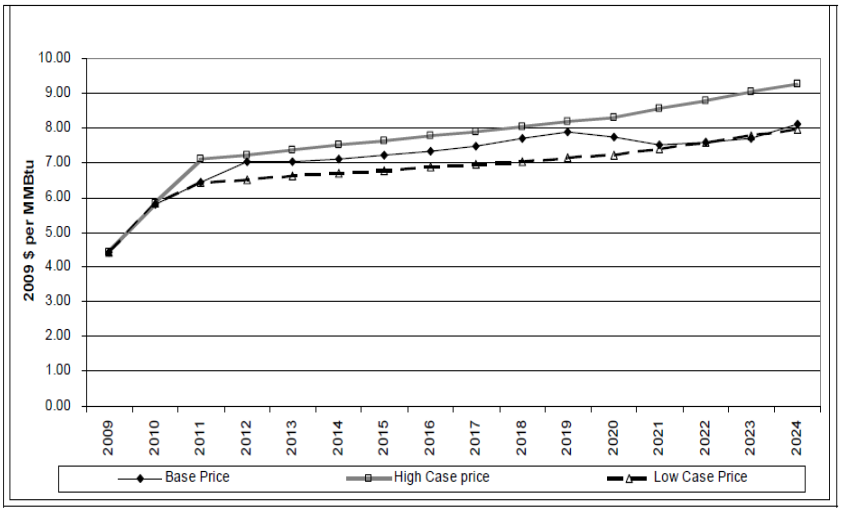
[*] ISO New England,"2010 Regional System Plan" http://www.iso-ne.com/trans/rsp/2010/index.html

SUPPLY AND PRICE

As of January 1, 2010, the world's total proved natural gas reserves, as reported by Oil & Gas Journal, were estimated at 6,609 trillion cubic feet—355 trillion cubic feet (6 percent) higher than the estimate of 6,254 trillion cubic feet for 2009. Almost three-quarters of the world's natural gas reserves are located in the Middle East and Eurasia. Russia, Iran, and Qatar together accounted for about 55 percent of the world's natural gas reserves as of January 1, 2010. The remainder is fairly evenly distributed throughout the globe. The last decade has seen steady increases in the demand for natural gas. However, reserve-to-production ratios remain relatively stable at 65 years and the U.S. Geological Survey (USGS) predicts that a substantial volume of natural gas is still undiscovered.

Figure IV-2 Natural Gas Avoided Costs Forecast



According to the EIA, 82% of U.S. natural gas consumption is produced domestically. The remaining 18% of U.S. consumed natural gas is imported.[5] About 86% of these imports come from Canada and the rest mostly from imported liquefied natural gas (LNG).[6] However, gross U.S. imports of LNG are expected to exceed imports from Canada by 2015

Vermont, along with other New England states, participated in an Avoided Energy Supply Costs (AESC) study to develop reasonable cost estimates of fuel consumption. The AESC report forecast shows that New England natural gas prices are expected to increase by approximately 45% between 2009 and 2024 in real terms.[7]

DEMAND GROWTH

Throughout the 1950s and 1960s, the U.S. market for natural gas expanded as low prices encouraged demand. Consumption reached an initial all-time high in 1972, but thereafter, uncertainties about supply and rising energy prices caused demand to decline and then rise to a new high in 2003. In 1986, U.S. natural gas consumption reached its lowest annual total since 1965. This reduced demand spanned all sectors, but was most severe in the industrial and electric utility sectors. By 1986, however, U.S. natural gas demand began to exceed domestic supply, a trend that continues to this day and has necessitated an increase in imports.

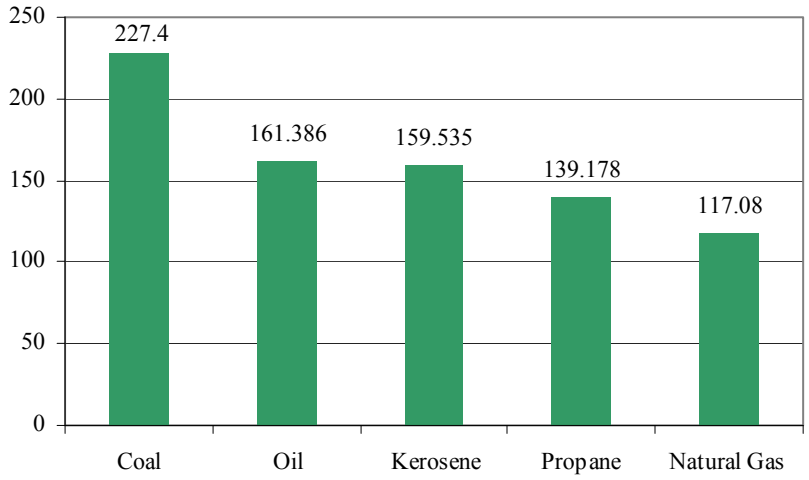
The EIA projects that natural gas consumption in North America increases by 0.7 percent per year from 28.3 trillion cubic feet in 2007 to 34.6 trillion cubic feet in 2035.[8]

A larger resource base of shale gas results in higher shale gas production overall and a higher rate of development than previously predicted. Increased production from gas shale plays takes production shares from other higher-cost sources—particularly, offshore production. Lower natural gas prices induced by growth in gas shales make offshore production less economical and will slow its development. However, overall, increased production of gas from shale will result in lower overall prices for gas; this is particularly true in the Northeast as nearby shale gas developments will lower the price differential faced by New England which is at the end of the pipeline.

AIR EMISSIONS AND ENVIRONMENTAL ISSUES

Among fossil fuels, natural gas generally emits the lowest levels of almost all pollutants per unit of energy used.[9] Nitrogen oxide emissions from natural gas and LPG are nearly the same and are higher than the level of NO_2 emissions from distillate fuel or wood use. However, natural gas emissions are very low in sulfur oxides and low in particulates, carbon monoxide, and volatile organic compounds. Carbon dioxide emissions per unit of energy used are significant, however, as *Figure IV-3* illustrates CO_2 is emitted at the lowest level of any fossil fuel energy source.

Figure IV-3 CO2 Emissions (Lbs/BTU)



Source: EIA

Additional environmental impacts from natural gas can include drilling and pipeline construction impacts and gas leakage from distribution systems (usually small amounts). These impacts include both short- and long-term disruption of wetlands, streams and rivers, water supplies, fields, woodlands, and endangered species habitats. Methane leakage from natural gas distribution systems can have serious environmental consequences because methane is a potent greenhouse gas. However, the leakage rate of methane from natural gas pipelines is estimated to be very small in most U.S. cities. In Vermont, VGS has replaced all of its cast iron and bare steel mains, which are a significant source of leaks in other states. Despite the important concerns about its environmental impacts, overall the utilization of additional natural gas can result in an improved environmental profile for Vermont if it is used to replace coal or oil.

STRATEGY H ENCOURAGE GREATER FUEL CHOICE THROUGH THE EXPANSION OF THE NATURAL GAS SYSTEM

Vermont should encourage the increased use of natural gas by supporting economically viable expansion of the natural gas service territory, promoting attachments to the current distribution system, encouraging the development of appropriately sized and strategically located natural gas electric generation, and promoting the use of natural gas vehicles.

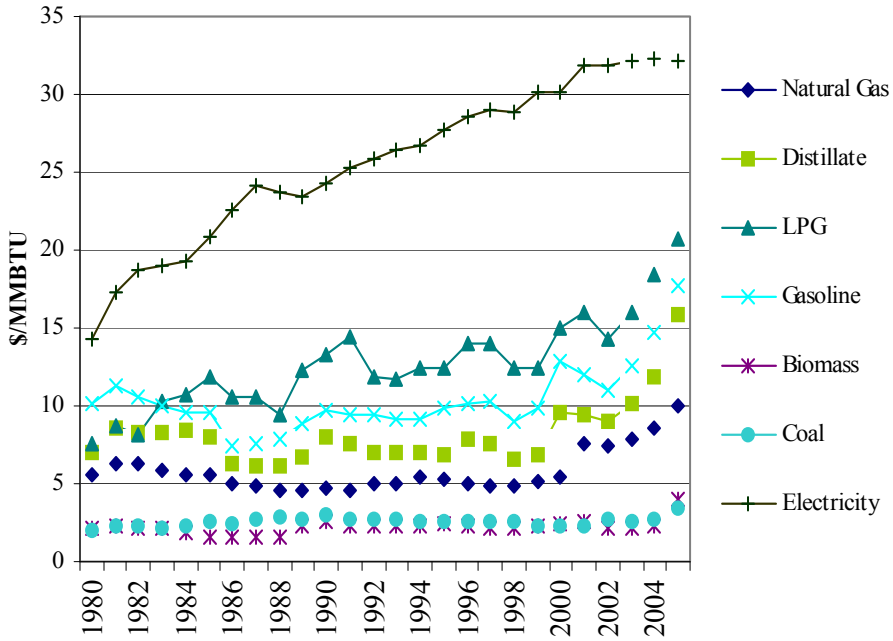
Natural gas accounts for a relatively small portion of Vermont's total energy use due to its current limited availability, Vermont's population dispersion, and its small industrial base. Major applications for natural gas in Vermont include residential and commercial space heating, water heating and cooking, various industrial processes, and a small amount for electric generation.

The main role of natural gas has been as a source of heat in homes, buildings and industry. However, efficient new technologies such as natural gas-powered cooling systems and heat pumps are beginning to compete with electricity in other end uses. In addition, the use of natural gas for electric power generation has become increasingly environmentally friendly and cost effective due to the advent of combined cycle and fuel-cell technologies from large-scale generation to small-scale residential systems. Gas-fired CHP also has great potential for benefiting both the system and the host. Natural gas is also attracting attention as a vehicle fuel as cities look for cleaner transportation options.[10]

NATURAL GAS SUBSTITUTION FOR OTHER END-USE FOSSIL FUELS

Natural Gas is a relatively clean and inexpensive fuel and should be substituted for other fossil fuels when cost effective.

Figure IV-4 Vermont Energy Prices



By switching to natural gas, customers who use electricity for heating and hot water can greatly reduce their energy bills as well as winter heating loads. Historically, natural gas prices have been lower than those of most other fossil fuels except coal. While market prices can be volatile, even under VGS's Alternative Regulation Plan, Vermont's natural gas customers can expect rate changes only every three months. This is partially due to the fact that VGS engages in a comprehensive hedging

program, which limits the company's and in turn its customers' exposure to short-term price volatility.

Environmental Impacts While natural gas is not without environmental impacts, those impacts are less harmful than those of other fossil fuels, (see page IV-89).

Geotargeted areas Switching customers in the capacity-constrained areas of Chittenden County and St. Albans to natural gas can help to reduce the need for costly electric transmission upgrades.

Incentives Currently, the Efficiency Utility offers customized incentives to customers using electric space and water heating in the natural gas service territory. VGS also offers incentives for higher efficiency furnace, boilers, and water heating systems.

Recommendation 23 Foster opportunities for substitution of natural gas for other fossil fuels.

Timing	NEAR-TERM
Emissions Impact	MODERATE
Energy Impact	MODERATE
Capital Cost	HIGH (per customer)
Cost-Effectiveness	MODERATE
Funding Sources	Gas rates
Relation to GCCC	ESD-8
Current Status	Ongoing
Parties Involved	Vermont Gas, Vermont Department of Public Service, Public Service Board, Efficiency Vermont

f) The DPS and PSB should continue to support the marketing and development efforts of Vermont Gas to enable cost effective service expansion and increase consumer opportunities for greater choice.

g) The Efficiency Utility and Vermont Gas should continue to provide incentives for fuel switching from electric to natural gas, and from fuel oil and propane to natural gas.

EXPANDING THE NATURAL GAS INFRASTRUCTURE

In response to customer growth and system reliability, in 1994 VGS began a multi-year project to expand the capacity of its transmission system. Phases one through three of the system expansion resulted in a looping of the system from the U.S.–Canada border to Beebe Road in Swanton, approximately 9.1 miles. The fourth and fifth phases of this project that extended the system from Swanton to Nason Street in St. Albans were completed in 2004. In the summer of 2007, Vermont Gas constructed an expansion of its distribution system to make natural gas available to 650 homes and a number of businesses in Jericho village. Vermont Gas is currently expanding into Richmond, Underhill and Hinesburg and is in the preliminary stage of reviewing possible expansion in to the Middlebury/Vergennes area.

There is great potential for expanding the use of natural gas to fuel more of Vermont's energy needs and to replace more environmentally damaging sources either in direct use or in electric generation. Expanding the natural gas service territory will provide all sectors with a clean heating fuel and an essential input to many processes. It will also make available a prerequisite fuel that many industries would require to be located in Vermont. Finally, encouraging natural gas expansion throughout the state would increase the competitiveness in the fuels market. As the natural gas service territory expands, natural gas will help to keep prices for other fuels low throughout Vermont.

PRIOR PIPELINE EXPANSION PROPOSALS IN VERMONT

In 1989, construction of a "Champlain Pipeline" was proposed to bring natural gas through Vermont from Highgate to Rockingham, via Rutland, en route to the Boston area. The proposal failed due to local opposition and the viability of a strong alternative, the Iroquois Pipeline connecting Canadian supplies to the Long Island area and eastern New York.

Nevertheless, during the 1990s there were two primary proposals to extend pipelines through the state of Vermont, one in the southwest and another from northwest to southeast. The first occurred in early 1999 when three companies, Iroquois Gas Transmission System, Vermont Energy Park Holdings, and Southern Vermont Natural Gas, proposed to build a pipeline from New York State to Bennington and then north approximately 60 miles to Rutland, Vermont. In Bennington and Rutland, Vermont Energy Park Holdings planned to build two gas-fired electric generating plants with a combined capacity of approximately 1350 megawatts.

The second proposal made by the Portland Natural Gas Transmission System ("PNGTS") in 1998 was to construct another pipeline that would travel through the Northeast Kingdom. The pipeline was to be a 250-mile-long, 20-inch pipeline from Canada to Portland, ME, and Haverhill, MA and carry 200 million cubic feet of gas per day from Canada to markets in New Hampshire and Maine. The New York-to-Bennington/Rutland proposal failed for similar reasons as the Champlain Pipeline. The PNGTS pipeline was ultimately constructed but essentially bypassed Vermont and was built primarily in New Hampshire. No proposals currently exist to construct a new pipeline system in Vermont. While natural gas expansion
can play an important role in the economic development of Vermont, policymakers should be aware of the land use issues that have arisen in the past and the challenges they present for such proposals in the future.

Recommendation 24 Encourage cost-based expansion of and upgrades to natural gas infrastructure

Timing	MID-TERM
Emissions Impact	MODERATE
Energy Impact	MODERATE
Capital Cost	HIGH
Cost-Effectiveness	MODERATE
Funding Sources	Gas rates
Relation to GCCC	ESD-8
Current Status	No projects proposed beyond Jericho
Parties Involved	VGS, PSD, PSB, FERC

h) VGS should continue to evaluate the long-term feasibility of building new pipelines to connect Vermont with U.S. pipeline systems.

i) The DPS and PSB should encourage the construction and extension of natural gas transmission and distribution systems that enhance system reliability, reduce costs, and expand natural gas service to more Vermonters.

NATURAL GAS ELECTRIC GENERATION

Natural gas is a secondary fuel source for the wood-fired McNeil generator in Burlington and Vermont depends on a certain amount of natural gas generation from out of state. However, there are currently no electric facilities that burn natural gas as a primary fuel in Vermont. Vermont should encourage the construction of natural gas electric generation plants in Vermont, strategically located to enhance system reliability and help defer transmission system upgrades or as an anchor load to leverage expansion of the VGS network to communities that are currently without natural gas.

OUT-OF-SERVICE NATURAL GAS DISTRIBUTION SYSTEMS

In the early 1980s there were six manufactured gas distribution systems operating in Vermont. These systems were located in Montpelier, Springfield, Barre, St. Johnsbury, Rutland, and Bennington. They provided service to residential, commercial, and industrial consumers. Economic and maintenance problems led to the closing of all of these facilities. In the 1990s there was some interest in rehabilitating and reactivating these distribution systems by inserting polyethylene pipe into the old pipes so they could carry gas.

This method of upgrading the pipes would greatly reduce both the amount of construction needed to build a distribution system and the cost of delivering gas. With relatively high-pressure polyethylene pipe, greater volumes of gas could be delivered than possible with the older systems, making the upgrade cost effective. Polyethylene piping would also eliminate corrosion problems experienced with cast or wrought iron piping that was used in the older distribution systems.

While not currently feasible, rehabilitation and reactivation of some of these systems could coincide with the installation of a gas transmission line, providing natural gas to areas where it has not previously been an option. A rehabilitated system could also utilize propane until a natural gas transmission line was built.

Increasing our use of renewables and decreasing our dependence on fossil fuels is an important goal for Vermonters. Nevertheless, fossil fuel power plants are still an essential component of Vermont's electric supply mix because of their ability to produce a certain quantity of electricity at a specifically designated time. As Vermont's peak load increases, it will be essential for electric utilities to meet Vermont's higher total energy demand with resources that can guarantee to deliver electricity during periods of peak demand. While renewables such as wind and hydro energy can provide reliable and consistent energy, they are still intermittent sources of energy. Solar has high coincidence with Vermont's increasing summer peak, but remains very costly. Wood-fired plants can also provide relatively low emissions and reliable peak generation. However, localized emissions from wood electric plants can impact air quality and therefore are

not always feasible. Since the VGS system peak is currently in the winter and the Vermont electric system peak is increasingly moving towards the summer, there are excellent opportunities for additional natural gas peaking electric generation. Natural gas has the potential to reliably provide the same capacity as another fossil fuel while producing fewer emissions and minimal local air pollution problems and leveraging the expansion of natural gas as a heating fuel.

There are several environmental, social, and economic development benefits Vermont could sustain if natural gas electric generation came to the state. The primary ratepayer benefit is the cost. While natural gas generation on a marginal basis is relatively expensive, especially in New England where prices are volatile, the capital costs of natural gas facilities are much lower than the cost of other base-load generation. Vermonters can also benefit from the expansion of the natural gas service territory that a natural gas facility could provide. While natural gas expansion is currently not economically feasible in many areas due to the rural and dispersed nature of the population, a natural gas plant could provide the anchor necessary to make pipeline expansion feasible and would therefore provide additional service and competition to lower fuel costs for more Vermonters.

The other primary benefit is that natural gas electric generation is a far cleaner source than electricity produced by coal plants. Natural gas electric generation emits similar amounts of nitrogen oxides and carbon monoxide per unit of energy used as oil-fired plants. However, CO_2 and particulate emissions are significantly lower than those from other fossil fuel-powered plants. Because of their lower capital costs and emissions profile, natural gas plants are ideal for adding additional peaking generation capacity as well as base-load capacity.

One major category of concern is that there is already a heavy dependence on natural gas generation in New England. As noted earlier, 40% of both energy and capacity in the region are from natural gas generators. Furthermore, approximately 75% of generation additions planned in New England are for natural gas or combined natural gas and oil units. While Vermont's electric portfolio currently has little exposure to market or fossil fuel price volatility, increasing Vermont's dependence on variably priced electricity such as natural gas could expose Vermonters to additional energy price volatility.

In 2012 and 2015, Vermont's respective contracts with Vermont Yankee and major portions of Hydro-Quebec will expire. While renegotiation of these contracts is feasible and is, in any event, taking place, Vermont should also consider opportunities for participating in a share of additional natural gas generation. Even without the expiration of these contracts, the construction of additional natural gas electric plants, properly located, may help to strengthen system reliability in potentially constrained areas, may provide a contribution to local generation capacity, and, depending on the location of the facility and generation type, could help to expand the footprint of the existing natural gas transmission and distribution network.

Recommendation 25 Encourage the development of strategically located natural gas electric generation closer to electric loads.

Timing	NEAR-TERM
Emissions Impact	MODERATE
Energy Impact	MODERATE
Capital Cost	HIGH (utility funded)
Cost-Effectiveness	MODERATE
Funding Sources	Electric rates
Relation to GCCC	ESD-8
Current Status	No projects proposed
Parties Involved	VGS, PSD, PSB, Electric utilities

j) State agencies, VGS and electric utilities should continue to evaluate opportunities to develop natural gas or dual-fuel electric generation facilities to meet capacity requirements.

k) The DPS, PSB, and VGS should continue to evaluate and take advantage of cost effective opportunities to extend the natural gas service territory and/or site additional natural gas pipelines within Vermont's borders.

NATURAL GAS USE IN VEHICLES

Natural gas is a promising alternative vehicle fuel and is already being used in Vermont as a transportation fuel. The first natural gas vehicles began operation in the northwestern part of the state, served by VGS. There are many advantages to be gained by supporting the continued growth in natural gas vehicles:

- Natural gas burns cleaner than unleaded gasoline with 25% less carbon dioxide emissions.
- Natural gas is not only cleaner, but also gentler on the engines that burn it. Engine, spark plug, and lubricating oil life are much greater than in gasoline engines, with engine lives of 500,000 miles possible.[11]
- Vehicles can be modified to run on either gasoline or natural gas, although engines designed to run on natural gas alone are more efficient. Natural gas is stored in vehicles either as liquid natural gas (LNG) or more commonly as compressed natural gas (CNG). This provides the flexibility that most consumers need.
- Due in part to the high octane rating and clean-burning properties of natural gas, some fleets have reduced maintenance and operating costs for NGVs compared with conventional vehicles.[12]
- Fleet vehicles based in VGS's service area provide an additional stable source of demand, without requiring the company to physically expand their system.

One major obstacle to using natural gas vehicles is the upfront cost. Converting existing automobiles to natural gas-burning vehicles can cost between $2,000 and $4,000. Vehicles designed to burn natural gas cost less than converted vehicles but more than gasoline-powered

vehicles, in part because natural gas storage cylinders used in automobiles are more expensive than gasoline fuel tanks. Major auto manufacturers have begun selling dedicated natural gas vehicles at a price somewhat higher than their gasoline equivalents. Typical price premiums for light-duty CNG vehicles can be $1,500 to $6,000 and for heavy-duty trucks and buses $30,000 to $50,000.[13] However, the price differential is expected to decline as production volume increases. Nevertheless, it will be important for Vermont to keep abreast of natural gas vehicle development to stay current with future transportation demands.

A large-scale expansion of natural gas into the transportation market would have significant impacts on Vermont's natural gas supply. The annual consumption of natural gas per car is about the same as one house that has natural gas space and water heating, as well as a natural gas oven and clothes dryer. The potential exists to double the demand for natural gas within the current Vermont Gas service area without expanding that area or the number of customers. This, however, would require greater pipeline capacity than currently exists.

Another obstacle is the fact that adding natural gas compressors to service stations is expensive. And while there are more than 1,000 natural gas filling stations nationwide, they are still relatively rare, making refueling inconvenient. (One can, however, drive all the way across Canada using natural gas along a certain route.) For these reasons, natural gas is probably best suited for fleet applications that can have their own refueling stations, at least for the near future.

Recommendation 26 Encourage the expanded use of natural gas as a vehicle fuel.

Timing	MID- and LONG-TERM
Emissions Impact	MODERATE
Energy Impact	HIGH
Capital Cost	HIGH (utility funded)
Cost Effectiveness	MODERATE
Funding Sources	Electric rates
Relation to GCCC	TLU-5
Current Status	Ongoing: Six UVM CNG busses will be in service by fall 2008 and Burlington Public Works has a NGV refueling station
Parties Involved	VGS, PSD, PSB, VPPSA, CCTA, GMTA, AOT

l) Regulators should continue to allow cost recovery for expenses associated with research testing and market development as is currently done in Vermont to encourage further natural gas substitution for other liquid fossil fuels.

m) As resources allow, the DPS and VGS should investigate the feasibility of providing natural gas fuel filling stations along heavily traveled highways in the Northeast such as the Interstate 89 and Interstate 91 corridors linking Montreal, Boston, and Hartford.

STRATEGY I IMPROVE THE SYSTEM RELIABILITY OF NATURAL GAS DELIVERY

Vermonters require a consistent quantity and quality of natural gas to maintain their homes and businesses. If the composition of natural gas changes and demand increases on VGS's service territory, issues of natural gas availability and quality will require close attention from Vermont regulators and policymakers.

NATURAL GAS STORAGE

It is essential to have adequate storage for the supply and delivery of natural gas in Vermont. There are two primary ways in which natural gas is stored, either in underground caverns or as LNG. Most storage capacity in the U.S. is underground in salt caverns, aquifers, and depleted oil and gas fields. There are over 429 underground facilities in the U.S. holding around 8 trillion cubic feet (TCF) and a working capacity of 3.5 TCF of gas. In New England there is no underground storage due to the prohibitive geology of the region; however, many New England natural gas companies, including VGS, contract for underground natural gas storage in other regions. Given the lack of natural gas storage fields in the region, New England states partially supplement their supply with stored LNG or propane. Currently, Vermont Gas does not have

LIQUEFIED NATURAL GAS (LNG) AND VERMONT

LNG currently meets approximately 20% of New England's annual and 30% of peak natural gas demand and is only growing in importance as the region's pipe transportation infrastructure becomes strained. The Everett Marine Terminal is one of only five operating LNG terminals in the U.S. and is located in Massachusetts. The Everett terminal has two LNG storage tanks with a combined capacity of 3.4 billion cubic feet, or 42 million gallons and is the longest-operating LNG terminal in the country. Construction of other LNG terminals has been proposed in order to enhance supply stability in the northeast including (as of November 2006) projects onshore and offshore in New Jersey, New York, Rhode Island, Massachusetts, and Maine, and in eastern Canada, New Brunswick, Nova Scotia, Newfoundland and Québec.

In Vermont, there is currently no reliance on LNG, either direct or indirect. However with increased terminals in the region, LNG storage may become cost competitive in Vermont. The increase in LNG in the region and throughout the country will also increase the competitiveness of the natural gas market and will likely lead to decreases in natural gas market prices, even in Vermont.

As natural gas use in Vermont continues to grow, both upstream Canadian storage and local Vermont storage facilities may become increasingly important supply sources for meeting peak demand. LNG storage facilities, which currently do not exist in Vermont, may have a role in the state's future. With the increasing availability of LNG in the region, LNG storage may be able to provide critical peak capacity enhancements to the VGS system. LNG storage may not just add capacity, but could also provide additional reliability by making available natural gas that is not delivered through the TransCanada Pipeline (TCPL). The siting of a large LNG storage facility located on Vermont's main rail or truck transportation network may also facilitate the entrance of additional natural gas local distribution companies (LDCs) interested in providing services in other areas of the state. Increasing storage capacity can also help to reduce price volatility. With a buffer supply of natural gas available, LDCs with additional storage can have an additional supply option when sharp fluctuations in natural gas prices occur.

LNG storage but has a propane air plant in Colchester. Vermont that has 9,000 million cubic feet demand (Mcfd) of installed capacity and 180,000 gallons of propane storage. Similar in purpose to an LNG peaking facility, this plant supplies VGS customers with a propane-air/natural gas mixture during peak periods when natural gas supplies are critical.

Recommendation 27 Encourage the construction of additional natural gas storage facilities to support and expand existing natural gas infrastructure.

Timing	MID- and LONG-TERM
Emissions Impact	MODERATE
Energy Impact	MODERATE
Capital Cost	MODERATE
Cost-Effectiveness	MODERATE
Funding Sources	--
Relation to GCCC	--
Current Status	None proposed
Parties Involved	VGS, PSD, PSB, emerging LDCs

It is essential to have adequate storage for the supply and delivery of natural gas in Vermont. There are two primary ways in which natural gas is stored, either in underground caverns or as LNG. Most storage capacity in the U.S. is underground in salt caverns, aquifers, and depleted oil and gas fields. There are over 429 underground facilities in the U.S. holding around 8 trillion cubic feet (TCF) and a working capacity of 3.5 TCF of gas. In New England there is no underground storage due to the prohibitive geology of the region; however, many New England natural gas companies, including VGS, contract for underground natural gas storage in other regions. Given the lack of natural gas storage fields in the region, New England states partially supplement their supply with stored LNG or propane. Currently, Vermont Gas does not have LNG storage but has a propane air plant in Colchester, Vermont that has 9,000 million cubic feet demand (Mcfd) of installed capacity and 180,000 gallons of propane storage. Similar in purpose to an LNG peaking facility, this plant supplies VGS customers with a propane-air/natural gas mixture during peak periods when natural gas supplies are critical.

Figure IV-5 LNG Receiving Facility Everett, MA

n) VGS should evaluate construction of LNG storage facilities in areas of Vermont where capacity is constrained and transmission expansion is difficult.

o) Vermont should evaluate construction of LNG facilities where they would allow for the entrance of additional LDCs or expand natural gas distribution service.

NATURAL GAS QUALITY

The U.S. energy supply portfolio is changing due to growth in natural gas demand as more gas is imported through LNG terminals and reserves in new areas are accessed. This means that the supply mix characteristics of natural gas are changing and will likely have an impact on the natural gas grid system as well as the economic activities supported by natural gas deliveries. The impacts of the changing supply will vary and have the potential to alter the fungibility of natural gas as a commodity and raise safety and environmental concerns.

For example, the processing of natural gas has recently declined due to a shift to transactions being made on a thermal equivalency basis. This frequently means that unprocessed gas contains a greater thermal potential and is therefore more valuable. It also means, however, that the gas entering the interstate system has a higher dew point temperature and is more likely to condense from a gas to a liquid, which can pose operational, safety, and environmental issues especially as the gas moves downstream. With unprocessed LNG, as well as new sources of gas, entering the interstate pipeline system, increasing concentrations of heavier hydrocarbons will pose potential problems as new gas supplies reach Vermont's pipelines.

In general, however, the changing supply mix will result in higher-value natural gas entering the interstate system because the higher heating value (HHV) of the natural gas will improve efficiency and reduce the need for increases in capacity. Nevertheless, tariff modifications and new standards to control dew points will be important regulations to consider as the supply mix changes.

Demand-side management (DSM) programs provide valuable services to natural gas customers, and new electric plant technologies are helping to make natural gas generation one of the cleanest and most efficient sources of power in Vermont.

EFFICIENT ELECTRIC GENERATION TECHNOLOGIES

Over the past decade, advances in technologies have made natural gas generation much more efficient. Where possible, all natural gas generation should be constructed using the most efficient technologies, and systems currently operating should receive efficiency retrofits where cost effective.

There are three main processes used to generate electricity from natural gas:

- **Combustion turbines:** Use natural gas to directly power a turbine, which in turn drives a generator shaft.
- **Steam turbines:** Use natural gas combustion to generate steam in a boiler, which can then run through a steam turbine.
- **CHP:** Also known as Combined Heat (and in some cases cooling) and Power Units (CHP), they are *the most efficient generation* sources, utilizing both a gas cycle and a steam cycle to generate electricity. Generation occurs through both a combustion turbine, which uses the direct combustion of natural gas, and the hot exhaust gases from the

combustion turbine to boil water that operates a steam turbine. CHP units are becoming commercially viable as both large-scale electric and heat generation systems for large-scale industrial and institutional applications as well as in small-scale residential projects.

The most fuel-efficient *emerging* technology for natural gas electric generation from the standpoint of fuel conversion efficiency is **Natural Gas Fuel Cells,** which generate electricity through electrochemical reactions instead of the combustion of fossil fuel. By passing fuels such as hydrogen and oxidates over electrodes, fuel cells produce electricity without combustion and the only byproducts are water, heat, and electricity. The benefits of fuel cells include few to no emissions as carbon dioxide is easily captured and contained in the process, their simplicity of design, and their compact nature and efficiency. The ability to use fuel cells on a small scale also makes them an ideal application for distributed generation systems. The main barrier to the extended use of fuel cells is that the installation of a fuel cell plant can cost more than $2,000 per kilowatt compared with $400–$800 per kilowatt for natural gas combined-cycle plants.[14] There are no specific recommendations at this time other than monitoring developments with more fuel-efficient technologies.

ENDNOTES

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SECTION V ENERGY EFFICIENCY

Investments in energy-efficiency programs and demand-side resources have swelled in recent years with the growing demand for energy and related services and the rising price of fossil fuels. Demand-side management (DSM) encompasses a range of service alternatives that includes energy efficiency, demand response, and load management. Energy-efficiency investments, in turn, consist of selecting or installing devices and/or equipment that will perform work using less energy input than would otherwise be necessary. While DSM traditionally focuses on utility (electricity and gas) resource decisions and investments, energy-efficiency options encompass all categories of fuel including electricity, motor gasoline,* and fuel oil for heating and process needs.

Energy efficiency can be differentiated from demand response (where electric or gas customers agree to reduce load during specific periods, generally associated with peak demand periods when capacity is constrained) and load management (that generally corresponds to shifting loads from peak to off-peak periods). Energy efficiency, including related utility investments in demand-side management, is the subject of this section. This is an artificial separation used for purposes of this presentation, since the topics of load management and demand response are closely linked to investments in energy efficiency. Certain issues, like investments in smart metering technologies, are relevant to both energy-efficiency activities and load management.

For more than a decade, Vermont has treated utility demand-side management energy efficiency as an integral part of the energy mix. During this time, Vermont utilities, the Energy-Efficiency Utility (EEU), and ratepayers have been increasing the investment levels and the associated savings achieved. . In 2007, Vermont became the first state to offset its projected underlying load growth through energy efficiency program activities. It also offset load growth in 2008. . Evidence of this success can now be seen through both the bottom-up detailed analysis Monitoring and Evaluation efforts of the Department and the top-down view of year-over-year sales growth relative to our neighbors. The success of the EEU through program savings translates into growing confidence in the success of their delivery efforts. Vermont has established effective electric-efficiency and natural gas programs consistent with statutory criteria through a collaborative process involving Vermont utilities and regulators, and more recently including active participation from members of the public.

Until recently, "unregulated"* fuel energy-efficiency programs have been delivered via state-run weatherization programs for income-eligible participants. Building codes and appliance standards have and will continue to increase the baseline efficiency levels of homes and

* For purposes of the discussion here, "unregulated" fuels refers to fuels that are not presently regulated under Title 30 of the Vermont Statutes. Under this definition, electricity and natural gas are regulated fuels. Fuel oil, kerosene, propane, and other petroleum-based fuels are "unregulated," as are wood fuels.

commercial buildings. Federal tax incentives, and more recently grants associated with the American Recovery and Reinvestment Act, have also spurred investment in energy efficiency among unregulated fuels. Energy efficiency has been a growing part of Vermont's regulated energy mix.

Vermont will continue to explore new ways to integrate energy efficiency into supply-side resource assessments. In general energy efficiency is, clean, and avoids environmental and aesthetic concerns associated with other resources. This section begins by discussing Vermont's current electric-efficiency programs, noting opportunities to improve the value to ratepayers into the future. In the second section, a suite of options is presented that augment and parallel a comprehensive unregulated fuel-efficiency program. In the third and final section, opportunities are identified that may serve to increase the efficiency of natural gas consumption.

STRATEGY J CONTINUE TO FOSTER SOUND INVESTMENT IN END-USE ELECTRIC ENERGY EFFICIENCY PROGRAMS

Vermont was an early and aggressive actor 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 continuing nearly a decade later by Vermont's Efficiency Utility (EEU). The majority of ratepayer investments in energy efficiency within the electric sector are now delivered under the auspices of Efficiency Vermont. The remainder is delivered through the City of Burlington's Burlington Electric Department (BED).* Both efficiency resource providers are funded through an explicit, separately stated charge on ratepayer electric bills. **Error! Reference source not found.** shows the annual efficiency savings versus the costs from the inception of the EEU.

Table V-1 Vermont Annual Efficiency Savings and Expenditures [1]

	BED Costs	EEU Costs	BED MWh Savings	EEU MWh Savings
2000	$579,991	$6,326,259	3,130	23,540
2001	$822,893	$9,682,919	3,094	37,489
2002	$1,070,815	$11,970,796	4,438	40,557
2003	$926,742	$13,735,377	3,346	51,216
2004	$845,977	$14,412,620	3,500	51,863
2005	$860,104	$15,095,564	4,948	57,055
2006	$998,511	$14,004,438	6,247	52,947
2007	$1,072,690	$17,788,830	9,227	93,933
2008	$1,499,592	$30,379,272	7,715	140,562

* Vermont's initial creation of an Energy Efficiency Utility structure in the form of Efficiency Vermont has been well documented in numerous publications and is not repeated here. For more information on the history of Vermont's efficiency programs, see the *Vermont Electric Plan 2005,* *http://publicservice.vermont.gov/index/2005%20Electric%20Plan.pdf*

In 2007, Vermont led the nation in per capita investment in electric energy-efficiency programs, spending $37.78 per capita to acquire efficiency resources.[2] Act 61 of 2005 removed the cap on the EEU annual budget; the Public Service Board subsequently began a proceeding to determine appropriate funding levels. As part of this proceeding, the Department of Public Service completed a comprehensive study on the cost-effective achievable electrical-efficiency potential in Vermont. The study concluded that by the year 2015, Vermonters could save 1.3 billion kWh through efficiency programs—a 19.4% reduction from forecasted kWh sales (see table V-3, below). These savings could be achieved with an expenditure of $305 million (or $30.5 million per year for 10 years), bringing approximately $895 million in benefits to Vermont ratepayers. The programs to deliver these benefits encompassed a number of areas—from lighting to programmable air-conditioning thermostats to fuel switching and early retirement measures.[*] For more information on the efficiency potential in Vermont, see the Vermont Electric Energy-Efficiency Potential Study Final Report, available on the DPS website at http://publicservice.vermont.gov/energy/vteefinalreportjan07v3andappendices.pdf.

Table V-2 Maximum Achievable Cost Effective Electric Energy Efficiency Potential by 2015

Sector	Maximum Achievable Cost Effective kWh Savings by 2015 from Electric Energy Efficiency Measures/Programs for Vermont (Cost Effective According to Societal Test)	2015 kWh Sales Forecast for This Sector (time of study)	Percent of Sector 2015 kWh Sales Forecast
Residential	567,511,161	2,659,831,768	21.3%
Commercial	450,383,577	2,115,167,148	21.3%
Industrial	268,928,672	1,851,792,067	14.5%
Total	1,286,823,410	6,626,790,983	19.4%

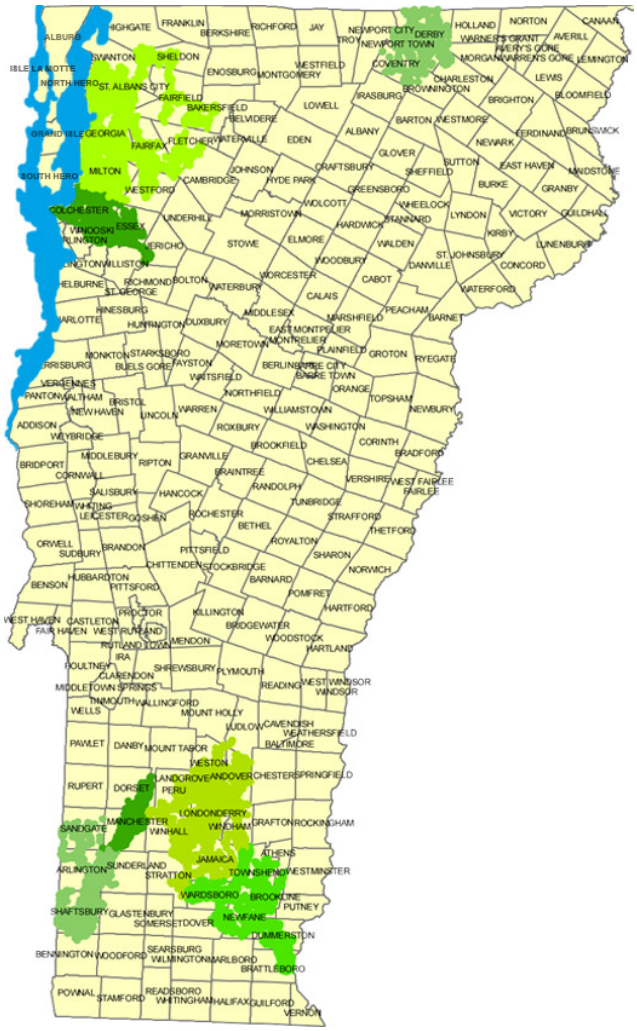
After considerable review of the analysis and proposals by interested parties, the Vermont Public Service Board increased the EEU budget by 75% above 2005 spending levels, to $30.75 million in 2008. In 2008, the Public Service Board again solicited comments and conducted a proceeding to determine the budget levels for 2009-2011. The Department conducted a limited update of its potential study, finding that new federal lighting standards and the potential for new technologies effectively balance one another in terms of savings potential. Other parties submitted varying proposals, and the Board determined that the budget should hold firm in 2009 (due to poor economy at the time), then increase to $40.7 million in 2011.[3] The increased budget continues to show Vermont's leadership and commitment to energy efficiency.

The Public Service Board ordered that the increased program funding levels of the Efficiency Utility through 2008 be directed toward specific geographic areas of the state that are forecasted to need costly investments in transmission facilities in the near future. For 2009-2011, the levels for these specific initiatives, known as Geographically Targeted (GT) efficiency program, would hold constant, with increased funding unconstrained to target the most cost-effective measures.

[*] The DPS, however, did not and still does not support including fuel switching and early retirement measures in the EEU budget—the volatility of fossil fuel prices may eliminate the individual participant's benefits of switching from electric to fossil fuels, and early retirement efficiency savings, while cost effective, are available only at very high budgetary costs and for a short duration. Department of Public Service (2006), "Recommendations for the Budget for the EEU 2006-2008," pp. 3–4.

Four areas of the state—St. Albans and vicinity, northern Chittenden County, Newport/Derby, and the southern portion of Vermont from Bennington to Manchester to Brattleboro (known as the "Southern Loop")—were chosen as a pilot for geographically targeted efficiency programs. The current targeted areas include St Albans, most of Chittenden County, the Southern Loop, and the Rutland area. The Vermont System Planning Committee (VSPC, discussed in Section III) is charged with, among other things, the systematic and strategic use of energy-efficiency investments through GT programs to avoid or defer transmission investments. Monitoring and evaluation of the savings from these pilot areas are essential to ensure that future investment in geotargeted efficiency both is aimed at the areas that provide the most value and continues to be valuable to all ratepayers. An evaluation research agenda is under development and an evaluation is expected to be conducted by the Department in 2010.

Figure V-1 Vermont's Original Geotargeted Areas (shaded)



The initial pilot areas (see Figure V-1). These areas have since been modified to exclude the Newport/Derby area (the substation upgrade could not be avoided due to non-energy efficiency reasons) and to include the North Rutland area. Monitoring and evaluation of the savings from these pilot areas are essential to ensure that future investment in geotargeted efficiency both is aimed at the areas that provide the most value and continues to be valuable to all ratepayers. A research agenda is under development and an evaluation is expected to be conducted by the Department in 2010. Vermont regulators recently established a planning and coordinating body known as the Vermont System Planning Committee (VSPC) that is charged with, among other things, the systematic and strategic use of energy-e1fficiency investments through GT programs to avoid or defer transmission investments. As part of this process, the PSB directed EVT to complete a 20 year forecast of expected electric energy efficiency savings given the currently approved budget. The forecast is expected by the end of 2009.

Vermont has helped to shape the character of the market for installed electric capacity, or Forward Capacity Market (FCM), to include energy-efficiency resources as an eligible component of this resource base (the FCM is discussed in further detail in Recommendation 17). Rigorous measurement and valuation standards are in the development process; the DPS and the

EEU have been collaborating with neighboring jurisdictions and ISO-NE to establish consistent regional verification standards for energy-efficiency programs that participate in the market.* Ultimately, the EEUs (EVT and BED) are bidding into the market energy-efficiency resources that will be used to meet the region's need for capacity. Costs for participating in the market initially exceeded payments due to initial bidding and plan development, but the revenues development, but the revenues have exceeded costs since 2008. The Legislature determined that revenues from participation in the FCM (along with the revenues associated with the Regional Greenhouse Gas Initiative) should be used by the EEUs to implement programs for unregulated fuels. Those programs have been initiated by the EEUs and are discussed further under Strategy K, below.

Just as the forward capacity markets and geotargeting efforts evolved, the nature and character of the efficiency utility and the programs and opportunities that may be explored through the efficiency utility continue to advance over time. The original structure of the EEU, where the Public Service Board contracted with an entity to be Efficiency Vermont on a three year basis, was the result of a comprehensive memorandum of understanding between many parties, which the Public Service Board approved. The configuration had been successful but was not without opportunity for further improvement. For example, the contract structure required periodic bidding for the contract despite mounting evidence that the model was becoming uncompetitive. Further, the longer-term planning horizon necessary for effective participation in the FCM together with practical concerns about the Board's role in administering the contract contributed to a view that some changes were warranted. In 2009, following a series of Public Service Board workshops to discuss and evaluate methods for improving the delivery of efficiency services in Vermont, and a formal investigation in Docket 7466, the Board approved a change in EEU structure to an "Order of Appointment." As described by the Public Service Board:[4]

> "This new structure retains the essential functions of the existing EEU but changes the relationship of the EEU with the Board and other entities. In particular, rather than being under a three-year contract with the Board, the EEU will move to a twelve-year rolling Order of Appointment model that will provide additional program stability and better serve ratepayers. Under this new model, the Board will no longer have a contractual relationship with the EEU, and the EEU will have increased responsibilities as well as increased oversight that is accomplished through more transparent proceedings and additional periodic, public reviews."

Parties will work under Phase II of Docket 7466 to resolve remaining issues identified by the Board and to transition to an Order of Appointment Structure.

Just as the forward capacity markets and geotargeting efforts evolved, the nature and character of the efficiency utility and the programs and opportunities that may be explored through the efficiency utility continue to advance over time. The Public Service Board, the Department of Public Service, the Vermont Energy Investment Corp. (the current contract holder for EVT), BED, and other interested Parties are continually evaluating methods for improving delivery of

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* The New England Governor's and Eastern Canadian Premiers, at their 31st annual conference in 2007, also agreed to develop consistent regional verification standards. The FCM endeavors will play a central role in the broader region's efforts.

efficiency services for Vermont ratepayers. One ongoing evaluation involves consideration of the structure and scope of services provided through the efficiency utility.

The current structure of the EEU is the result of a comprehensive memorandum of understanding between many parties, which the Public Service Board approved. The configuration has been successful but is not without opportunity for further improvement.
To discuss the current operating environment and potential improvements to the structure of the EEU, the Public Service Board initiated a Working Group process. This working group has held a series of workshops to address the issues noted above.* The intensive, collaborative process has allowed participation of many parties to consider any necessary changes. The workshops continued through 2008, and the Legislature in S.209 (2008) gave the Public Service Board explicit authority to make necessary changes; any such changes to the current EEU structure would continue to allow for program delivery for the benefit of all of Vermont's electric ratepayers. The Department petitioned the Board to open an investigation into the structure of the energy efficiency utility, and that investigation became the subject of Docket 7466. At the time of publication of this document, the Docket remains open.

Recommendation 28 Evaluate and improve cost-effective energy efficiency opportunities, the EEU structure, and program delivery mechanisms

Timing	NEAR-TERM
Emissions Impact	MODERATE
Energy Impact	MODERATE
Capital Cost	LOW
Cost-Effectiveness	MODERATE
Funding Sources	Ratepayers
Relation to GCCC	ESD-1
Current Status	Ongoing, PSB Workshops have been in process since July 2007
Parties Involved	EVT, BED, DPS, PSB, Vermont Electric Utilities, AIV, IBM, CLF

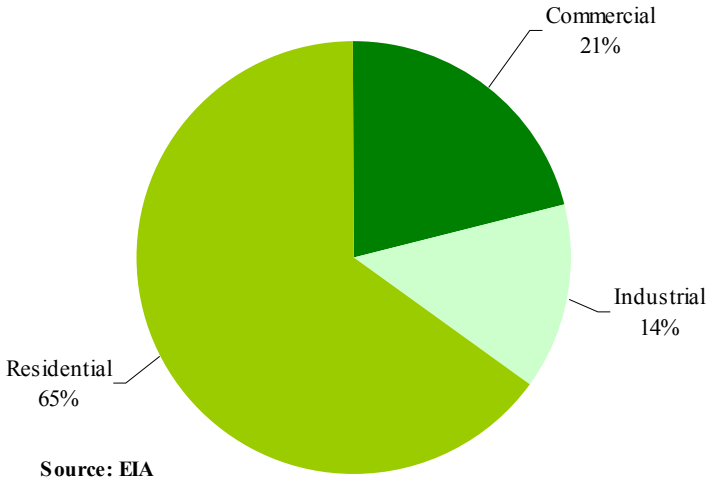
a) Electric utility planners and the Department should annually revisit and review the key technical assumptions and estimates of ratepayer benefits and tailor assumptions to T&D planning efforts through the VSPC subcommittee process.
b) The Vermont PSB should revisit the geotargeted areas at least every 3 years to ensure future investment is aimed at the areas of the state that will provide the greatest value.

STRATEGY K PROMOTE GREATER EFFICIENCY INVESTMENTS FOR UNREGULATED FUEL CONSUMPTION

* Other important issues have been raised as well; a full accounting of the working group's activities can be found at http://psb.vermont.gov/docketsandprojects/eeu/structureworkinggroup. Information regarding the Docket ongoing at the time of this writing can be found here: http://psb.vermont.gov/docketsandprojects/eeu/7466

Regulated industries have often been the focus of energy policy; as cost-based regulated utilities they simply offer more opportunity for meaningful policy interventions than unregulated industries. Recently, however, fuels that are not regulated such as fuel oil, kerosene, propane, and wood (biomass) have received increased attention. Each of these fuels is distinct from regulated utility fuels in that the costs are not shared among a defined and closed group of ratepayers. However, these fuels (excluding transportation) account for 26% of Vermont's total energy demand, 27% of the State's greenhouse gas emissions, and 82% of Vermont's space-heating and industrial process heat requirements. To place it in context, this energy demand (45 billion BTU) is greater than the BTU demand met by Vermont Yankee and Hydro-Quebec power, combined.[5] The residential sector accounts for 65% of unregulated fuel consumption, nearly double the combined usage of the commercial (21%) and industrial (14%) sectors.

Figure V-2 Unregulated Fuel Consumption by Sector (2003)



Source: EIA

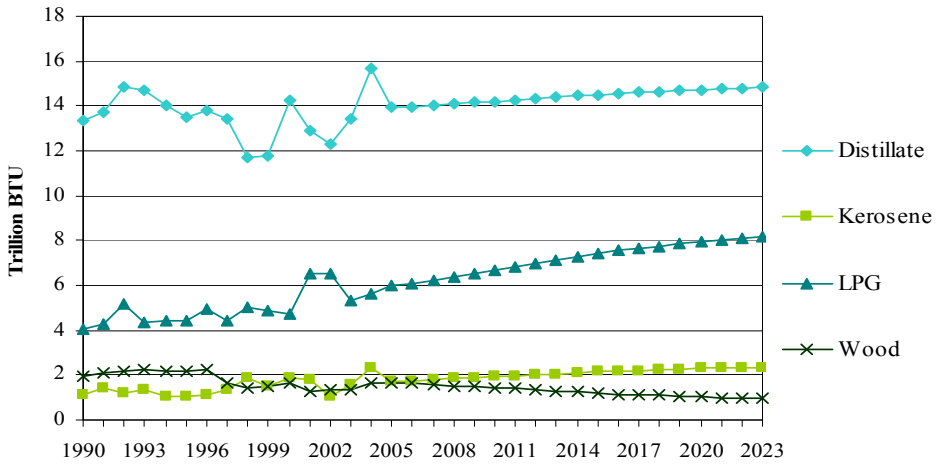
In January 2007, at the request of the Legislature, the Department of Public Service completed an energy-efficiency potential study for distillate fuel oil, propane, kerosene, and wood fuels ("The DPS study"). The DPS study necessarily included a forecast for these fuels: fuel oil, LPG, and kerosene consumption is expected to continue to increase, while wood consumption gradually decreases, on a BTU basis. The forecast also predicts that in Vermont fuel oil will continue to be consumed at a rate higher than that of all of the other fuels combined.*

According to the DPS study, fuel oil holds the largest market share, accounting for approximately 52% of the overall unregulated fuel consumption. It is most commonly used for space and water heating in residential households. Kerosene, used primarily for space heating where fuel tanks are outside, but also in stand-alone space heaters and to blend with off-road fuel to prevent gelling in cold weather, makes up a small portion of Vermont's residential energy consumption.. Liquefied Propane Gas (LPG), used in space and water heating along with its use as a fuel for many cooking appliances, is expected to continue its strong growth. Finally, wood use (mostly in homes for main and supplemental source space heating) has decreased steadily for years and is expected to continue to do so at a slow rate, although continued increases in the price of fuel oil and other fossil fuels could change this assumption. The commercial and industrial sectors show similar trends.

* The complete report: http://publicservice.vermont.gov/pub/other/allfuelstudyfinalreport.pdf.

High levels of consumption create challenges and opportunities for efficiency initiatives in the unregulated fuels sector. To get an indication of the total savings available, the DPS study selected appropriate energy savings measures to determine total unregulated fuels technical and achievable cost-effective potential energy savings. Technical potential can be defined as all the energy savings measures that are technically feasible to install, in all three sectors. The technical potential provides a good basis for the magnitude of the energy savings available in the unregulated fuels market. The total technical energy savings potential as a percentage of the forecast of fuel consumption by the year 2016 is 29.7% for distillate fuel oil, 17.7% for propane, 12% for kerosene, and 29.7% for wood. The results of the DPS study show that large amounts of unregulated fuels energy savings potential are technically possible. However, achieving all of the technical potential for these unregulated fuels would come at a significant, unworkable cost to the consumer. Therefore, it is appropriate to consider the cost-effective achievable unregulated fuels efficiency potential. Cost-effective achievable potential is defined as the potential for the realistic penetration of energy-efficient measures that are cost effective according to the Vermont Societal Test and would be adopted given aggressive funding levels. As shown in *Table V-3* below, the total cost-effective achievable potential as a percentage of the forecast of fuel consumption by 2016 is 14% for fuel oil, 8% for propane, 5.9% for kerosene, and 14.2% for wood. It is important to note here that fuel oil accounts for most of the savings as it is used much more extensively throughout the state than the other fuels: the savings from fuel oil account for 72% of all cost-effective achievable efficiency in the unregulated fuel sectors.

Figure V-3 Historical and Forecast Unregulated Fuels Use



Source: GDS All Fuels Study 2006

Table V-3 Energy Efficiency Achievable Cost Effective Potential by Sector by Fuel Type (2016)

Sector	*Oil*	*Propane*	*Kerosene*	*Wood*
RES	10.2%	5.6%	3.3%	18.3%
COM	24.2%	21.7%	21.9%	16.0%
IND	10.2%	6.7%	10.2%	9.7%
TOTAL	14.0%	8.0%	5.9%	14.2%

To facilitate a timely study, one delivery mechanism was chosen to model as a basis for which cost-effective potential could be measured. As noted above, delivering services in this manner was shown to have significant cost-effective potential. The cost to acquire those savings is not

insignificant: $149 million over 10 years, or $14.9 million per year (nominal dollars). This figure does not include program participant costs, which add another $92 million to the overall investment over the next 10 years. The investments were found to provide net present value savings to Vermont of approximately $486 million.

The DPS study demonstrated that significant opportunity exists to increase the efficiency of unregulated fuels use in Vermont. There are a number of ways to achieve these efficiencies, including current retrofit and market opportunity initiatives such as Home Performance with Energy Star, Vermont Gas retrofit programs, Building Energy Codes, and others. However, on the basis of the DPS study and greenhouse gas concerns, the General Assembly in 2008 passed legislation that created a "Heating and Process Fuel Efficiency Program" supported by a "Fuel Efficiency Fund." This section of the energy Plan discusses this legislation and also offers a suite of policies from building energy standards to an enhanced weatherization program that could compliment the Fuel Efficiency Program to reduce unregulated fuel demand in Vermont, reducing both emissions and energy expenditures. Efforts should be made to implement the policies below that provide the energy savings at the lowest life-cycle cost.

ENERGY-EFFICIENCY SERVICES FOR UNREGULATED FUELS

Beginning in 2010, direct revenues from Vermont's participation in both the Forward Capacity Market and the Regional Greenhouse Gas Initiative will be allocated to Efficiency Vermont for the purpose of developing comprehensive unregulated fuel energy-efficiency services. Funding through 2011 totals approximately $8.7 million, and Efficiency Vermont has begun service delivery as described in the addendum to its annual plan filed with the Public Service Board in December of 2009.[6] With somewhat limited resources relative to the magnitude of opportunities, Efficiency Vermont is targeting certain selected markets, including building a robust market for services through its Home Performance with ENERGY STAR program, Commercial Heating System Efficiency Improvements, Dairy Farm Fossil Fuel Heat Recovery Units, and a low income partnership. In addition, activities will be coordinated to be delivered seamlessly to customers in conjunction with activities funded through the electric energy efficiency charge.

BUILDING ENERGY STANDARDS

Vermont has both residential (RBES) and commercial (CBES) building energy standards in effect. The residential energy code has been in effect since 1997 and the commercial energy code since January of 2007. Both standards are based on the widely used International Energy Conservation Code (IECC) produced by the International Code Council. The IECC is updated every 3 years, and Vermont statute calls for an energy code update process to begin promptly thereafter. The update process consists of the formation of a stakeholder working group that makes recommendations for enhancements to the code, which is then adopted following any modifications made as a result of wider participation in a State rulemaking process. Currently, the Vermont CBES are based on the 2004 version of the IECC and the Vermont RBES are based on the *2000* version of the IECC. Although there is no statewide enforcement mechanism or

inspection process to enforce energy codes, builders, architects, and engineers certify that buildings are met to codes, and building owners have a right of action to recover damages if the codes were not met.* The City of Burlington is the State's lone enforcement exception, where energy criteria are verified in the city's building inspections for new construction.

Other voluntary building energy-rating systems are available to ensure increased efficiency in buildings, often certifying that the building has been built to above-code specifications. Examples include the U.S. Green Building Council Leadership in Energy and Environmental Design (LEED) program and the U.S. Department of Energy offered Energy Star program. In addition, Efficiency Vermont has recently developed a Core Performance program to achieve significant, predictable, above-code energy savings in commercial new construction. These voluntary programs recognize buildings with superior energy performance, offering incentives to further decrease a building's energy demand.

Recommendation 29 Promptly initiate adoption of International Energy Conservation Code for both commercial and residential buildings, and encourage above-code building design.

Timing	NEAR-TERM
Emissions Impact	HIGH
Energy Impact	HIGH
Capital Cost	HIGH
Cost-Effectiveness	HIGH
Funding Sources	Building owners, homeowners, and project developers
Relation to GCCC	ESD-3
Current Status	Act 92 signed March of 2008; RBES and CBES are in place. Training programs for contractors and code enforcement agents is recommended for further analysis and consideration.
Parties Involved	DPS, BED, EVT, Vermont home builders, general contractors, engineers, architects

a) *The Department of Public Service should continue to promptly initiate updates to residential and commercial codes.*
b) *The Department of Public Service should continue to encourage above-code building design, such as Efficiency Vermont's Core Performance Guide.*
c) *As resources permit, the DPS should evaluate the effectiveness of existing self-certification mechanisms and consider further the need for additional strategies for strengthening energy-code enforcement or compliance based on its evaluation.*

ACT 250 ENERGY-EFFICIENCY CRITERIA

* Residential market studies by the DPS are underway that include evaluation of RBES compliance; results are due in August of 2008. This study should roughly indicate the type of compliance achieved by the self-certification mechanism. Commercial market studies are also underway, but will likely give little indication of compliance because the commercial code is relatively new.

Building energy codes in Vermont are supplemented by "Act 250," Vermont's Land Use and Development statute that requires review of proposed major development and subdivisions prior to construction. Before a project that falls under Act 250 is permitted, it must satisfy a number of environmental, social, and fiscal impact criteria, including criterion 9F, which applies to energy conservation. The statue states that a permit will be granted only if

> "the planning and design of the subdivision or development reflect the principles of energy conservation and incorporate the best available technology for efficient use or recovery of energy."[7]

As it relates to criterion 9F, the term "best available technology" has been interpreted to mean the best of proven design techniques and of normally accessible equipment and materials. When evaluating equipment and materials for use, the option that uses the least amount of energy or has the lowest life-cycle costs shall be selected to comply with the best available technology requirement. For commercial buildings the baseline to satisfy the 9F criterion has generally been the Vermont Guidelines for Energy-Efficient Commercial Construction, which as of January 1, 2007 is also the commercial energy code for the State. The Department of Public Service evaluates projects for compliance with the 9F criterion and can recommend above-code energy-efficiency measures that the applicant should install if they are cost effective on a life-cycle basis. For residential buildings, meeting the Residential Building Energy Standard is considered compliance with Act 250 criterion 9F
If and when the DPS recommends above-code efficiency improvements for an Act 250 permit to be granted, the agency needs to ensure that recommendations are consistent and evenly applied to provide predictability to builders, architects, and engineers that are needed to plan and construct efficient, affordable buildings.

The New Buildings Institute, Inc. has created a Core Performance Guide Vermont Edition that may be ideally suited to the task for small-to-medium-sized commercial buildings. The Core Performance Guide is designed to reduce energy use in new buildings by 20–30% compared to the Vermont Commercial Energy Code (based on the IECC 2004 and ASREA 90.1-2004). Core Performance requirements are most appropriate for new buildings and major renovations, but can be applied to smaller projects.

Recommendation 30 Strengthen energy efficiency criteria by adopting uniform and transparent above-code standards that could be applied through Act 250 reviews.

Timing	NEAR-TERM
Emissions Impact	HIGH
Energy Impact	HIGH
Capital Cost	MEDIUM/HIGH (per unit)
Cost-Effectiveness	HIGH
Funding Sources	Building owners, homeowners, and project developers
Relation to GCCC	ESD-3
Current Status	*DPS completes ongoing review of Act 250 energy efficiency criteria under current requirements.*
Parties Involved	DPS, BED, EVT, Vermont home builders, general contractors,

	engineers, architects

a) *As resources permit, the DPS should create a task force to consider above-code guidelines for commercial building, such as the Core Performance Guide for commercial buildings, to be used to satisfy the Act 250 energy efficiency criteria.*

VERMONT'S WEATHERIZATION PROGRAM

Vermont's Weatherization Program is run by the Vermont Office of Economic Opportunity (OEO). The mission of the OEO's Weatherization Program is to reduce the energy costs for low-income families, particularly for elderly persons, people with disabilities, and children, by improving the energy efficiency and comfort of their homes while ensuring their health and safety. The Vermont Weatherization Program was started in 1976 in response to the nation's energy crisis. Funding was initially provided solely by the U.S. Department of Energy (USDOE). This changed in 1990 when the State of Vermont established a permanent source of funding through the Vermont Weatherization Trust Fund (WTF), financed by a tax of 0.5% on all non-transportation fuels sold in the state (the gross receipts tax). The WTF stabilized the funding, infrastructure, and technical capacity of the program. Of the current program funding the overwhelming majority is provided by state funds, with approximately 80% coming from state funds and 20% coming from the USDOE.

To participate in the program households must meet income eligibility guidelines listed by the OEO—currently 60% of state median income or less. Approximately 49,000 households are eligible. Weatherization Services available to income-eligible people include the following:

- Comprehensive "whole-house" assessment of energy-related problems.
- Building diagnostics, including blower door, carbon monoxide, and heating system testing and infrared scans.
- "Full-service" energy-efficient retrofits, including dense-pack sidewall insulation, air sealing, attic insulation, and heating system upgrades and replacements.

Vermont's Weatherization Program currently treats approximately 1,400 units per year. The OEO works as a partner with Efficiency Vermont, Vermont Gas, and the Burlington Electric Department to provide efficiency services to these homes. Every dollar spent on efficiency implementation in these homes has returned greater benefits to customers. In 2005, for example, the return was $1.98. For the housing units treated in the 2005 program year the cost benefit ratio of 1.53 was based on the energy savings benefits alone, and was much greater once health and safety measures were included.

Table V-4 Weatherization Funds and Total Homes Served 2002-2007[8]

YEAR	DOE	LIHEAP	WXTRUST	TOTAL	No. Units
2002	$1,025,691	0	$4,512,826	$5,538,517	1211
2003	$1,256,227	$400,000	$5,191,886	$6,848,113	1339

2004	$1,277,921	0	$5,221,135	$6,499,056	1336
2005	$1,283,358	0	$5,113,081	$6,396,439	1352
2006	$1,353,926	0	$5,417,512	$6,771,438	1443
2007	$1,353,926	0	$6,008,088	$7,362,014	1344

The Weatherization Program has successfully been providing cost-effective weatherization services to low-income Vermonters for many years. However, tens of thousands of qualifying homes continue to wait in a queue to receive services. Increased funding could allow for increased program reach, along with an increased scope of services to more comprehensively treat the home. The recommendations for weatherization are part of the development of all-fuels efficiency programs under Act 92.

APPLIANCE EFFICIENCY STANDARDS

Ensuring that a residential or commercial building core is efficient is essential to facilitate a reduction in Vermont's unregulated fuel demand. To complement the thermal performance and system efficiency in energy codes discussed above, appliance standards for new products can be implemented by states that ensure new products meet minimum efficiency levels. California enacted the first appliance efficiency standard in 1974. State-by-state adoption of appliance efficiency standards, spurred by California's initiative, continued to about the mid-1980s until appliance manufacturers, faced with the prospect of many different standards, collaborated with states to establish a national appliance efficiency standard. In 1987 the National Appliance Energy Conservation Act (NAECA) was signed into law, establishing standards for many appliances and giving the Department of Energy (DOE) the authority to update the standards when justified. In addition to NAECA more appliance standards were set in the Energy Policy Act of 1992 and 2005 and the Energy Independence and Security Act of 2007. For appliances that are covered under these federal standards, states are preempted from enacting their own appliance standards that conflict with the federal standards. However, the federal law does allow for states to formally apply to the DOE for a waiver that allows them to implement standards more stringent than the federal standards if the state can prove they have an unusual and compelling reason to do so. To date no state has received a waiver.

Vermont, in the 2005–06 session of the General Assembly, enacted legislation directing the Department of Public Service to promulgate rules establishing appliance standards for new products that serve to increase the minimum efficiency levels achieved in homes and businesses, including furnaces, boilers, and metal halide lamp fixtures, among other products.[*] The residential boiler and furnace standards included in the Act are preempted by federal standards. Vermont, along with other northeastern states, was concerned that the DOE was far behind on updates (1992 was the last update for these appliances), so they set standards anyway. Vermont is cooperating with Massachusetts and Rhode Island, who have enacted similar preempted appliance-efficiency standards, in a joint waiver request to the DOE to implement the new standards. The DOE has given some indication that joint requests may be looked on more favorably.

[*] 9 V.S.A. chapter 74 (Act 152 of the 2005–2006 general session).

Recommendation 31 Continue process to seek a waiver from federal appliance standards where Vermont enacted standards increase minimum efficiency.

Timing	NEAR-TERM
Emissions Impact	MEDIUM
Energy Impact	MEDIUM
Capital Cost	LOW
Cost-Effectiveness	HIGH
Funding Sources	Consumers and appliance manufacturers
Relation to GCCC	--
Current Status	*DPS completes ongoing review of Act 250 energy efficiency criteria under current requirements.*
Parties Involved	*Department of Public Service, Office of the Attorney General, Regional Energy Efficiency Groups, other regional states*

a) *Continue active involvement in DOE's appliance efficiency standard process, and advocate for stricter appliance standards.*

TIME-OF-SALE EFFICIENCY AND DISCLOSURE REQUIREMENTS

The time-of-sale of a building presents an opportunity to educate potential buyers about the energy use of a home or a commercial building. A time-of-sale energy consumption disclosure could require a seller to disclose the annual energy consumption (including at least 1 year of electric use, 1 year of heating fuel use, and the number of people in the household, or business hours of operation) and/or results of any energy rating performed on the building at the time of sale. This energy information would be useful to potential buyers as a means to compare energy-efficiency levels of various buildings they may be interested in purchasing and encourage investment in efficiency by either a prospective buyer or a seller of property. An energy consumption disclosure could be incorporated into the current disclosure requirement that includes building construction, safety, and health issues. Differing versions of time-of-sale disclosure requirements have been adopted in New Jersey, Kansas, Maine, and many cities across the country.

The next step beyond an efficiency disclosure requirement is the potential for efficiency improvement requirements at time of sale. Burlington City has a "Minimum Rental Housing Energy-Efficiency Standards Ordinance" that requires certain efficiency measures to be installed prior to sale (including cost caps). The buyer and the seller of the property can negotiate the efficiency improvements into the sale price. Detailed analysis of this type of measure should be conducted before this model is applied statewide, as barriers to implementation include enforcement, available contractors to perform work, and undue burden on buyers and sellers caused by increased property prices and sale requirements. Technical and financial assistance maybe needed prior to any potential requirement's development.

Recommendation 32 Investigate time-of-sale energy consumption disclosure requirements.

Timing	NEAR-TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	--
Cost-Effectiveness	--
Funding Sources	Building and home owners and buyers
Relation to GCCC	ESD-3a
Current Status	Burlington has a time-of-sale efficiency requirement for rental units.
Parties Involved	Department of Public Service, Department of Housing and Community Affairs, Energy Efficiency Advocates, Vermont Realtors Associations, Vermont home builders, Burlington Electric Department.

a) *As resources allow, the Department of Public Service should create a task force to investigate the feasibility, desirability, and potential timeframes for the establishment of a Time-of-Sale disclosure requirements at time-of-sale.*
b) *Before Vermont attempts to establish any time-of-sale requirements, Vermont should address the fundamental workforce constraints associated with any audit or verification mechanism employed.*

STRATEGY L ENSURE A COMMITMENT TO SOUND PROGRAM DESIGN AND EFFECTIVE SAVINGS CHARACTERIZATION OF VERMONT GAS SYSTEMS ENERGY EFFICIENCY PROGRAMS

VGS's annual expenditures approximately 1.5% of its revenues. While these percentages compare favorably with other natural gas DSM programs nationally, there could be opportunity to achieve higher levels of efficiency. Currently, there are no requirements for periodic completion or assessment of VGS's energy-efficiency potential studies, nor any independent verification of their savings claims.

Table V-5 Vermont Gas DSM- Reported Annual Costs and Savings

	Vermont Gas Expenditures	VGS Annual Savings (Mcf)
2000	$812,692	43,555
2001	$1,053,016	43,186
2002	$954,167	51,834
2003	$1,136,766	51,344
2004	$1,122,179	56,968
2005	$1,234,239	74,300
2006	$1,282,729	58,795
2007	$1,512,455	78,670
2008	$1,881,459	98,400

Without such mechanisms, it is difficult to assess how ambitious or current the programs are relative to statutory requirements or their electric utility counterparts. It is also difficult to validate savings claims. The DPS and VGS should collaborate to ensure that all cost-effective achievable potential is achieved and appropriate evaluation and verification of programs occurs.

Recommendation 33 Update potential for and acquire all cost-effective natural gas efficiency savings; update monitoring and verification process

Timing	NEAR-TERM
Emissions Impact	HIGH
Energy Impact	HIGH
Capital Cost	LOW
Cost-Effectiveness	HIGH
Funding Sources	Gas Rates
Relation to GCCC	ESD-1
Current Status	VGS has an ongoing program
Parties Involved	Department of Public Service, VGS, EVT, BED

a) *Vermont Gas should periodically complete a natural gas efficiency potential evaluation that is independently reviewed by the, and acquire available efficiency resources that are cost effective.*

In light of the evolving nature of all-fuels program VGS should reevaluate the appropriate mechanisms to coordinate/collaborate natural gas efficiency with Efficiency Vermont.

ENDNOTES

[1] Burlington Electric Department (2008) Annual Report: http://www.burlingtonelectric.com/EnergyEfficiency/EnergyEfficiencyAnnualReport.pdf, and Efficiency Vermont (2008) Annual Report (and prior years). Reports available at: http://www.efficiencyvermont.com/pages/Common/AboutUs/AnnualReport/

[2] Eldridge, Maggie et al., "The State Energy Efficiency Scorecard for 2006," American Council for an Energy-Efficient Economy, June 2007, Report Number E075.

[3] Public Service Board "Order RE: Energy Efficiency Utility Budget for Calendar Years 2009, 2010, and 2011." 8/29/08

[4] Public Service Board "Order Approving Change in EEU Structure and Scheduling Status Conference. 11/24/09. Page 5

[5] Calculations based on data in the Department of Public Service's *Utility Facts.*

[6] http://efficiencyvermont.com/stella/filelib/EVT_AP10%20Addendum%20_FINAL%20.pdf

[7] 10 V.S.A. §6086.

[8] Table provided by Office of Economic Opportunity, March 2007.

SECTION VI TRANSPORTATION AND LAND USE

INCREASE THE EFFICIENCY OF VEHICLES AND REDUCE EMISSIONS

Efficiency in the transportation context can pertain separately to the miles per gallon a vehicle achieves or to the amount of emissions from the engine combustion of that vehicle. Advances in technology are continually increasing the miles-per-gallon potential of vehicles, while at the same time reducing engine emissions. Regulations have been in place nationally since 1975 for fuel economy; emissions standards were adopted even earlier. Regulatory policies can help drive further advances in technology to significantly reduce fuel consumption and emissions, without reducing mobility. Further, although Vermont is a small state and has limited power to drive the market for a particular technology, the state can capitalize on available or emerging technologies to reduce consumption of and emissions from fuel used to meet transportation needs. The discussions below will document some policy successes and offer potential paths forward for the state.

Recommendations in this subsection are divided into three strategies. The first is *regulatory policy*, including discussions of Corporate Average Fuel Economy standards and the state's adoption of the Vermont Low Emission Vehicle Standards. Second, the *efficiency of new and existing vehicles* can be improved in part through consumer education and incentives to increase the market share of high efficiency vehicles and technologies already available to the general public. Finally, *research and development* of plug-in hybrids and technologies that would be enabled by supporting infrastructure offer significant possibilities for Vermont's future vehicle fleet.

STRATEGY M FUEL ECONOMY AND EMISSIONS STANDARDS

Two major areas of the transportation sector are regulated—Corporate Average Fuel Economy (CAFE) standards specifying the required miles per gallon of vehicles sold in the U.S. and Low Emission Vehicle (LEV) standards set separately by the federal and California governments. These policy paths achieve differing goals of reducing consumption and reducing emissions. Although no policy recommendations are offered here, CAFE and LEV standards are described in more detail below, as both policies have broad implications in Vermont and nationally.

CAFE

Corporate Average Fuel Economy (CAFE) standards were first created by the Energy Policy Conservation Act in 1975 in response to the Arab Oil Embargo and tripling of fuel prices in 1973–74. They were intended to double new car fuel economy by the model year 1985. The standards separately measure the weighted average fuel economy of passenger cars and trucks manufactured for sale in the United States and require certain efficiency levels. Recently, these standards were updated in the Energy Independence and Security Act of 2007—the passenger vehicle standards were increased to require 35 mpg average fleet economy by 2020.

This represents the first change in mileage requirements since 1990 (see Table VI-1 Fuel

Table VI-1 Fuel Economy Standards for Passenger Cars and Light Trucks Model Years 1978 through 2007 (in mpg) [1]

Model Year	*Passenger Cars*	*Light Trucks* [(1)]		
		Two-wheel Drive	*Four-wheel Drive*	*Combined* [(2), (3)]
1978	18.0 [(4)]	...	...	...
1979	19.0 [(4)]	17.2	15.8	...
1980	20.0 [(4)]	16.0	14.0	...[(5)]
1981	22.0	16.7[(6)]	15.0	... [(5)]
1982	24.0	18.0	16.0	17.5
1983	26.0	19.5	17.5	19.0
1984	27.0	20.3	18.5	20.0
1985	27.5[(4)]	19.7[(7)]	18.9[(7)]	19.5[(7)]
1986–88	26.0[(8)]	20.5	19.5	20.0
1987	26.0[(9)]	21.0	19.5	20.5
1988	26.0[(9)]	21.0	19.5	20.5
1989	26.5[(10)]	21.5	19.0	20.5
1990	27.5[(4)]	20.5	19.0	20.0
1991	27.5[(4)]	20.7	19.1	20.2
1992	27.5[(4)]	...	...	20.2
1993	27.5[(4)]	...	...	20.4
1994	27.5[(4)]	...	...	20.5
1995	27.5[(4)]	...	...	20.6
1996	27.5[(4)]	...	...	20.7
1997	27.5[(4)]	...	...	20.7
1998	27.5[(4)]	...	...	20.7
1999	27.5[(4)]	...	...	20.7
2000	27.5[(4)]	...	...	20.7
2001	27.5[(4)]	...	...	20.7
2002	27.5[(4)]	...	...	20.7
2003	27.5[(4)]	...	...	20.7
2004	27.5[(4)]	...	...	20.7
2005	27.5[(4)]	...	...	21.0
2006	27.5[(4)]	...	...	21.6
2007	27.5[(4)]	...	...	22.2

Economy Standards for Passenger Cars and Light Trucks Model Years 1978 through 2007 (in mpg) below for passenger vehicles. Light truck standards have increased slightly over the last 3 years due to reformed rules from the Secretary of Transportation, from 20.7 (1996–2004) to 22.2 (2007). The light duty standard will increase to 23.5 mpg in 2010, and afterwards to a "level which maximizes net benefits . . . set at the maximum feasible level."[2] The savings associated with the increased CAFE standards have positive environmental and economic impacts in Vermont.

1. Standards for MY 1979 light trucks were established for vehicles with a gross vehicle weight rating (GVWR) of 6,000 pounds or less. Standards for MY 1980 and beyond are for light trucks with a GVWR of 8,500 pounds or less.
2. For MY 1979, light truck manufacturers could comply separately with standards for four-wheel drive, general utility vehicles, and all other light trucks, or combine their trucks into a single fleet and comply with the standard of 17.2 mpg.

3. For MYs 1982–1991, manufacturers could comply with the two-wheel and four-wheel drive standards or could combine all light trucks and comply with the combined standard.
4. Established by Congress in Title V of the Motor Vehicle Information and Cost Savings Act.
5. A manufacturer whose light truck fleet was powered exclusively by basic engines which were not also used in passenger cars could meet standards of 14 mpg and 14.5 mpg in MYs 1980 and 1981, respectively.
6. Revised in June 1979 from 18.0 mpg.
7. Revised in October 1984 from 21.6 mpg for two-wheel drive, 19.0 mpg for four-wheel drive, and 21.0 mpg for combined.
8. Revised in October 1985 from 27.5 mpg.
9. Revised in October 1986 from 27.5 mpg.
10. Revised in September 1988 from 27.5 mpg.

Recommendation 34 Continue to support CAFE standards and advocate for the enactment of increasingly tougher standards.

Timing	LONG-TERM
Emissions Impact	HIGH
Energy Impact	HIGH
Capital Cost	MODERATE/HIGH (per consumer)
Cost Effectiveness	HIGH
Funding Sources	Consumers and Manufacturers
Relation to GCCC	--
Current Status	Ongoing debate in Congress; a slight increase in light duty standards has been required through 2007 statutory changes.
Parties Involved	Congressional delegation

LOW EMISSION VEHICLE PROGRAM

The Low Emission Vehicle (LEV) Program represents a tailpipe emission reduction policy initially promulgated by California in 1990/91. The Federal Clean Air Act (CAA) of 1970 provides the framework for regulating emissions from motor vehicles and it granted California the authority to set its own vehicle emission standards in lieu of implementing the federal program. Other states may adopt the California program as their own but are otherwise prohibited from setting their own emission standards. Manufacturers must meet either standard depending on the program adopted by the state in which they wish to sell vehicles, with the federal version being the default program. It is important to note that the LEV program is not a vehicle efficiency program, but an emissions reduction program. Its goal is to reduce emissions from vehicles, without determining how that reduction is met. Vermont moved to adopt the California LEV program in calendar year 1996 and it took effect in the state in the vehicle model year 2000. Three other states in the region, New York, Massachusetts, and Maine, have also adopted the LEV standard and a total of 14 states around the country have adopted the standard. Automakers have challenged Vermont's implementation of the California LEV standards but Vermont recently won a federal court decision in favor of its continued participation in the program.[*] However, the EPA has subsequently rescinded the exception that permitted California and other states to have a LEV requirement, because the EPA views LEV standards as belonging to its own sphere of influence through CAFE standards that were updated in the Energy Independence and Security Act of 2007.

[*] http://www.nytimes.com/2007/09/13/us/13emissions.html?n=Top/Classifieds/Autos/Topics/Green%20Tech

The Vermont Low Emission Vehicle program requires that all new passenger vehicles (any vehicle with 7,500 odometer miles or less) sold and registered in Vermont meet California motor vehicle emission standards. To maintain consistency with the California program (as required by federal law), the Vermont ANR filed rule-making documents with the Secretary of State in 2005 to amend Vermont's regulation regarding the LEV program. Under the new rule, one set of greenhouse gas (GHG) standards was established for passenger cars, small light-duty trucks, and small SUVs, and another set was established for large light-duty trucks and large SUVs. Both sets of GHG standards will be gradually phased in between model-years 2009 and 2016. When fully implemented during model-year 2016, new motor vehicles subject to the regulation will be required to emit approximately 30% fewer GHGs than before the regulation.* In a report published for the Governor's Commission on Climate Change, it was estimated that by 2030, these new regulations would save approximately 1.26 $MMTCO_2e$ (million metric tons of carbon dioxide equivalent) emissions per year.[3] In addition to stricter emission standards, the LEV program also seeks to improve vehicle characteristics such as engine durability, engine management, and on-board diagnostic systems.

Passenger vehicles with diesel engines are not available for sale in Vermont because they do not meet Vermont emission standards under the LEV program described above. Diesel passenger vehicles are discouraged due to health and other economic costs associated with their emissions. Heavy-duty vehicles with diesel engines carry much of the freight that is shipped around Vermont today. Progress has been made and standards have been set to reduce the emissions from heavy-duty engines; however opportunities exist to further increase the efficiency and reduce emissions from heavy-duty diesel engines.

Recommendation 35 Continue to adopt the most stringent LEV standards available.

Timing	LONG-TERM
Emissions Impact	HIGH
Energy Impact	HIGH
Capital Cost	MODERATE (per consumer)
Cost Effectiveness	HIGH
Funding Sources	Consumers and Manufacturers
Relation to GCCC	--
Current Status	Vermont is one of many states adopting the California LEV program
Parties Involved	ANR, EPA, Federal Law

* California adopted the "Pavley" amendments in 2004 which, as noted, are intended to regulate Greenhouse Gas (GHG) emissions. To retain consistency with California, Vermont adopted these GHG amendments as well. This aspect of LEV was challenged by automakers in court in 2007. The court ruled that Vermont's adopted provisions were not preempted by federal law.

STRATEGY N OTHER EFFORTS TO IMPROVE OPERATIONAL EFFICIENCY OF NEW AND EXISTING VEHICLES

Instead of waiting for increased CAFE standards, some vehicle manufacturers have capitalized on consumer demand for more efficient vehicles by offering a number of hybrid and other relatively high efficiency passenger vehicles to consumers in recent years. However, the most efficient of these vehicles have a higher initial cost that can dissuade buyers even though the vehicle may be more economical in the long run.

Economic incentives and clear, accessible information could encourage consumers to make efficient decisions. Further, aftermarket products such as low rolling resistance tires and low viscosity oil, along with consumer awareness of vehicle maintenance effects on efficiency hold the opportunity to reduce energy consumption in the transportation sector.

HYBRID AND FUEL EFFICIENT VEHICLES

In January of 2005, the Joint Fiscal Office published a legislative report on Hybrid Electric Vehicles.[4] They noted the incentives already available in Vermont: The first is through the federal income tax deduction (up to $3400 at the time depending on the vehicle's fuel economy). The benefit of the deduction is automatically passed through to Vermont taxpayers with respect to their state income tax liability, because state income tax liability is based on federal income after deductions. Second, a number of incentives are available as state income tax credits designed to encourage high-tech industries. More incentives could increase sales of hybrids in Vermont. In 2007 only 420 new or used hybrid vehicles were sold in the state (~1% of the total vehicles sold).[5]

It is important to note that not all efficient vehicles are hybrids. In fact, of the top 10 model-year 2009 vehicles, 5 were hybrids (including the top 4—see Table VI-2 below).[*] Establishing specific incentives for fuel-efficient vehicles would promote the purchase of the most efficient vehicles available, without "picking a winner." In Vermont, where consumers' collective power to influence auto manufacturer decisions is comparatively limited because of small market size, this may be the most effective incentive mechanism. To this end, Governor Douglas in his State of the State address in January of 2007 suggested a percentage reduction in the purchase and use tax levied on new vehicles in the state if the vehicle is "fuel efficient"—defined as operating at a minimum of 30 mpg.

[*] In 2008, 7 of the 10 top models are hybrids. http://www.epa.gov/fueleconomy/overall-high.htm

Table VI-2 Most Efficient Vehicles Based on EPA Ratings (Model Yr 2009) *

2009 Rank	Vehicle	City/Hwy mpg	Vehicle Type
1	Toyota Prius (Hybrid)	48/45	Car
2	Honda Civic Hybrid	40/45	Car
3	Nissan Altima Hybrid	35/33	Car
4	Ford Escape Hybrid	34/31	SUV
5	Samart Fortwo	33/41	Car
6	Toyota Camry Hybrid	33/34	Car
7	Volkswagon Jetta (manual diesel)	30/41	Car
8	Volkswagon Jetta (auto diesel)	29/40	Car
9 (tie)	Toyota Yaris (manual)	29/36	Car
10	Toyota Yaris (auto)	29/35	SUV

Another possible way to increase the efficiency of vehicles in Vermont is through changes to company vehicle fleets. Company fleets are more easily regulated than individually owned vehicles because they are managed in groups. Fleet practices and priorities depend heavily on fleet type. Rental vehicles turn over very rapidly and dominate fleet purchases of cars, but rental fleets have no motivation to conserve fuel. Government fleets pay attention to environmental performance and are the easiest to regulate, but turn over slowly and are subject to numerous and sometimes incompatible mandates (Government fleets are discussed in the government actions section, see Strategy Z: Reduce Petroleum Fuels Consumption for State Government Transportation Needs). Commercial fleets take an interest in fuel economy but have not yet been drawn into coordinated efforts to promote fuel-efficient vehicles to any significant extent. As of the fall of 2006, there were over 5400 commercial vehicles registered in Vermont. "Best-in-class" incentives or requirements, which encourage company fleet managers to purchase the most efficient vehicles, could be a viable addition or alternative to the other incentives discussed in this section.

A third method to encourage the purchase of fuel efficient vehicles is a "feebate" structure, where purchasers of the least efficient vehicles would pay a fee at the time of purchase and purchasers of the most efficient vehicles, including hybrids, would receive an incentive, or rebate. This revenue neutral program could be structured to operate within each vehicle class, so businesses and families for whom a larger vehicle is a necessity would not be adversely affected, as an SUV or a large truck would still be eligible for an incentive—the purchaser would simply be encouraged to buy the most efficient vehicle in that particular class. This is important in Vermont, as 31% of vehicles purchased fall into either the "large" or "largest" vehicle categories, and 41% are designated "medium."[† 6] A number of analyses have indicated that many of the benefits associated with this type of program arise from changes made by manufacturers when they recognize shifts in market demand toward vehicles with greater fuel efficiency. As stated earlier, Vermont has limited power to influence manufacturer decisions because of the small size of its auto market. Although it isn't currently being discussed, a regional approach to a feebate system could prove beneficial. However, this raises issues about administration and coordination of the program, and how funds would be distributed. In any feebate program, readily available information for the purchaser is essential. Feebates have been proposed in a number of areas

* *Ibid.*

† "Medium" vehicles include: heavy-duty station wagon, lower middle, mid luxury, mid sporty, midsize pickup, mini sport utility and minivan. "Large" vehicles include: full-size pickup, full-size van, prestige luxury, prestige sporty, roadster, sport utility and traditional large. "Largest" vehicles include: utility vehicles.

around the country but have yet to be implemented; a number of options are discussed in the Governor's Commission on Climate Change Final Report.

Recommendation 36 Evaluate opportunities to encourage vehicle efficiency through targeted incentives.

Timing	NEAR/LONG-TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	LOW
Cost Effectiveness	HIGH
Funding Sources	Taxpayers unless structured as revenue neutral
Relation to GCCC	--
Current Status	--
Parties Involved	AOT, Dept of Taxes, Vermont business community

a) *AOT and Dept. of Taxes should work with the business community to evaluate various incentives and possible "best-in-class" requirements for encouragement of efficient company fleets.*

VEHICLE MAINTENANCE AND EFFICIENT AFTERMARKET TECHNOLOGIES

Many vehicles are not purchased new, and most vehicles stay in the owner's possession for a number of years. Opportunities are available to increase the efficiency of vehicles after they leave the showroom or the used car lot, by informing consumers of the benefits of aftermarket technologies and strategies that are commercially available and cost effective. Vehicle maintenance is necessary to ensure vehicles perform at optimum efficiency levels throughout their life. Even small everyday maintenance such as checking tire pressure can make a significant difference in a vehicle's fuel consumption. Further, some currently available aftermarket technologies such as low rolling resistance tires and low viscosity oil can improve mileage and performance.

Vehicle Maintenance and Inspection: As a complement to new car emissions standards, the Vermont Vehicle Inspection Program, overseen by the Vermont Department of Motor Vehicles, provides an annual inspection of vehicles, including emissions control systems.* For vehicles to pass inspection and be eligible to operate on Vermont roads, the vehicle must pass a series of safety and operations tests and be fitted with the air pollution control equipment (or replacement components), which the manufacturer installed on the vehicle. During the inspection process, malfunctioning components are identified which not only increase the vehicle emissions, but also result in increased fuel consumption. For example, it is well documented that failed oxygen or air-fuel ratio sensors will increase emissions and fuel consumption on the order of 30%.

* The Vermont Low Emission Vehicle (LEV, discussed above) program is intended to bring the cleanest cars the auto manufacturers have in mass production to consumers in Vermont. However, no matter how advanced a vehicle's emissions control system is, without proper maintenance and service, the technology cannot deliver on its design.

Inspections help to ensure that efficient and safe vehicles are on Vermont roads, and all opportunities to enhance the program should be explored.

Table VI-3 Commercially available efficient replacement tires[7]

Brand	Model	Size
Bridgestone	B381	185/70R14
Nokian	NRT2	185/70R14
Sumitomo	HTR 200	185/70R14
Dunlop	Graspic DS-1	185/70R14
Dunlop	SP40 A/S	185/70R14
Bridgestone	Blizzak WS-50	185/70R14
Goodyear	VIVA 2	185/70R14
Continental	Conti Touring Contact CH95	205/55R16
Michelin	Pilot Alpine	205/55R16
Michelin	EnergyMXV4 Plus	205/55R16
Dunlop	SP Winter Sport M2	205/55R16
Michelin	Arctic Alpine XL	235/75R15
Dunlop	Axiom Plus WS	235/75R15
BF Goodrich	Long Trail T/A	245/75R16
Michelin	XPS Rib LT	245/75R16
Michelin	LTX M/S	245/75R16
Bridgestone	Dueler A/T D693	245/75R16

Tire Inflation and Vehicle Maintenance Awareness and Information: Under-inflated tires and poorly maintained vehicles can significantly decrease a vehicle's fuel economy. A vehicle with one tire under-inflated by 8 pounds per square inch (psi) can cause a 4% decrease in fuel economy.[8] Poor maintenance of vehicle systems such as oil and air filters can also decrease efficiency significantly. A coordinated informational campaign could help inform consumers about ways to save fuel and money.

Low Rolling Resistance Tires: About 80–88% of the energy contained in a vehicle's gasoline tank is wasted in thermal, frictional, and standby losses in the engine and exhaust system.[9] After the engine successfully converts chemical fuel energy to rotational energy at the drive axle, losses occur between the wheel rims and tires and between the tires and the road. These losses are collectively known as rolling resistance. Tires on new cars generally have lower rolling resistance than those tires on the "aftermarket" (replacement tires), due to auto manufacturer pressure to meet federal CAFE standards (discussed above). However, consumers currently do not have information available, or assistance to help them select replacement tires for optimal fuel economy once their original tires have worn out. Efficiency information is not printed on the tire and dealers often do not stock efficient tires or have information available. The likely scenario is that customers replace their tires as needed on fairly short notice, due to tire failure or an advertised sale.[10] Low rolling resistance tires are already on the market and the minimal incremental cost of $5–12 per tire is recovered quickly, as the average fuel savings are approximately 3%.[11] Low rolling resistance tires meet federal standards for tread wear, traction, and temperature resistance.[12] Table VI-3 above lists the tires with the lowest rolling resistance on the replacement market today. Information availability is the largest barrier to greater market penetration. California, in an effort to address this problem, passed legislation in 2003 requiring the state to implement a tire efficiency program by 2008 that is designed to ensure replacement tires sold in the state are at least as efficient as those originally on the vehicle.

Low Viscosity Oil: There is some evidence that lower viscosity oil can increase vehicle fuel economy by reducing energy losses from internal friction. The oil, which works especially well in colder climates, could reduce the need for oil changes, and have no ill effect on engine wear. In passenger vehicles, some tests have shown increases in efficiency of between 1 and 5%.[13] Ecos Consulting reported to the International Energy Agency that low viscosity oil only needs to be changed every 10,000 miles, costs $5/quart, and increases fuel efficiency by an average of 4%.[14]

Recommendation 37 Encourage proper vehicle maintenance through information dissemination and efficient technologies.

Timing	NEAR-TERM
Emissions Impact	MODERATE
Energy Impact	MODERATE
Capital Cost	LOW
Cost Effectiveness	HIGH
Funding Sources	--
Relation to GCCC	--
Current Status	--
Parties Involved	AOT, DPS, tire retailers and distributers

a) *Evaluate aftermarket tire efficiency labeling requirement, and/or tire efficiency requirements.*[*]
b) *Conduct education and information outreach, led by AOT and PSD, to inform consumers of the choices available concerning replacement tires, low viscosity oil, and tire inflation.*

DIESEL ENGINES

Over 70 million gallons of diesel fuel were sold in Vermont in 2006. Most of this fuel is consumed in on-highway transportation related applications, and is used in heavy-duty engines, such as in buses and commercial trucks. Due to manufacturers' failure to produce diesel engines that meet Low Emission Vehicle (LEV) standards, new passenger vehicles powered by diesel engines are currently not sold in Vermont. Diesel engines produce far greater amounts of particulate matter and nitrogen oxides; these pollutants have significant health and environmental effects, such as contributing to increased cancer risk, smog, fine particulate matter, and acid rain.[15] Because of these impacts, diesel passenger engines are not desirable in Vermont, unless cleaner engines or cleaner fuel is developed.

Diesel engines are often used in heavy-duty vehicles, as the diesel combustion process leads to high torque and power. Recently, much progress has been made in reducing the emissions from heavy-duty diesel engines. The Environmental Protection Agency (EPA) promulgated rules that took effect in 2006 requiring "ultra low sulfur diesel" (ULSD) fuel to be used in all diesel engines. This fuel contains 97% less sulfur than conventional diesel and produces less particulate emissions in diesel engines of all ages. Further, the fuel enables emissions control technologies such as particulate traps and catalytic converters, which were formerly only available on conventional gasoline engines.[16]

[*] Because California is already encouraging the inclusion of low resistance tires in the replacement market, Vermont likely could follow and implement the policy locally, resulting in a significant impact to the state. Had California not already acted, Vermont's sphere of influence would be very limited.

The gains achieved with the ULSD requirement are a step in the right direction, but there is room for further environmental progress in the realm of diesel fuel use. For example, idling vehicles are not performing useful work, yet are still consuming fuel and producing harmful emissions. A typical truck burns one gallon of diesel fuel for each hour that it idles.[17] This idling often is perceived as the only way of maintaining heat in diesel engines, maintaining electric power to support ancillary motors, and cab comfort.[18] However, instead of idling, vehicle owners can purchase small generators or auxiliary power units specifically designed for trucks and buses that provide heat, air conditioning, and/or power while a vehicle is not in motion. These devices substantially reduce the fuel consumed and emissions generated during long-duration idling. Three states in the region have idling regulations: Connecticut, Massachusetts, and New Hampshire. Each enforces penalties for idling longer than 5 minutes (with some exceptions).[19] Thirty truck stops nationwide are equipped with idle reduction facilities; none are in Vermont however. The Vermont General Assembly took a strong step in 2007 by setting policy to limit the idling of school buses, with limited exceptions. There are over 1,800 school buses that are owned and contracted by the state to provide service to Vermont's schoolchildren. The Department of Education has issued rules which took effect on May 1, 2008 regarding the idling of school buses on school grounds. The rules direct bus operators to: shut off engines immediately upon arrival on school grounds, start up again only when the bus is loaded and ready to depart, and not to idle for more than a total of 5 minutes in any 60-minute period while on school grounds.[*] [20] Another option to reduce idling, electrification of truck stops, has been explored in other areas of the country; for Vermont the initial costs and the dispersed, limited number of truck stop areas appear to minimize benefits resulting from this strategy.

The EPA Smartway program is a voluntary partnership between the EPA and various freight industry sectors that establishes incentives for fuel efficiency improvements and greenhouse gas emissions reductions. There are three primary components of the program: (1) creating partnerships, (2) reducing all unnecessary engine idling, and (3) increasing the efficiency and use of rail and intermodal operations (rail is discussed under *Strategy S Better Use and Efficiency of Vermont's Rail Networks*). The partners, who commit to improve the environmental performance of freight operations, use EPA developed tools to quantify the benefits of fuel-savings strategies. The partnership works with states and others to develop innovative financing options that help partners purchase devices that save fuel and reduce emissions.[21]

[*] Provisions in the Dept. of Education rules allow for bus idling in certain circumstances including: 1) when the engine is required to operate special equipment for disabled persons; 2) when the engine is required to operate safety equipment other than lighting systems, such as windshield defrosters, and the operation of the equipment is necessary at that time to address specific safety, traffic, health, or emergency concerns; and 3) when the vehicle is being serviced and the operation of the engine is essential to the service being performed.

Recommendation 38 Continue to encourage efficiency in the heavy-duty diesel fleet

Timing	NEAR-TERM
Emissions Impact	MODERATE
Energy Impact	MODERATE
Capital Cost	LOW
Cost Effectiveness	HIGH
Funding Sources	EPA Smartway
Relation to GCCC	--
Current Status	--
Parties Involved	ANR, ULSD fuel standards and diesel engine standards in place, General Assembly passed provision limiting school bus idling.

a) ANR should consider the establishment of anti bus/truck idling standards.
b) Work with the EPA Smartway Partnership and Vermont companies to achieve fuel consumption and emissions reductions from freight operations.

STRATEGY O SUPPORT R&D AND OUTREACH TO IMPROVE THE EFFICIENCY OF PLUG-IN HYBRID VEHICLES

There are many technologies on the horizon that will need research, development, and deployment pilots to determine if they will be commercially viable. While Vermont is generally not in the position to offer large incentives for this activity, the state can assist companies and organizations in a number of areas, including information outreach, demonstration projects, and procurement of federal funds.

PLUG-IN HYBRID ELECTRIC VEHICLES

The Plug-in Hybrid-Electric Vehicle (PHEV) is a hybrid vehicle with additional battery capacity and the ability to be recharged from an electrical outlet. It differs from purely electric vehicles in that it still has an internal combustion engine and a liquid fuel tank, which kicks in on longer trips when the battery charge is depleted. On short trips, it is possible that the combustion engine will not be needed—potentially valuable as the average commuter trip in Vermont is approximately 30 miles roundtrip. The vehicle would ideally be recharged during the night, when electrical energy demand is low. The first prototypes of these vehicles have been developed, a commercial van application is expected soon, and availability in the mass consumer marketplace is expected in 2010.

Plug-in hybrid-electric vehicles have the potential for a wide range of fuel efficiency, emissions, and economic impacts, depending on the vehicle size, how it is operated, what time of day it is charged, the mix of fuel sources from the electricity used to charge the vehicle, and other variables. At least one electric utility in Vermont is studying the effects of plug-in hybrids on the electric infrastructure, and considering rate designs that might encourage electric use during the evening to help fill the valley's and improve the load profile. Plug-in hybrids, in combination

with advanced metering infrastructure, could enable at least a partial shift from petroleum-based fuels to an electricity-powered transportation system. The costs and benefits of such a shift are evolving rapidly with developments in battery technology. The potential impacts on consumers, net emissions, and utility loads should be studied in more detail, but early indications are promising for consumers, ratepayers, and society. Vermont should tailor its study to focus on the issues of local and regional concern, such as regional emissions impacts, Vermont utility load profiles, and the special challenges associated with severe climate.

In the long term, Vehicle-to-Grid ("V2G") technology seeks to take plug-in hybrid technology another step by making the plug-in reversible. In other words, V2G would allow the home and vehicle owner and the local utility to take advantage of the electrical storage capacity of the vehicle battery, sending electricity from the vehicle to the household. If successful, this technology could provide distributed generation capacity to Vermont. However, this technology is still in the early stages of development. The National Renewable Energy Laboratory (NREL) is working to quantify the costs and benefits of such technology, and developing feasibility studies.[22] Section 131 of the 2007 Energy Independence and Security Act authorizes $90 million per year in 2008–2012 for DOE PHEV grants.

Recommendation 39 Encourage plug-in hybrid-electric vehicle technology.

Timing	NEAR-TERM
Emissions Impact	HIGH
Energy Impact	HIGH
Capital Cost	HIGH
Cost Effectiveness	HIGH
Funding Sources	Electric Rates
Relation to GCCC	Addressed as part of TLU-5; Low Carbon Fuel Standard, which is addressed in this Plan in Recommendation 38: Evaluate a Low-Carbon Fuel Standard.
Current Status	Study underway by Green Mountain College, UTC, and Vermont electric utilities
Parties Involved	PSD, electric utilities, EVermont, Green Mountain College

a) *DPS should continue to encourage electric utilities to research effects of plug-in hybrid technology on the electric infrastructure.*
b) *Vermont utilities and regulators should ensure that the metering technology and rate designs are in place to ensure that plug-in vehicles improve the load profile of Vermont's electric utilities.*
c) *As resources permit, the DPS should establish an educational and outreach campaign providing basic facts to consumers and retailers through an information clearinghouse. Continue to study the costs and benefits of plug-in hybrids and V2G technology.*
d) *The State of Vermont should lease or acquire plug-in hybrid vehicles for state-use as they become commercially available under reasonable terms to further improve the emissions profile and economics of government use.*

STRATEGY P SHIFT TRANSPORTATION FUEL DEMAND TO LOW-CARBON FUELS

A shift in transportation fuel demand to low-carbon fuels should foster increased availability and production of these fuels. Consumption of low-carbon transportation fuels in place of petroleum (which is high carbon) would reduce emissions and dependence on imported fuel. Regionally produced biodiesel and ethanol (mostly from Midwest corn, although there is some production elsewhere) are already commercially available; efforts are underway to research and develop ethanol production from cellulosic feedstocks.* Other technologies, such as plug-in electric vehicles and electric vehicles appear close to commercial production and could significantly reduce the carbon footprint of transportation fuels. Also, hydrogen fuel and the development of fuel from algae are ideas that are in early stages of development, but hold potential for the future. This section will discuss low-carbon fuel demand and availability. For a discussion of renewable fuel production, please see 0. To shift transportation fuel demand to low-carbon sources, evaluation of a Low-Carbon Fuel Standard (LCFS) is proposed below. A LCFS requires that the mix of emissions from transportation fuels be reduced to a specified level within a certain timeframe. The LCFS approach is often preferred because it lets the market decide which fuels will meet the target—rather than choosing a "winner." If biodiesel and ethanol turned out to be "winners," demand for these fuels would be increased through a LCFS.

A LCFS, if deemed appropriate, would not take effect in the short term. Thus, commercially available low-carbon fuels (biodiesel, ethanol) are an effective way to reduce carbon emissions from transportation fuels until a standard can be promulgated. Currently, Vermont's on-road gasoline may contain some ethanol, as a number of refiners have been using it to boost octane levels of the fuel they produce.[23] The addition of ethanol to gasoline is voluntary however, and the amount used varies depending on the price of ethanol and its availability after meeting fuel requirements elsewhere. For purposes of this Plan, it will be assumed that there is little-to-no ethanol currently in Vermont's fuel supply. Biodiesel consumption, on the other hand, has been growing exponentially over the last few years. Both fuels have positive and negative implications, which are discussed in greater detail below. Where negative implications can be mitigated, biofuels can be an integral part of lowering motor fuel demand and reducing greenhouse gas emissions.

LOW-CARBON FUEL

A Low-Carbon Fuel Standard (LCFS) is a full life-cycle greenhouse gas rating system that requires the mix of emissions from transportation fuels to be reduced to a specified level within a certain timeframe. It intends to reduce the GHG intensity of fuels by regulating fuel providers through flexible credit trading mechanisms. This approach is often preferred because it lets the market decide which fuels will meet the target—rather than choosing a "winner." California pioneered the LCFS when in January 2007 the governor issued an executive order mandating a

* Biodiesel and ethanol from corn are considered low carbon on a "net" energy basis; more work is necessary to evaluate the fuels on a complete life-cycle basis in Vermont and would be necessary before a Low-Carbon Fuel Standard could be implemented.

10% reduction in carbon intensity for the transportation sector by 2020. California's regulatory process to implement the standard will be completed no later than December of 2008.

In California, 95% of gasoline used is refined within the state. This makes refiners the most likely candidates for regulation; along with in-state blenders and importers. The LCFS:

- Sets a carbon intensity reduction target;
- Creates standard life-cycle fuel emissions quantification and methodology;
- Creates a framework for the market-based trading and banking of credits and creates equivalency factors (for example, if cellulosic ethanol was deemed more desirable than other fuels, it could be weighted by a factor of 2); and
- Creates a tracking system.

Fuel providers can meet compliance targets by obtaining and retaining credits. Credits will be obtained by selling fuel that has lower carbon intensity than gasoline or by purchasing credits from another provider. Credits can be acquired through the sale of biodiesel, ethanol, cellulosic ethanol, electricity (either all-electric vehicles or plug-in hybrids, with a different metric for fuel use), hydrogen, natural gas, propane, other biomass-based fuels, fuel cells, or other fuels and technologies with a carbon/GHG rating (using the standard methodology) more favorable than gasoline. For each compliance path, questions need to be answered concerning fuel production, infrastructure requirements, and economic issues.

The LCFS in California would not necessarily translate directly to Vermont or the Northeast region, as Vermont has no refiners, and the Northeast has only a few. Further study would be necessary to determine how fuel providers would be regulated in this region. It is likely best for Vermont to work with its regional partners to create a broad LCFS encompassing a larger market with high fuel demand. Contemplation of a LCFS framework has already begun through the Governor's Commission on Climate Change process. In addition, the State is supporting the investigation of an LCFS through the Conference of New England Governors and Eastern Canadian Premiers which, through its Climate Change Steering and Transportation and Air Quality Committees, is working with the Northeast States Center for a Clean Air Future (NESCCAF) in conducting an assessment of the viability of a regional LCFS for the Northeast. The study will "evaluate opportunities and obstacles related to the implementation of a LCFS, provide recommendations for effective design, and promote consistency across states." The study will provide an independent assessment of the potential for a LCFS in the region and identify unique factors that will differentiate a Northeast LCFS from the one being used in California. The study is expected to be finished in August of 2008.[*] Both the Vermont Agency of Transportation and the Agency of Natural Resources are participating in the New England Governor's committees.

[*] The NESCCAF study will also consider a possible role for low-carbon fuels in the region's market for distillate oil. It is feasible that distillate oil could be included in a low-carbon fuel standard.

Recommendation 40 Evaluate the potential for a state or regional Low-Carbon Fuel Standard.

Timing	MID-TERM
Emissions Impact	HIGH
Energy Impact	LOW/HIGH
Capital Cost	--
Cost Effectiveness	--
Funding Sources	--
Relation to GCCC	TLU-5 in the context of a low-carbon fuel standard
Current Status	--
Parties Involved	ANR, AOT, DPS, NEG-ECP, VT Biofuels Association, fuel dealers, electric and gas utilities

a) *AOT, ANR, and DPS should continue to work within the context of the Conference of New England Governors/Eastern Canadian Premiers to investigate the feasibility of a Low-Carbon Fuel Standard for Vermont and the region.*

STRATEGY Q FACILITATE RENEWABLE FUEL DEMAND

A Low-Carbon Fuel Standard, if created, would facilitate demand for low-carbon fuels. However, after evaluation, initiation, rulemaking, and transition times, a LCFS would likely not be in place for some time. There are ways to increase the demand for low-carbon fuels, particularly biodiesel, in the short term. The policies below will address the facilitation of increased demand for biodiesel and ethanol.

BIODIESEL

Biodiesel is produced through a process in which oils are combined with alcohol (ethanol or methanol) in the presence of a catalyst to form ethyl or methyl ester. The biomass-derived ethyl or methyl esters can be blended with conventional diesel fuel or used as 100% biodiesel. When blended in low levels, at 20% or less, biodiesel can be used in most diesel engines with few or no modifications. It can be made domestically from soybean or canola oils, animal fats, waste vegetable oils, or micro algae oils. In addition to use as vehicle fuel, biodiesel can also be used to heat buildings or generate electricity (Biodiesel as a policy option for these areas can be found in section VII - Biomass in Vermont).

Biodiesel consumption in Vermont has grown exponentially over the last 4 years, with 1.4 million gallons of blended fuel consumed in 2006 (See *Table VI-4 Biodiesel Consumption (millions gal)*, below).* Despite the increase, biodiesel sales (blended or 100%) currently account for less than 2% of total diesel sales. Biofuels have significant potential to reduce

* This number represents both B-100 (100% biodiesel) and lower percentage blends. It also includes biodiesel sold for use in home heating, which is believed to be a very small share of the total sold.

consumption of motor gasoline and diesel and their associated greenhouse gas emissions. However, there are a number of factors to consider when evaluating biodiesel as a transportation fuel. Most importantly, the combustion of biodiesel in vehicle engines could actually *increase* nitrogen oxide emissions.* Nitrogen oxides are one of the key elements in the production of ground level ozone. Ozone, in turn, is a major chemical in smog, and can cause serious health problems at high levels. Ozone levels in Vermont are already approaching limits set to ensure human health.

Table VI-4 Biodiesel Consumption (millions gal)[24]

	Diesel	Biodiesel
2002	66.7	N/A
2003	68.4	0.01
2004	68.3	0.06
2005	68.0	0.28
2006	72.2	1.40

The support of biodiesel has the potential to encourage the demand for diesel-fueled passenger vehicles. However, an increase in diesel passenger vehicles, without the availability of biodiesel to fuel them, would increase diesel petroleum fuel consumption in the light-duty fleet, increasing greenhouse gas, NO_x, air toxics, and particle emissions in Vermont. Although no diesel passenger vehicles are currently available for sale in Vermont due to manufacturers' failure to meet the Low Emission Vehicle Requirements, at least one model will qualify in 2008 and more are expected in the future. These vehicles must meet only minimal standards and could displace cleaner options. An increase in biodiesel consumption is desirable, but not if it also requires an increase in overall diesel fuel consumption. If availability cannot keep pace with biodiesel demand for passenger vehicles, consumers may purchase diesel vehicles with the notion that they will fuel with biodiesel, only to find that most of the time they are forced to use standard diesel fuel. Commercial and heavy-duty vehicle fleets and home heating fuel needs are sufficient to drive demand for biodiesel. Therefore, this Plan will focus on increasing transportation biodiesel demand in the heavy-duty vehicle sector, through potential fleet incentives and facilitation of biodiesel availability for commercial fleets.

As noted in Strategy Z, the State has used biodiesel for a number of years in its operations, consuming nearly 150,000 gallons of blended biodiesel for transportation purposes in fiscal year 2007. In addition to state use, some private companies have begun to use biodiesel as well. In cold weather, biodiesel, like any diesel fuel, can cloud and gel. B20 will cloud and gel at approximately 2º–10º Fahrenheit warmer than conventional diesel fuel. The same precautions employed for petroleum diesel in cold weather are needed for biodiesel at 20% blends—and the same solutions apply as well, such as the use of cold flow additives or fuel heaters.[25] To avoid these potential problems, a 5% biodiesel blend is often used in the winter months, and a higher percentage in the summer. When used as B20, vehicles may have a 1–2% reduction in performance (power, torque, fuel economy); however this difference is not generally discernible in day-to-day operations.[26] As a benefit, it can reduce wear on engines, due to its greater lubricity.

* There have been a number of studies that show inconclusive results for low-level blends of biodiesel. B100 has been shown to increase NO_x emissions. However, an October 2006 National Renewable Energy Laboratories report concluded that when using B20 "individual engines may show NO_x increasing or decreasing, but on average there appears to be no net effect, or at most a very small effect on the order of + or – 0.5%." (www.nrel.gov)

A number of barriers exist in the effort to increase demand for biodiesel in Vermont. Some manufacturers will not honor their engine warranties if a vehicle is fueled by biodiesel, claiming that any problems are caused by biodiesel use. However, other manufacturers already endorse biodiesel use and honor the warranty for quality fuel, although many recommend only the use of lower (up to 5%) blends of biodiesel. National standards are currently under development to ensure the quality of biodiesel fuel. Another barrier to greater use of biodiesel is its availability; biodiesel is currently available from only a handful of fueling stations around the State. The initial cost of adding a separate tank (although not necessary if all fuel is blended), along with uncertainties in the siting and permitting process, dissuade fuel dealers or private companies from adding biodiesel to their fuel options. A step-by-step guide describing handling, storing, and using biodiesel, along with a description of Vermont's permitting requirements, would ease the process. Technical assistance, where necessary, would also help. A reduction in the diesel fuel tax rate, as proposed by the governor in 2007 (2% was proposed), or a fuel tank installation incentive could encourage more dealers to offer biodiesel.

To encourage biodiesel demand in the State, the Vermont Biodiesel Project is in the first phase of the Vermont Biofuels Initiative, a public/private collaboration established to help accelerate growth of the emerging biofuels industry in Vermont. The Vermont Biodiesel Project is a collaboration of the VT Sustainable Jobs Fund, the VT Biofuels Association, the Department of Public Service, and the VT Fuels Dealers Association. The Biodiesel Project should continue to have State support to encourage sustained biodiesel demand.

The larger initiative supports three related components:

1. Development of the biofuels industry network;
2. Market conditioning through biofuels education, incentive programs, and a commercial-scale pilot project; and
3. Biodiesel capacity and infrastructure development.

To increase consumption some states have considered mandating the use of biodiesel. Washington requires 2% of the total diesel fuel sold be biodiesel, produced locally, and has a provision to ramp the requirement up to 5% in the future. Louisiana requires that a minimum of 2% of all diesel fuel sold is biodiesel, triggered when monthly in-state production reaches 10 million gallons monthly. Minnesota mandates that all diesel fuel contain a minimum of at least 2% biodiesel, based on a minimum yearly production of 8 million gallons of biodiesel per year, which they have far exceeded presently. Further, the Governor of Minnesota recently outlined a plan to raise the requirement to 20% biodiesel by 2015. Many other states are considering biodiesel requirements tied to local production as well. Incentives for production of biodiesel are discussed in Strategy W.

Recommendation 41 Encourage biodiesel use in commercial heavy duty vehicles.

Timing	NEAR-TERM
Emissions Impact	--
Energy Impact	--

Capital Cost	--
Cost Effectiveness	--
Funding Sources	--
Relation to GCCC	TLU-5 in the context of a low-carbon fuel standard
Current Status	--
Parties Involved	Dept. of Taxes, AOT, ANR, VT Biodiesel Association, fuel dealers, AIV

a) *Promote existing guidebooks and promote technical assistance available from the National and State biodiesel associations for commercial enterprises (companies or fuel dealers) wishing to install a biodiesel-specific fuel tank.*
b) *Adopt governor's biodiesel transportation tax reduction proposal as prevailing fiscal and economic conditions permit.*

ETHANOL

Ethanol is an alcohol-based renewable fuel produced by fermenting and distilling starch crops that have been converted into simple sugars. Widely used feedstocks for this fuel include corn, barley, and wheat. Ethanol can also be produced from "cellulosic biomass" such as trees and grasses. These cellulosic biomass feedstocks are beginning to yield significantly more energy than growing, harvesting, and distilling traditional feedstocks, such as corn, into ethanol, and have significantly higher greenhouse gas benefits. Most current U.S. production of ethanol is from corn, and several current ethanol facilities are undertaking research and development in partnership with the DOE to address technical and other barriers to using cellulosic feedstocks. A description of Vermont's ethanol production potential can be found under *Strategy W*.

There is currently no production of ethanol in New England, and there are only a few high-blend ethanol-fueling stations in the region. Connecticut, Massachusetts, and parts of New York are required to oxygenate (7.3% ethanol) or reformulate (5.4% ethanol) gasoline because they are "Severe Non-Attainment areas" under the Clean Air Act, and have replaced the banned fuel additive MTBE with ethanol. According to the Conference of New England Governors, the infrastructure challenges to implement the change were addressed successfully: an adequate distribution system was developed, and no price increases were reported by the EIA.[27] Vermont has banned MTBE,[28] but the state has no requirement to use an additive to reformulate or oxygenate fuel. If Vermont required fuel to be oxygenated or reformulated using ethanol, it would essentially act as an ethanol mandate because ethanol is currently the only option for oxygenated and reformulated gas. If Vermont were to require that gasoline sold in-state be oxygenated or reformulated, the rough cost to consumers would be $0.02–0.05/gallon.[29] This creates negligible difference in the performance of an automobile, and only a slight decrease in fuel efficiency. Simple calculations show that approximately 26 million gallons of gasoline could be displaced with ethanol should Vermont reformulate its gasoline.[30] At the prices above, the estimated cost to Vermonters would be between $7.13–17.83 million per year. Some petroleum fuel consumption would be averted, but life-cycle emissions benefits might be minimized by the need to transport corn ethanol long distances prior to delivery in Vermont. Vermont should only encourage the use of ethanol where full life-cycle emissions of the fuel are less than that of gasoline.

Where full life-cycle emissions of ethanol are net positive, and when the fuel is commercially feasible at a reasonable price, Vermont should consider requiring all fuel to be reformulated or oxygenated.

Recommendation 42 Evaluate costs and benefits of encouraging reformulated or oxygenated fuel as a way to support the use of ethanol as an additive.

Timing	NEAR-TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	--
Cost Effectiveness	--
Funding Sources	--
Relation to GCCC	TLU-5 in the context of a low carbon fuel standard
Current Status	--
Parties Involved	ANR, VT Biofuels Association, fuel dealers AIV

a) *Vermont should consider a differential tax regime between gasoline and ethanol-supplemented gasoline (including reformulated and oxygenated fuels).*
b) *ANR, with PSD, should report on how to best measure the current amount of ethanol delivered to Vermont in its motor gasoline.*
c) *ANR, with PSD, should evaluate the costs and benefits to requiring reformulated and/or oxygenated gasoline.*

STRATEGY R NCOURAGE ALTERNATIVES TO SINGLE-OCCUPANCY VEHICLES

The Vermont Agency of Transportation ("AOT" or "VTrans"), along with the State's municipalities, is responsible for managing Vermont's transportation network and ensuring the road network is well maintained, safe, and efficient. Critical to the achievement of AOT's road maintenance goals is funding from the federal government. To receive this money however, Vermont's budget must include sufficient funds to match those coming from Washington. In Vermont, federal transportation dollars are more important than in other areas due to the small size of the state and its budget, and a lack of revenue-creating transportation programs.* The federal funding often drives VTrans activities and programs. Creating new and maintaining current funding sources are important ways to ensure successful implementation of the recommendations in this section.

Certain policies and programs that maintain and enhance the efficiency of transportation infrastructure and services can directly influence Vermonters' choices regarding amount and mode of travel. Travel choices in turn, affect the amount of greenhouse gasses and other pollutants emitted by the transportation sector. Strategies S, T, and U, detailed below, could contribute to reducing emissions, energy consumption, and costs associated with the transportation sector.

As stated in the introduction, the transportation sector is the largest single contributor to petroleum consumption and GHG emissions in Vermont. Frequently, travel is made inefficiently —in a single-occupancy vehicle (SOV). SOV travel often occurs during the home to work commute, which in Vermont averages over 30 miles roundtrip.[31] The policies discussed and recommended under this strategy provide suggestions to curtail the number of commuter and other inefficient miles traveled, and where possible shift them to more efficient modes of travel. Although listed separately, the discussions and recommendations below *must be linked* through comprehensive transportation planning, and in municipal and regional land-use plans.

MIXED-USE LAND DEVELOPMENT

Land use patterns have a large impact on transportation energy demand. Although development pressures in Vermont may be less than in metropolitan areas, they are nonetheless noteworthy and often have significant impact on undeveloped, rural areas. Dispersed development (sprawl) is dependent on the personal vehicle and is difficult to reach with public transit services. Mixed-use development planning works to contain sprawl and increase transportation choices that facilitate daily tasks. It conserves energy and resources by reducing the distance people have to travel for necessary trips. Mixed-use planning works best in combination with other fuel saving measures such as public transportation, carpooling, and non-motorized forms of transportation.

* The State's statutory obligations with regard to the transportation network can be found in Titles 19 and 23 of the Vermont Statutes Annotated.

Vermont has a number of related policies, programs, and laws already in place to encourage communities "to plan development so as to maintain the historic settlement pattern of compact village and urban centers separated by rural countryside."[32] * According to statute (3 V.S.A. § 4020-4021), all state agency decisions affecting land use should be consistent with the framework of land use goals that encourage a more dense settlement pattern that is conducive to alternatives to the automobile. The Municipal and Regional Planning Development Act specifically supports mixed-use development through engagement of state, municipal, and regional planners in a comprehensive planning process and creation of a regulatory and policy framework to provide guidance to public decisions.

Some embedded factors, such as wastewater treatment and water supply infrastructure, can make compact, mixed-use development difficult; however there may be opportunities for public transit or other energy reduction strategies in locating major new commercial or employment centers near existing housing centers. Vermont has many traditional, compact, small-to-medium-sized town centers that can potentially benefit from planned mixed-use development. In recognition of this, the legislature passed a "Designated Growth Centers" bill (S.142; "Act 183") in 2006 that further endorses and supports high-density, concentrated, mixed-use developments for growth centers, specifically supporting them with financial and regulatory incentives.

The state should continue taking an active role in encouraging mixed-use development in Vermont's municipalities. The Vermont Department of Housing and Community Affairs manages several grant programs to help support local and regional planning efforts. One example is the Municipal Planning Grant Program. This is a state-funded program designed to support Vermont towns in their municipal planning efforts. The program funds technical assistance for town planning, regulatory, and non-regulatory implementation of plans, encouragement of citizen participation and education, and innovative demonstration planning projects.† Planning grants can sway local municipalities who have the greatest influence in land use projects such as rewriting town plans, updating zoning bylaws, and continually updating GIS databases. Activities associated with downtown village center or growth centers planning are considered a priority funding activity.[33] Further incentives of this type will continue to encourage development that supports reductions in energy use.

Recommendation 43 Consider energy implications in land-use planning by facilitating mixed-use, public transit-oriented development that limits sprawl.

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* These include, but are not limited to, Act 250, Executive Order #15 of 1985 giving priority to locating state government in existing buildings, and programs of the Vermont Economic Progress Council and Vermont Economic Development Authority.

† Up to $800,000 is available in any given year for these grants, and municipalities may apply for up to $15,000 for single applications or up to $25,000 for consortia applications.

Timing	NEAR-TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	--
Cost Effectiveness	--
Funding Sources	--
Relation to GCCC	Discussed in TLU-1, referred to as "Compact and Transit-Oriented Development." The policy has a number of implementation mechanisms including: providing technical and financial resources to municipalities; strengthening state-level planning; creating state-municipal and public-private partnerships; and consideration of carbon neutrality in development projects.
Current Status	Ongoing
Parties Involved	AOT, ANR, Dept. of Housing and Community Affairs, regional planning commissions, CCMPO, economic development councils, and municipalities

a) *Continue to encourage development in downtowns, village centers, and growth centers through continued and/or increased funding of state programs, offering financial incentives[*] and ensuring state infrastructure provides support for designated centers.*

b) *Target Growth Center and other incentives to projects that facilitate transit service and infrastructure development and availability. State owned infrastructure projects should be targeted similarly.*

High-density mixed-use land use planning permeates through the rest of the discussion and recommendations under the umbrella of this strategy. Each of the recommendations below is an integral piece of this planning process. Taken piecemeal, the policies below may be less effective. For example, a transit facility located on the outskirts of town is likely to be not as effective as a facility located at a major employment center or in the center of downtown. The policies in this strategy should be looked at as a whole forest, rather than just individual trees.

PUBLIC TRANSIT

Public transit services are an efficient method of reducing inefficient driving miles and will be an essential part of Vermont's energy future. Vermont's local public transportation network is made up of 14 transportation providers, offering a mixture of fixed and flexible routes and demand-response service. Commuter bus service, offered by six providers, has increased significantly over the last several years. The Chittenden County Transit Authority (CCTA), the only provider serving an "urban" area, is by far the largest transportation provider and offers the most fixed

[*] Growth Center Incentives currently include "Downtown and Village Center Program Tax Credits," where qualified applicants can claim credits in designated centers. The total credits allowed annually are capped at $1.5 million. In 2006 and 2007, the credits were fully awarded in the first 3 months of the fiscal year. The state should evaluate the benefits of increasing the allowed credit cap.

routes. Intercity service, both intra and inter state, is provided by Greyhound (Vermont Transit is now a subsidiary of Greyhound).

VTrans, who oversees the local providers, has stated in its Public Transportation Policy Plan its broad objective of preserving and enhancing the existing public transportation system.[34] While striving toward this goal, the agency has the statutory mandate to take into account the following: provision of basic mobility for those who are transit dependent, access to employment, congestion mitigation to preserve air quality, and advancement of economic development objectives.[35] In practice, no objective has been interpreted to be more important than any other, meaning energy considerations must be taken in context with these compelling interests.

VTrans and public transit service providers face a number of challenges while attempting to meet these potentially competing objectives and preserving and enhancing the existing transportation network. Vermont is an extremely rural state—population and development densities are low in most areas. Securing ridership levels high enough to justify fixed route service can be difficult in small, dispersed towns. To meet this challenge, many flexible routes have been introduced, along with demand-response services.[*] In all areas of the state, demand-response services are offered, as it supports Vermont's "Aging in Place" policy that allows older residents to remain in their residences despite declining mobility. The rural nature of Vermont and the demands of an aging population, in combination with high fuel prices have put economic pressures on service providers who are already struggling to stay within their budgets while maintaining service levels.

Public transit funding comes from several sources. VTrans currently works with service providers to secure federal funding through several programs. For fiscal year 2009, total federal funding for public transit in Vermont will amount to more than $14 million. Federal funding includes support for: development of new public transit routes, support of alternatives to single-occupancy vehicles, funding of existing routes, and assisting with purchases of new buses. The state provides some funds to match the federal monies, as do local providers; local funds are also generated through the general property tax (which must compete for funds with other local services) and local providers' contracts with businesses and the state. *Funding is perhaps the most critical issue to continuing and increasing public transit services in the state*. Currently, the governor and legislature set funding levels through the state budget each year and providers must constantly adjust to available funds. A dedicated fund would be ideal, but is unlikely to be feasible with budget constraints and competing priorities.

Adequate funding is necessary for Vermont's public transportation system to maintain current service levels while working on service expansions.[†] Replacing older public transit vehicles not only increases the efficiency of the transit fleet (reducing associated emissions and energy costs),

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[*] Fixed routes are best suited to more densely developed urban environments—CCTA in Chittenden County operates the largest number of fixed routes. Flexible routes are a hybrid between fixed routes and demand-response services—for example having a published route and schedule but with the flexibility to deviate from the route for a prearranged pick-up. Finally, demand response services are in response to specific request where the passenger calls into a dispatch for a ride.

[†] As of February 2007, there was a $9 million public transit vehicle replacement backlog.

but also makes for a more comfortable and safer ride for passengers. If fuel costs continue to increase without parallel funding increases, *reductions* in service may result and increasing ridership, resulting in reductions in commuter and other inefficient vehicle miles traveled, might not materialize. One option to increase the choices available to commuters is for the State to offer business energy tax credits for transportation service investments, where businesses could claim a credit for a percentage of the costs of adding services for their employees. This could leverage state funds with private investments to achieve maximum value.*

Another efficient use for available funds is to target them to increase the connectivity of Vermont's transportation system. This strategy could enhance transportation efficiency without putting added strain on service provider's budgets. Connecting local services to regional and interstate service to create a seamless transportation web would provide broad access to service and increase ridership levels. For example, VTrans has built commuter lots with transit facilities and access in mind (see the Park-and-Ride section, below). Intercity bus services offer connections to major Vermont cities and towns along with interstate services to Boston, New York, and Montreal, where connections can be made to points throughout North America. Local providers collaborating with these regional and interstate providers can continue to increase access. Recently the opposite has been occurring, as intercity service has been reduced or discontinued (such as the Bennington to Burlington route), cutting transportation options for Vermonters.

Recommendation 44 Encourage increased public transit ridership by supporting targeted expansion of services throughout the state.

Timing	NEAR-TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	--
Cost Effectiveness	--
Funding Sources	--
Relation to GCCC	Fundamental element of TLU-1 discussing Transit-Oriented Development, also noted as one of the options as an alternative to SOV in TLU-2.
Current Status	Ongoing
Parties Involved	AOT, Agency of Human Services, the Public Transit Advisory Council; the Public Transportation Association; transit service providers; regional, municipal, and local planning organizations; private and public organizations with environmental interests, and disadvantaged populations (low income, seniors et al.), among others.

* An example of this type of program can be found in Oregon, where the credit is available for many types of energy-saving business investments. See http://www.oregon.gov/ENERGY/CONS/BUS/BETC.shtml

The Agency of Transportation, in coordination with public transit service providers and regional and municipal planning organizations, should:

a) *Investigate and, if practicable given fiscal and economic circumstances, institute an energy tax credit program for businesses that will allow them to partner with public transportation providers to encourage home-to-work use of public transportation.*
b) *Investigate other funding strategies to increase public transit ridership during the home-to-work commuter trip.*
c) *Continue to regularly evaluate service routes and target new or revised public transit routes to serve home-to-work trips and to increase connectivity between services.*
d) *Work to eliminate the public transit vehicle replacement backlog.*

PARK-AND-RIDE

Vermont currently has 27 state-owned and -maintained Park-and-Ride locations. Park-and-Ride facilities are a valuable tool in efforts to create efficient transportation networks—they can reduce commuter and other vehicle miles traveled without reducing a persons' mobility, they are relatively inexpensive to build and maintain, and they have the full support of the public. Although it is difficult to determine who uses Park-and-Ride facilities and why they use them, the AOT was able to complete a study in 2004 detailing usage levels and identifying priorities for upgrades to Park-and-Ride facilities. The AOT currently has 15 programmed Park-and-Ride projects in various stages of development, including proposals for 9 new facilities and 6 expansion/upgrades of existing facilities. A number of other existing facilities are in need of expansion or upgrades. Currently, state Park-and-Ride sites are 100% funded by the federal government, through the Congestion Mitigation and Air Quality (CMAQ) Improvement Program.

The Vermont Agency of Transportation's Municipal Park-and-Ride Grant Program facilitates construction of additional Park-and-Ride locations. This program issues grants to municipalities to build their own town-scaled and -maintained facilities. The AOT has been authorized in State fiscal year 2008 to competitively award $200,000 (state-funded) to municipalities, an increase from $100,000 in previous years. Demand for these grants has thus far exceeded the supply of funds. To date, the program has granted funds totaling over $317,000, making possible 22 new facilities over 3 years.

The AOT estimates that 70% of Park-and-Ride facility usage is work-related commuter use. The price of gasoline generally affects the usage levels of the facilities—as fuel prices go up, the availability of parking spaces drops. Opportunities exist in current and future facilities to coordinate with public transit providers to connect services. Rideshare and other programs should also be included in this coordination.

Recommendation 45 Maintain and increase the development of Park-and-Ride facilities around Vermont and support their usage by public transit providers.

Timing	NEAR-TERM
Emissions Impact	MEDIUM
Energy Impact	MEDIUM
Capital Cost	LOW
Cost Effectiveness	
Funding Sources	Primarily federally funded
Relation to GCCC	Fundamental element of TLU-1 discussing Transit-Oriented Development, also discussed specifically in the discussion of alternatives to SOV in TLU-2.
Current Status	Ongoing
Parties Involved	AOT, municipalities, regional planning commissions, public transit providers, rideshare services

a) *AOT should complete a comprehensive survey of usage patterns to determine the most effective locations for expansion and upgrades of current lots, and potential future lots, including potential partnership with bordering states.*
b) *Increase public transportation facilities in Park-and-Ride lots and coordinate route schedules to coincide with the busy commuting hours.*

RIDESHARE/VANPOOL

Park-and-Ride facilities, discussed above, facilitate public transportation, and the sharing of rides outside of public transit, in Vermont. *Ridesharing* refers to carpooling and vanpooling (the term is sometimes also applied to public transit, particularly commuter express bus). Ridesharing has minimal incremental costs because it makes use of vehicle seats that would otherwise be unoccupied. It tends to have lower costs per vehicle-mile than public transit because it does not require a paid driver and avoids empty backhauls. However, Ridesharing is generally only suitable for trips with predictable schedules such as commuting or attending special events. *Carpooling* uses participants' own automobiles. *Vanpooling* usually uses rented vans (often supplied by employers, non-profit organizations, or government agencies). Most vanpools are self-supporting; operating costs are divided among members. According to the Bureau of Transportation, 11% of Vermonters carpool or ride in a vanpool to get to work.[36]

Attempting to increase the number of shared rides taken by Vermonters, *Vermont RideShare* is a comprehensive service that includes carpooling, a pool-to-school promotional program, employer-based rideshare, emergency ride home, interest-free van loans, and private sector van leasing. Nearly 5,000 participants are registered in the RideShare database. Promotional efforts and education campaigns by the Rideshare agencies and VTrans increase public awareness of commuter alternatives. Currently, the Vermont Rideshare program addresses both carpools and vanpools. The Carpool program is administered through the Public Transit division of VTrans and three providers (Rural Community Transportation, Inc; Advance Transit; and Chittenden

County Transportation Authority) who act as managers for the carpools originating from their respective regions. A new website is planned for 2008, and the current three regions will be consolidated to a single one that encompasses the entire State. Forecasted savings in administering this program will be re-distributed to the vanpool program and the overall marketing of Vermont RideShare.

Despite its benefits, only one state-supported vanpool is in operation in Vermont. This lack of participation in the vanpool program and a general unfamiliarity in the state has led to a review by the Agency of Transportation. The review of the vanpool program points to several challenging aspects that are difficult to overcome: it is up to employers and/or individuals to form a group of 10–12 people; form a 501(c)(3); pay for 10% of vehicle costs at the time of purchase; and to insure, administer, and manage the vehicle. Recommendations from this review will call for a revamped program that will focus on rider convenience and cost effectiveness. Several programs in other states are being considered as models.

Recommendation 46 Increase participation in Rideshare/VanPool programs.

Timing	NEAR-TERM
Emissions Impact	MODERATE
Energy Impact	MODERATE
Capital Cost	LOW
Cost Effectiveness	HIGH
Funding Sources	--
Relation to GCCC	Discussed specifically as part of TLU-2, Alternatives to SOV
Current Status	Ongoing rideshare and vanpool review
Parties Involved	AOT, VT rideshare providers, transit service providers, regional planning commissions

a) *Implement recommendations of Rideshare and Vanpool review conducted by the Agency of Transportation.*

USE OF COMMUNICATION NETWORKS TO REDUCE INEFFICIENT MILES TRAVELED

Vermonters travel an average of 15.4 miles to work each day, with a commute time of over 21 minutes.[37] Many of these driving miles and much of this time in the vehicle could be reduced by the increased usage of telecommuting for work purposes. There has been no specific, identifiable movement in the past toward replacing commuter trips with telecommuting in Vermont. If successful, this could provide a way to reduce inefficient miles traveled through utilization of communication networks, reducing the need for physical transportation without diminishing access.

Programs to elevate the access and visibility of telecommuting could reduce the number of commuter trips made in Vermont. Telecommuting can be seen as unstructured and fostering reduced productivity levels. The risks and rewards of telecommuting likely vary with the

situation. However, there are economic advantages to telecommuting, such as lower fuel use and reduced wear and tear on roads and vehicles.

As part of its Smartway program, the Environmental Protection Agency (EPA) has sponsored a growing public–private partnership called the Best Workplaces for Commuters program. Employers agree to several terms in an application with the EPA, including ensuring a minimum level of participation and offering a choice of commuter benefits. Telecommuting is one of the options that employers can offer to employees. Employers then get the benefit of being recognized as a great workplace and are able to attract top employees.

Recommendation 47 Support the Connect VT initiative to facilitate advanced communication networks that allow for telecommuting.

Timing	NEAR-TERM
Emissions Impact	LOW
Energy Impact	LOW
Capital Cost	--
Cost Effectiveness	--
Funding Sources	--
Relation to GCCC	Discussed as part of Commuter Choice/Benefits policy in TLU-7
Current Status	"E-State" initiative to have telecommunications coverage in all areas of the state by 2010.
Parties Involved	PSD, VTA, VT Businesses for Social Responsibility, private businesses

a) Vermont must ensure stable, reliable communications networks to enable telecommuting through public/private efforts to bring broadband statewide.
b) As part of "e-state" initiative, the state should provide outreach and information concerning the benefits of using telecommunications networks to reduce inefficient miles traveled.

STRATEGY S BETTER USE AND EFFICIENCY OF VERMONT'S RAIL NETWORKS

Vermont has had railroad infrastructure since 1849, when the state's first railroad was completed. Since then, the rail system has become an integrated component of the state transportation system. Vermont's passenger and freight rail systems interconnect with the regional and national infrastructure to provide access to the entire continent and offer a low-emitting, energy-saving alternative to vehicles and trucks. The recent nationwide industry trends have created challenges to funding and maintaining infrastructure at the levels needed to significantly grow rail usage. Historically, Vermont has demonstrated dedication to encouraging and supporting passenger and freight service stability and expansion.

The Vermont Agency of Transportation develops a Vermont State Rail & Policy Plan, to "provide a strategic policy framework for maintaining and enhancing the state rail system." Last

completed in 2006, the plan provides an assessment of rail system conditions and analyzes needs and performance. In addition, it identifies funding sources and specific actions the state can take to complete its goals.* The recommendations below provide continuing support for the Vermont Rail Program and reinforce many of the conclusions of the Rail & Policy Plan.

Most activity on Vermont's active lines is dedicated to the movement of freight, although passenger service also plays an important role. Maintenance, on both state-owned and private lines, is ongoing. This maintenance is enhanced by capital projects that improve infrastructure and safety of tracks, bridges, and road crossings. As demonstrated below, these improvements are essential to the growth and expansion of Vermont rail networks. Public/private partnerships, both in-state and regionally, are a necessary component of future rail service.

FREIGHT RAIL SERVICES

From 1992 to 2002, freight rail traffic that both originated and terminated in Vermont decreased by 21%. However, freight that originated in Vermont increased over 75%, due mainly to increased shipments from Omya, Inc, a producer of calcium carbonate with facilities in Florence, Vermont. Freight rail tonnage, overall, is projected to increase at a rate of 2.4% annually. The potential may exist for Vermont's railroads to provide additional rail routes and profit from increased intermodal traffic. But already, many rail yards, including Rutland, Burlington, and St. Albans, do not fully meet the needs of the railroad or the community. Appropriate intermodal facilities are necessary to transfer the freight from rail to local truck for delivery to the final destination. Improvements for the above-mentioned facilities are supported by the State Rail Program, but bridge and track infrastructure improvements have taken priority.

Many of Vermont's railroad tracks and bridges have a weight limit of 263,000 pounds per car, however nationwide the industry standard is a 286,000-pound weight limit. Already, at least two Vermont customers "light load" their cars (meaning they are not loaded to capacity) to meet the required weight limit. Further, many bridges across the state are in need of rehabilitation, and there are a number of areas that need modification to allow for proper height clearance so railroad cars can be double stacked. Improved infrastructure can provide opportunity for increased freight traffic, potentially reducing interstate truck freight traffic in the state. However, a considerable investment is necessary: According to the State Rail Plan Update, completed in 2005, over $138 million will be needed to upgrade bridges and track in Vermont to safely accommodate 286,000-pound railcar loading.[38]

Overall, any goal of shifting the transportation of freight from truck to rail could be difficult. Most freight carried into or through Vermont originates out of state, is short haul, and is intended for use by private industry in wholesale and retail distribution systems, called "Just-in-Time" delivery systems. Private industry owns much of the rail network in Vermont, and their freight decisions are based on cost and timing. State government, to encourage more freight rail usage by private industry, would need to collaborate with private industry and regional partners to study and develop interconnected, efficient freight networks.

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* For the State's full Policy Plan, please see the Vermont State Rail Program webpage at www.vermontrailroads.com.

In 2007, the Conference of New England Governors and Eastern Canadian Premiers created a "Transportation & Air Quality Committee" tasked with "engag[ing] the private sector in a public/private partnership to study and develop the long-term interconnectivity of freight networks and facilities [that] could reduce the emissions impact of freight movement."[39] The results of this engagement, in addition to infrastructure improvements in Vermont, could improve the proportion of freight that is carried by rail as opposed to trucks.

Recommendation 48 Facilitate improved use of railroads for the movement of freight shipments around the state through strategic investments in infrastructure upgrades.

Timing	NEAR-TERM
Emissions Impact	MODERATE
Energy Impact	MODERATE
Capital Cost	HIGH
Cost Effectiveness	MODERATE
Funding Sources	--
Relation to GCCC	Discussed in Regional Intermodal Transportation System policy in TLU-6, stating a goal of a 100% increase in VT freight rail by 2028.
Current Status	VTrans continues to implement actions outlined in the State Rail and Policy Plan to increase the use and efficiency of freight rail service.
Parties Involved	AOT, Federal RR Administration, Amtrak, NEG-ECP, RR operators, FHWA, congressional and senatorial leaders

a) *Secure and spend federal and other funding to upgrade freight rail infrastructure, focusing on increasing the weight limit of railroads, ensuring appropriate accommodation of double-stacked railcars, and upgrading intermodal facilities.*
b) *Collaborate in the NEG/ECP process to engage private industry to develop the long-term connectivity of the Northeast's rail networks.*

PASSENGER RAIL SERVICES

Passenger rail travel, when compared to vehicle travel, is extremely efficient. In terms of BTU per passenger mile, rail travel is over 20% more efficient.[40] However, the future of passenger rail service in Vermont is related to the viability of future freight service, as the business case for operation of passenger service in most corridors is only viable if the cost to maintain the rail line can be shared between freight and passenger operations.

Two medium-distance passenger trains currently operate in Vermont: The *Vermonter* runs between St. Albans and Brattleboro and continues to New York City and Washington, D.C., and the *Ethan Allen*, which connects Rutland, Vermont, and New York City by way of Albany, New

York. Both federal and state subsidies support these trains.[*] Vermont currently provides between $3.5 and 4 million to support Amtrak operations in the state.[41] Ridership has declined overall in the past decade, due to a number of factors, including a reduced number of routes (see table VI-5, below). The future of Vermont's passenger rail service is uncertain, as Amtrak's operating costs have risen, while the continuation of federal funding is in question. The FY 2005–09 Amtrak strategic plan indicates Vermont's segments are at risk as a result of "infrastructure condition, potential downgrade or abandonment." Regulators and the SPEED Facilitator should work with Vermont electric utilities to fulfill their statutory responsibilities under the SPEED Program.

Table VI-5 VT Passenger Rail Ridership

Year (Ends June)	*Vermonter*	*Ethan Allen*	*Total*
2000	79,080	42,992	122,072
2001	72,235	43,278	115,513
2002	68,713	39,613	108,326
2003	61,948	35,786	97,734
2004	61,431	37,966	99,397
2005	54,687	38,920	93,607
2006	52,490	41,100	93,590

Despite passenger numbers that have fallen off in the past few years, Vermont continues to demonstrate a commitment to its passenger rail service, and momentum is building for increasing routes and services as gasoline prices rise and concerns about emissions continue to influence decision makers. VTrans secured funding for the acquisition of Diesel Multiple Units (DMU) (carriages with their own diesel engine, which operate on a smaller scale, at a higher efficiency and at lower cost levels than traditional multiple-car trains). The DMU technology should be considered for the future, as it provides a strong option for flexible, demand responsive rail service. Infrastructure upgrades (discussed in the Freight Rail Services section above) would have the effect of increasing the maximum allowable speed on the rail lines, making passenger service faster and more desirable.

As with freight, passenger rail service provides links to the Northeast region and the rest of the country. In the past, Amtrak provided service to Montreal through an extension of the *Vermonter* route. This service was discontinued because it was no longer profitable. However, that route, along with other routes along the Boston–Montreal corridor, should be considered once again. Like the connection to Montreal, commuter rail does not currently exist in Vermont. The last attempt was The Champlain Flyer, a service from Charlotte to Burlington, which never gained steam and did not achieve ridership levels necessary to justify continuation.

[**] Vermont is one of only a handful of states that makes a contribution to Amtrak services. The others are California, Illinois, Michigan, Missouri, North Carolina, New York, Oregon, Washington, and Wisconsin.

Recommendation 49—Facilitate increased passenger rail ridership levels.

Timing	NEAR-TERM
Emissions Impact	MODERATE
Energy Impact	MODERATE
Capital Cost	HIGH
Cost Effectiveness	MODERATE
Funding Sources	See Recommendation 1, Freight Rail Service.
Relation to GCCC	Discussed in Regional Intermodal Transportation System policy in TLU-6, stating a goal of a 200% increase in passenger rail use by 2028.
Current Status	Policies have been aimed at increasing ridership, with limited success. Implementation of State Rail and Policy Plan continues. Purchase of DME and added service will be evaluated after operations begin.
Parties Involved	AOT, NEG-ECP, Federal RR Administration, Amtrak, congressional leaders, RR operators and owners.

a) Continue to support Amtrak service in Vermont, and use the NEG/ECP and other collaborative processes to further interconnect Vermont passenger rail stations with neighboring jurisdictions.
b) Continue support for freight rail, as it is essential to a successful passenger rail future.

STRATEGY T ENCOURAGE EFFICIENT VEHICLE TRIPS THROUGH ECONOMIC INCENTIVES/DISINCENTIVES

In addition to encouraging alternatives to single-occupancy vehicle (SOV) travel and supporting the growth of rail travel, a good way to reduce emissions from the transportation sector is to increase the efficiency of vehicle travel. Offering economic incentives and disincentives would push drivers to give greater consideration to their driving habits and possible ways to make their travel more efficient.

COMMUTER BENEFITS PROGRAM(S)

As noted above, trips made on the home-to-work commute include some of the most inefficient vehicle-miles traveled in Vermont. Adopting or encouraging commuter benefit packages could lessen the environmental impacts associated with driving to work; reducing not only fuel consumption, but emissions as well. A number of options are available to reduce travel to work in a single-occupancy vehicle. Some of these options include:

- Allowing pre-tax dollars to be spent on public transit or other alternative commuting methods,
- Facilitating opportunities for telecommuting, and

- Providing incentives (such as preferential parking or "transportation vouchers")* to carpools, vanpools, or other employees who do not drive to work alone.

Vermont has already made significant progress in many of these areas, both through policy and through private company initiatives.Many companies and organizations (including the state) already offer preferred carpool parking nearer offices. However, opportunities still exist to reduce commuter miles through economic incentives. Educating employers on the benefits to them and their employees, increasing preferred parking, and expanded transit service are all actions which could reduce commuter miles.

Recommendation 50 Encourage companies, organizations, and institutions to offer commuter benefits programs.

Timing	NEAR-TERM
Emissions Impact	MODERATE
Energy Impact	MODERATE
Capital Cost	HIGH
Cost Effectiveness	MODERATE
Funding Sources	--
Relation to GCCC	Commuter Choice/Commuter Benefits programs are discussed in TLU-7 with a goal of all employers with more than 50 employees offer a program.
Current Status	Not implemented
Parties Involved	AOT, CCMPO, large employers (including the state), municipalities

a) Provide education and technical assistance to any company or public institution seeking to offer commuter benefits to their employees.
b) The State of Vermont should lead by example (see Recommendation 62).

ALTERNATIVE FUNDING MECHANISMS FOR TRANSPORTATION INITIATIVES

By far, the largest piece of the AOT budget is focused on paving and general road maintenance projects and when combined with other projects that AOT supports, the amount left for alternatives to single-occupancy vehicle (SOV) travel, such as public transit, park and rides, rail, pedestrian, and bike facilities, and multi-modal transportation, is comparatively small. It would be prudent for Vermont to search for alternative funding mechanisms to support initiatives such as the SOV alternatives mentioned above. An increase in the tax on motor fuels is an option for obtaining funds that is discussed often and is controversial. It has been documented in other contexts that the existing per-gallon approach to taxing fuels will likely be unsustainable in the face of declining liquid volumes due to more fuel-efficient vehicles and the increasing

* Transportation vouchers, also termed "green parking" vouchers, can be provided by employers to employees who don't drive to work. They are worth the cash value of the free parking benefit and can be funded through the money saved by reduced construction and maintenance costs for the parking lot.

electrification of the passenger vehicle fleet. The topic will be discussed here as an economic disincentive to driving.

A gasoline tax has been shown not to be an economic incentive to drive less. In 2007, the Center for Rural Studies surveyed over 500 households; when asked what might encourage them to reduce their driving, gasoline prices was the factor least selected.[42] The factor that *was* selected most often as an encouragement to reduced driving was greater availability of public transportation. In FY 2006, 9% of the AOT budget was devoted to the SOV alternatives listed above. At 4% of the AOT budget, public transit received almost half of the SOV alternative money. In FY 2007, the trend was the same; public transit received 4% of the AOT budget, although the amount did increase.

Table VI-6 Vermont Agency of Transportation Transit Funding*

FY 2005	$13,722,514
FY 2006	$14,888,893
FY 2007	$17,622,758

Greater funding for SOV alternatives, especially public transit, is important as the state looks for ways to cut GHG emissions by reducing vehicle miles traveled and making transportation options more efficient.

Recommendation 51—The State should support AOT consideration of alternative forms of transportation funding.

Timing	NEAR-TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	--
Cost Effectiveness	--
Funding Sources	--
Relation to GCCC	Transportation funding mechanisms are briefly discussed as TLU-9, with a goal of funding a low-GHG system as part of a broader funding system.
Current Status	Current fuel tax implemented in 1999
Parties Involved	AOT, Dept. of Taxes, General Assembly, State Administration

STRATEGY U **CONSERVING ENERGY THROUGH LAND USE REFORMS**

MIXED-USE LAND DEVELOPMENT

Decisions affecting land use directly affect energy use and the consequent production of greenhouse gases, primarily because of the strong relationship between where we live and work

* Joint Fiscal Office, *Budget Documents*, Transportation Documents, http://www.leg.state.vt.us/jfo/Transportation.htm.

and our transportation needs. Although development pressures in Vermont may be less than in metropolitan areas, they often have significant impacts on low-density, rural areas.

Dispersed development (sprawl) is dependent on the personal vehicle and is difficult to serve with public transit services, therefore novel efforts are necessary to reduce vehicle miles traveled. Research shows that increasing a community's density and its accessibility to job centers are the two most significant factors for reducing vehicle miles traveled. Therefore, encouraging mixed-use development serves to contain sprawl, moderate infrastructure investments, and increases transportation choices. Well planned development conserves energy and resources by reducing the distance people have to travel for necessary trips.

Supportive changes to land-use policies, community development and building codes can reduce the State's consumption of energy and associated emissions, while fostering economic development and creating employment.

Vermont has a number of related policies, programs, and laws already in place to encourage communities "to plan development so as to maintain the historic settlement pattern of compact village and urban centers separated by rural countryside."[*] According to statute (3 V.S.A. § 4020-4021), all state agency decisions affecting land use should be consistent with land use goals that encourage a more dense settlement pattern. The Municipal and Regional Planning Development Act specifically supports mixed-use development through engagement of state, municipal, and regional planners in a comprehensive planning process and creation of a regulatory and policy framework to provide guidance to public decisions.

Vermont has many traditional, compact, small-to-medium-sized town centers that can potentially benefit from planned mixed-use development. In recognition of this, the legislature passed a "Designated Growth Centers" bill (S.142; Act 183) in 2006 that further endorses and supports high-density, concentrated, mixed-use developments for growth centers, specifically supporting them with financial and regulatory incentives.

The state should continue taking an active role in encouraging mixed-use development in Vermont's municipalities. The Vermont Department of Housing and Community Affairs manages several grant programs to help support local and regional planning efforts. One example is the Municipal Planning Grant Program. This is a state-funded program designed to support Vermont towns in their municipal planning efforts. The program funds technical assistance for town planning, regulatory, and non-regulatory implementation of plans, encouragement of citizen participation and education, and innovative demonstration planning projects.[†] Planning grants can fund municipal efforts to rewrite town plans, update zoning bylaws, and update GIS databases. Activities associated with downtown village center or growth

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[*] 24 V.S.A. 4302(c)(1)These include, but are not limited to, Act 250, Executive Order #15 of 1985 giving priority to locating state government in existing buildings, and programs of the Vermont Economic Progress Council and Vermont Economic Development Authority

[†] Up to $800,000 is available in any given year for these grants, and municipalities may apply for up to $15,000 for single applications or up to $25,000 for consortia applications.

centers planning are considered a priority funding activity.* Further incentives of this type will continue to encourage energy efficient development.

Below are a number of recommendations that address the cross-cutting issues of land use, transportation, and energy efficient building practices.

Recommendation 52 Consider energy implications in land-use planning by facilitating mixed-use, public transit-oriented development that limits sprawl.

Timing	NEAR-TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	--
Cost Effectiveness	--
Funding Sources	--
Relation to GCCC	Discussed in TLU-1, referred to as "Compact and Transit-Oriented Development." The policy has a number of implementation mechanisms including: providing technical and financial resources to municipalities; strengthening state-level planning; creating state-municipal and public-private partnerships; and consideration of carbon neutrality in development projects.
Current Status	Ongoing
Parties Involved	AOT, ANR, Dept. of Housing and Community Affairs, regional planning commissions, CCMPO, economic development councils, and municipalities

c) Continue to encourage development in downtowns, village centers, and growth centers through continued and/or increased funding of state programs, offering financial incentives† and ensuring state infrastructure provides support for designated centers.

d) Target 'Growth Center' and other incentives to projects that facilitate transit service and infrastructure development and availability.

e) Prioritize state-owned infrastructure projects that support development in Growth Centers and facilitate transit service. .

f) Explore the use of financial incentives to encourage rehabilitation/reuse of existing buildings.

e) Target planning grants to towns which update zoning bylaws in order to include residential housing in mixed use developments

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* Municipal Planning Grant Program, Vermont Department of Housing and Community Affairs.

† Growth Center Incentives currently include "Downtown and Village Center Program Tax Credits," where qualified applicants can claim credits in designated centers. The total credits allowed annually are capped at $1.5 million.

Vermont's local and regional land-use planning organizations should increase efforts to develop plans that improve land use decisions by incorporating energy demand/efficiency, greenhouse gas emissions reduction, and development of renewable energy resources. These plans are expected to accommodate housing needs, provide employment opportunities, reduce the rate of growth of vehicle miles, while reducing energy and greenhouse gas impacts across the State. High-density mixed-use land use planning permeates through the rest of the discussion and recommendations under the umbrella of this strategy. Each of the recommendations below is an integral piece of the land use/energy planning process.

Recommendation XX: Local and regional land use plans should be consistent with the Comprehensive Energy Plan and be revised concurrently with CEP updates.

Timing	LONG-TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	--
Cost Effectiveness	--
Funding Sources	--
Relation to GCCC	
Current Status	Ongoing
Parties Involved	AOT, ANR, Dept. of Housing and Community Affairs, regional planning commissions, CCMPO, economic development councils, and municipalities

a) *Municipal and regional land use plans should include specific energy guidelines based on forecasts of (local) energy demand and usage.*
b) *Energy components within municipal and regional plans should address the subjects of energy efficiency, greenhouse gas emissions, and renewable energy potential.*

Recommendation XX: State should encourage and support local and regional land-use planning organizations' adoption of energy efficient land use planning.

Timing	NEAR-TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	--
Cost Effectiveness	--
Funding Sources	--
Relation to GCCC	
Current Status	Ongoing
Parties Involved	AOT, ANR, Dept. of Housing and Community Affairs, regional planning commissions, CCMPO, economic development councils, and municipalities

a) *Consider adopting a statewide growth management plan, based on local and regional plans, aligning state planning, financing, infrastructure, and regulatory land use policies and programs.*
b) *As resources permit, expand the efforts of the Department of Public Service to provide technical and financial assistance to regional agencies and local governments to facilitate energy-efficient planning and development*
c) *Determine the extent to which state and local tax policies affect and guide land use practices and revise policies to incorporate consideration of energy efficiency and greenhouse gas emissions into these policies.*
d) *Consider changes to Act 250 to ensure that review of land development will responsibly include review of the energy needs resulting from this development and that land use development is consistent with the State's electric utilities long-term service plans.*

Vermont's electric utilities are on the frontline in planning and initiating energy investments. They are well qualified to share their expertise in energy planning while local land use plans are being designed. Moreover, utilities can provide energy efficient design and site location services to developers helping ensure commercial/industrial/residential developments meet or exceed energy and emissions standards. The following recommendation serves to strengthen the link between land use development and the electric utility to ensure that energy supply can serve new development in the most efficient and least wasteful manner.

Recommend XX: Direct Vermont's utilities to play an active role with regional/local governments, and developers to encourage climate-friendly and energy-efficient development in their service areas.

Timing	NEAR-TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	--
Cost Effectiveness	--
Funding Sources	--
Relation to GCCC	
Current Status	Ongoing
Parties Involved	AOT, ANR, Dept. of Housing and Community Affairs, regional planning commissions, CCMPO, economic development councils, and municipalities

ENDNOTES

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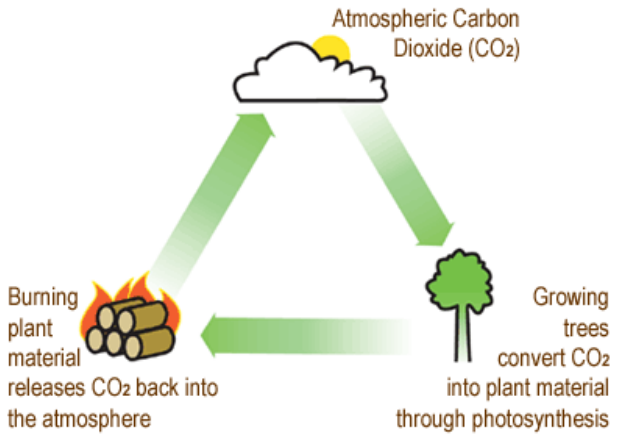
SECTION VII BIOMASS

Biomass is any organic matter that is available on a renewable basis through natural processes or as a by-product of human activity. In the U.S., the most common forms of biomass used for energy are agriculture and forest crops and residues, animal waste, municipal solid wastes, and industrial wastes. While certain types of biomass, such as wood, are used for energy without significant processing, many organic products are converted to biofuels, a liquid form of biomass energy, before being consumed. Both forms have helped to displace a significant amount of fossil fuel consumption in the U.S. Historically, the most prevalent biomass energy resource in the U.S. has been the by-product of paper production.[1] This is especially true in the Northeast where the development of other biomass resources is just beginning. The growth of organically derived liquid fuels such as ethanol has, however, increased dramatically over the last few years throughout the U.S. and has the potential to become more widely utilized in the Northeast and Vermont.[2] This Plan discusses some of the ways that Vermont can take advantage of the biofuels "boom" that is occurring domestically and make biomass energy choices that are economically, environmentally, and socially responsible. The following sections contain strategies and recommendations for mobilizing supply of, demand of, and electric generation from, biomass resources in Vermont.

STRATEGY V DISPLACE CONSUMPTION OF FOSSIL FUELS BY ENCOURAGING A SUSTAINABLE BIOMASS ENERGY DEMAND

Biomass can play a significant role in providing energy for Vermont. Wood and biofuels resources are steadily becoming more popular in the Vermont energy market and are cost competitive with traditional fossil fuels. However, there are still significant challenges associated with increasing the demand for biomass energy. The following section addresses these challenges and describes some of the ways policymakers can help Vermonters utilize biomass, an abundant in-state energy source.

Figure VII-1 Biomass Carbon Fuel Cycle



Source: Wood Fuel Wales

EXPANDING THE USE OF WOOD ENERGY

Wood is one of the least expensive sources of thermal energy in Vermont. While the price continues to increase (see *Table VII-1* VT Price of Wood (green). 22 million BTU/cord), wood is projected to be less expensive than every other heating fuel through 2040 (**Error! Reference source not found.**). According to the VT PSD 2005 Appliance Saturation Survey, of Vermont residents who pay for their own heat, 11% use wood as their primary heating source. Of the respondents to the survey, 50% indicated that they utilize at least one form of supplemental

heat in their homes, 24% have supplemental stoves fired by either wood or coal, and 13% have wood-burning fireplaces.[3] There is great potential for the utilization of more wood resources as efficient wood-burning appliances are installed in more homes. Home heating with firewood is not for everyone, however, as there can be a substantial amount of work associated with wood heat. If homeowners wish to supply their own firewood, they must have adequate land on which to cut the wood and also sufficient space to store the wood under cover during the heating season. Storage space is required for those who want to heat with wood, regardless of whether or not they cut the wood themselves. In addition to cutting and storing firewood, homeowners who heat with wood should be prepared to continually monitor the fire. There is no heat if the fire goes out!

In addition to firewood, homes can also be heated with pellets made from biomass. Sales of pellet-burning appliances nationwide have grown from 30,970 in 2000 to 118,490 in 2005.[5] Yet according to the EIA, Wood Residential consumption has been gradually declining since 1979 (see *Figure VII-4 Vermont Wood Energy Consumption*). Nevertheless, at $180 per ton of wood pellets, the cost to heat with a wood pellet stove in Vermont during the 2007 heating season was less than that of every other fuel at only $13.64/mBTU, far below fuel oil at $26.85/mBTU and even natural gas at $21.38/mBTU.[6] Using wood for energy can help to reduce acid rain by reducing reliance on other fossil fuels. This is because the overall carbon footprint of wood

Table VII-1 VT Price of Wood (green). 22 million BTU/cord[4]

May each year	*$/cord*	*$/BTU*
2007	$180	$13.64
2006	$170	$12.88
2005	$150	$11.36
2004	$125	$9.47
2003	$125	$9.47
2002	$125	$9.47
2001	$125	$9.47

energy is minimal due to the carbon absorption that occurs through tree growth* (see *Figure VII-1 Biomass Carbon Fuel Cycle*). However, when switching from oil or gas to wood pellet or certified stoves, higher localized air emissions result. And in many locations, wood stoves and fireplaces are the largest source of particulate matter air pollution.[7] Therefore, it is critical for policymakers to keep in mind local air quality concerns when encouraging the substitution of wood for fuels like oil and propane gas. Some of the most efficient methods of using heat and options for future wood utilization are discussed below.

District Energy systems, which provide heat from a central source to a number of buildings, can gain significant efficiencies in heating (and cooling). These systems are widely used in Europe. The PSD has been exploring the use of new, highly efficient biomass combustion technologies as a primary energy source for district energy. The state has two biomass district energy systems already in place, in the Capitol complex in Montpelier and the State office complex in Waterbury. Discussions have been taking place for a number of years concerning upgrading or

* The only carbon emissions associated with the utilization of sustainable wood resources are those emissions that occur due to the transportation of wood fuel.

expanding the Montpelier system to include the rest of the city. Planning has been hampered by the initial investment needed to make this project happen. The State of Vermont is in a position to show leadership by funding this project in cooperation with the City of Montpelier as an example for the rest of the state. According to the Capital District Master Plan, an expanded district heating system in Montpelier could lead to an increase in income of $1.2 million in Central Vermont and an increase in tax revenues of more than $200,000 (both in 1999 dollars).[8]

The DPS has worked together with the Chittenden County Regional Planning Commission and Burlington Electric Department (BED) to secure funding from the Urban Consortium to explore the viability of biomass district energy for Vermont communities. The **Community Renewable Energy Project (CORE)** has worked with Burlington and Montpelier to advance proposals for district energy in those two cities. BED, in part with the assistance of funds secured by the DPS and the Department of Forest, Parks and Recreation (FPR), worked recently to develop a viable district energy system proposal using heat from the McNeil Station.

The PSD has worked with the School Energy Management Program (SEMP) along with the Biomass Energy Resource Center (BERC) Fuels for Schools Program (VFFS), to develop standards for chip quality and delivery that are appropriate to these small-scale combustion systems. The wood chip boilers used in these systems emit less particulate matter than new wood and pellet stoves.[9] There are now 33 Vermont schools that heat with clean, efficient wood chip systems (see *Table VII-2 Vermont School Wood Chip Users 2007*). Schools and other state institutions represent a significant market for new wood heating systems and have the potential to provide a stable source of wood fuel demand in the future.

Table VII-2 Vermont School Wood Chip Users 2007

Wood Chip Heated Schools	Sq. Foot
Barre City Elem	126,594
Barre Town Elem	158,000
Berlin Elem	37,058
Blue Mountain Union	77,000
Brattleboro Union HS	330,000
Browns River MS	90,000
Burlington HS	
Calais Elem	23,000
Camels Hump MS	85,000
Champlain Valley Union HS	220,000
East Montpelier Elem	37,000
Frances C. Richmond School	
Grand Isle Elem	42,500
Hanover HS	
Hartford HS	157,560
Hazen Union HS	80,000
Johnson Elem	50,000
Leland & Gray Union HS	83,667
Lyndon Town	105,000
Mt Abraham UHS	
Mt Anthony MS	150,000
Mt Anthony HS	
Mt Mansfield Union HS	150,000
North Country Union HS	160,000
Randolph UHS	140,672
St. Albans Town Ed Center	125,000
Spaulding HS	210,522
Springfield HS	270,000
U-32 HS	200,000
Westford Elem	40,000
Westminster Center School	
Williamstown MS/HS	

For years the PSD and FPR, working cooperatively with funding provided by DOE's **Northeast Regional Biomass Program (NRBP)**, have promoted the use of wood chip technology in a variety of industrial applications. Efficient wood chip systems have been installed in numerous applications, from a heating plant for a low-income housing development to systems using sawmill waste that lower costs and increase product value.

Wood biomass energy systems are an excellent way to provide a sustainable and renewable source of heat for residential and commercial applications, both small and large. If implemented correctly, a program of support for biomass energy would be beneficial for Vermont in the long run and would help offset fossil fuel use. Therefore, it is in the best interests of the state to encourage the sustainable use of wood energy for heating and process uses.

Recommendation 53 Encourage the sustainable use of wood energy for heating and process uses.

Timing	NEAR-TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	--
Cost-Effectiveness	--
Funding Sources	--
Relation to GCCC	AFW-6, Supporting the increased use of forest biomass for energy
Current Status	Ongoing
Parties Involved	PSD, PSB, ANR, FPR, forest products companies and loggers

a) *State and municipal government should encourage the development and expansion of cos-t effective district wood heating systems.*
b) *The Vermont Superintendents Association's School Energy Management Program (SEMP), Department of Education, Department of Forests, Parks & Recreation, Biomass Energy Resource Center (BERC), and Department of Public Service should work together to investigate the feasibility of installing additional wood heating systems in Vermont's schools and institutions.*
c) *ANR, DPS Clean Energy Development Fund, and EVT should provide assistance to businesses interested in utilizing wood energy in commercial, and industrial applications in Vermont for CHP.*
d) *Advocate for increased public outreach and wood energy education programs.*

EXPANDING THE USE OF BIOFUELS

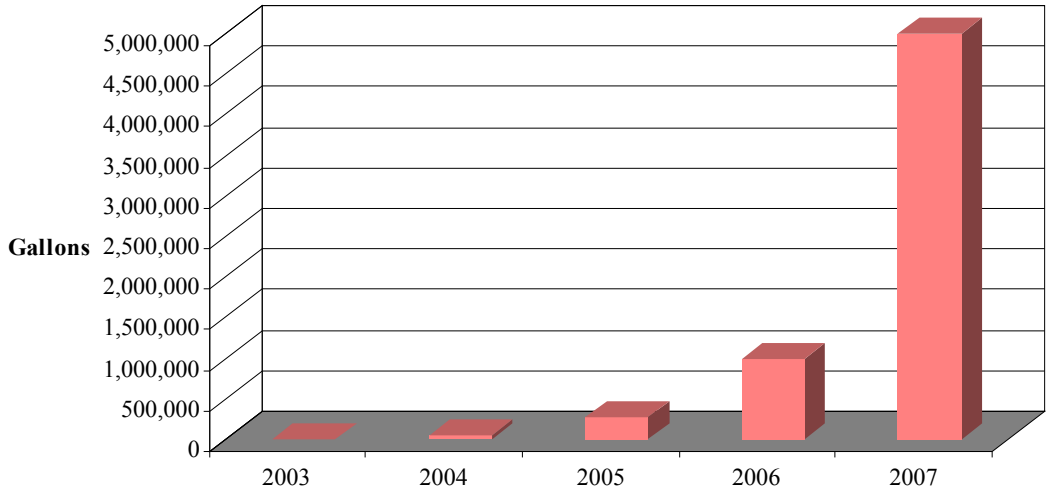
Biofuels, including ethanol and biodiesel, are the fastest growing source of energy in the U.S. While they are currently utilized less than wood, they have an even greater potential for use in Vermont. When produced sustainably, biofuels can displace fossil fuels and can lead to environmental and local economic development benefits. Many lower biofuel blends are also competitively priced and widely available, especially as the prices of fossil fuels continue to rise. Furthermore, in addition to reducing our dependence on foreign oil, greater utilization of ethanol and biodiesel can help Vermonters reduce air and groundwater pollution by reducing the amount of oil (both by-products and liquids) that gets released into the environment.

Both ethanol and biodiesel are starting to play roles in Vermont's energy market. Ethanol, which is blended with gasoline, is almost exclusively used in the transportation sector. For a discussion

of the uses of ethanol in the transportation sector, see 0. Biodiesel, on the other hand, is used in transportation, heating, and electric generation, the latter two of which are discussed in this section. Biodiesel is a clean-burning fuel alternative to petroleum-based oil. As a heating and process fuel, biodiesel is easy to use, biodegradable, nontoxic, and sulfur free and can be blended with petroleum diesel. In Vermont's cold climate, biodiesel has proven that it can be safely utilized to meet energy needs, despite initial fears that its use would cause mechanical failure. Over the last several years, successes in various Vermont pilot studies have proven that biodiesel can be an effective fuel in compressors, snow and farm equipment, and residential, commercial, and institutional heating systems, despite the region's cold climate.

Currently, biodiesel blends from B2 to B20 are available from fuel dealers in some areas of the state (see "For Delivery" locations, *Figure VII-2* Biodiesel Consumption in Vermont below) for use in home heating systems.* While higher-percentage blends are currently under consideration, these blends are not yet endorsed because their use in residential heating systems in Vermont has not been adequately evaluated.

Figure VII-2 Biodiesel Consumption in Vermont



Source: Vermont Biofuels Association

Many Vermonters have, however, had success with these higher blends and there appears to be great potential for their use in home heating. According to the results from the Vermont Bioheat Program, a slight decrease in system combustion efficiency of up to 0.7% can occur when switching from fuel oil to a B20 blend. Nevertheless, the two fuel dealers who participated in supplying B20 found that there were no maintenance-related calls due to the higher fuel blend.[10]

* For a list of fuel dealers that sell biodiesel in Vermont see the Vermont Biofuels Association website http://www.vermontbiofuels.org/wheretobuy/wheretobuy.shtml

Figure VII-3 Vermont Biodiesel Locations

Source: Vermont Biofuels Association

There are also significant opportunities for biodiesel blends to be used for commercial and industrial purposes. Several pilot projects have already been initiated in Vermont under the coordination of the PSD, the Vermont Fuels Dealers Association, the Vermont Sustainable Jobs Fund, and the Vermont Biofuels Association. One project took place at Smugglers Notch Ski Resort, which had early success with biodiesel blends in their tractors, backhoes, and other heavy equipment. In the winter of 2006, Smugglers Notch tested B20 in its snowmaking equipment

with great success. While additional precautions for gelling and sludge release were made, the project's success encouraged the resort to continue using the fuel in future ski seasons.

BIODIESEL EMISSIONS

The emissions profile of biodiesel utilized in heating and process facilities is also significantly better than that of traditional diesel. Biodiesel not only has passed the Tier 2 health effects testing requirements of the U.S. Clean Air Act, but also has been shown to reduce carbon dioxide, carbon monoxide, and particulate emissions and practically eliminates sulfur oxides and sulfate matter when compared with regular diesel. See table below for selected B100 and B20 emissions comparisons with traditional diesel fuel.

Table VII-3 Average Biodiesel Emissions Compared to Conventional Diesel, According to EPA

Emission Type	B100	B20
Regulated		
Total Unburned Hydrocarbons	–67%	–20%
Carbon Monoxide	–48%	–12%
Particulate Matter	–47%	–12%
NO_x	+10%	+2% to –2%
Non-Regulated		
Sulfates	–100%	–20%*
PAH (Polycyclic Aromatic Hydrocarbons)†	–80%	–13%
NPAH (nitrated PAHs)‡	–90%	–50%§
Ozone potential of speciated HC	–50%	–10%

Source: National Biodiesel Board

Another pilot was conducted with the Department of Buildings and General Services (BGS) in the Vermont State building complex in Waterbury. The project tested blends of B5, B10, and B20 for both their emissions profile and mechanical feasibility. Results of the project included carbon monoxide and maintenance reduction benefits and increases in sulfur dioxide concentrations.[11] Success in blending higher concentrations of biodiesel with heating oil has provided encouragement for further study and use of biofuels by the State of Vermont. Currently, fuel mixes of up to B20 have quality standards created by the American Society of Testing and Materials (ASTM). The ASTM standard is a rigorous certification given to fuels to ensure a certain level of quality and many warranties require that ASTM-certified fuels are used to remain valid. No standards exist for fuel mixes greater than B20.

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* Estimated from B100 result.
† Average reduction across all compounds measured.
‡ Ibid.
§ 2-nitroflourine results were within test method variability.

Ensuring a Sustainable Biofuels Supply

Any increase in the consumption of biofuels drives up the demand for energy crops as well as the prices for those crops. This can lead to both positive and negative changes in the U.S. and global economy. On one hand, many farmers who are equipped to grow energy crops receive a steady demand for their products and local economies benefit from a multiplier effect from the boost to the farm industry. On the other hand, an increase in crop prices can also have an impact on the cost of food and can create pressure on farmers, especially in economically unstable countries, to clear more forested land to produce energy crops. Obtaining biofuels from sustainably grown crops is an important issue that policy makers need to take into consideration. The EU, for example, has proposed legislation to ensure biofuels from unsustainably produced crops would not be able to enter the European market. While biofuels can help Vermont move towards clean energy goals and reduce the negative impact that energy consumption has on the environment, policy makers should be aware of all the consequences of biofuels policies and work towards ensuring a sustainably produced biofuels supply for Vermont consumers.

Recommendation 54 Encourage sustainable biofuels displacement of fossil fuel heat and process use in the residential, commercial, and industrial sectors.

Timing	NEAR-TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	--
Cost-Effectiveness	--
Funding Sources	--
Relation to GCCC	AFW-12, In-State Liquid Biofuels Production
Current Status	Ongoing
Parties Involved	USDOE, PSD, ANR, VT Biodiesel Project, VT Biofuels Association, non-profit organizations

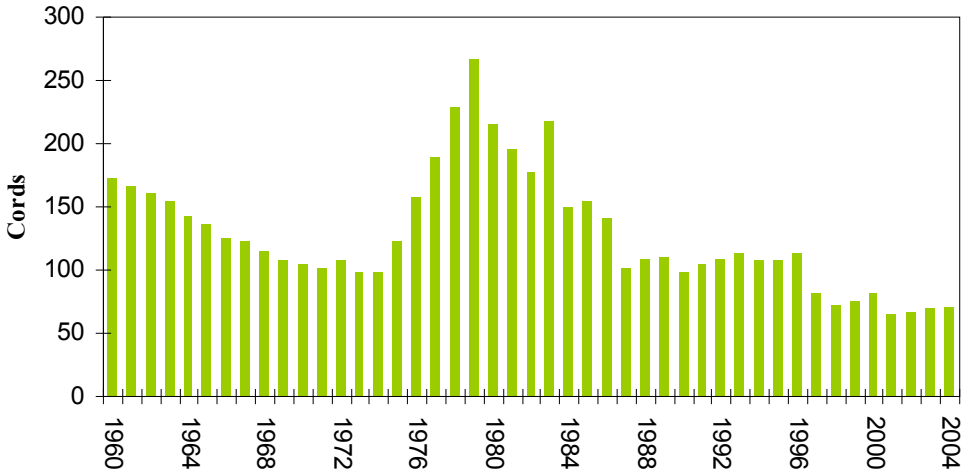
a) *State agencies and Vermont community groups should support regional and national efforts to negotiate for warranties on heating systems and equipment that utilize biofuels.*
b) *The Vermont Agency of Natural Resources should evaluate the effects (environmental, mechanical, safety, etc.) of using B5 and greater blends of biodiesel in heating and industrial processing systems in Vermont.*
c) *Vermont consumers and community groups should encourage fuel dealers to supply biofuels in an environmentally sustainable manner.*
d) *The Vermont legislature should consider tax credits for homeowners that use biodiesel blends for home heating as prevailing fiscal and economic considerations permit.*

e) Vermont state agencies should continue to lead biofuels initiatives by utilizing biofuels in state buildings and vehicles (See Recommendation 60 and Recommendation 61).

NEW RESIDENTIAL WOOD STOVES AND APPLIANCES

Many advances have been made to improve the efficiency and reduce the emissions of residential stoves and furnaces. However, the EPA estimates that between 70% and 80% of wood stoves in use in the United States are older and inefficient. Like the rest of the U.S. population, many Vermonters continue to use older, inefficient, polluting stoves that have higher life-cycle costs and cause greater environmental harm than EPA-certified models. For example, the relative emissions of fine particles from uncertified stoves that many people use are 4.6 lbs/MMBtu of heat output while from newer EPA-certified stoves they are 1.4 lbs/MMBtu of heat output and for pellet stoves they are 0.49 MMBtu of heat output. Higher-efficiency stoves reduce wood consumed per wood stove, decrease emissions by at least 70%, and can displace other fuel sources such as oil, gas, and propane (with higher emissions).[12] The PSD, the Department of Forest, Parks and Recreation, and the EPA co-sponsored, with wood stove dealers and the Hearth Products Association, a wood stove turn-in program that provides discounts for the purchase of a new stove. This program has since ended. The EPA is supporting three new wood stove change-out pilot programs in various parts of the country, providing rebates and incentives for customers, but none in Vermont. Vermont has a goal of a 3% increase in new wood and pellet heating appliances that can be achieved only through a sustained effort by the state and local governments.[13]

Figure VII-4 Vermont Wood Energy Consumption



Source: EIA

Recommendation 55 Facilitate and speed the transition to cleaner, more efficient wood burning by promoting the transition to new residential stoves and appliances.

Timing	NEAR-TERM
Emissions Impact	--

Energy Impact	--
Capital Cost	--
Cost-Effectiveness	--
Funding Sources	--
Relation to GCCC	AFW-8B
Current Status	--
Parties Involved	PSD, ANR, FPR, retailers

a) *Evaluate the effectiveness of including wood energy-efficiency programs as part of an all fuels efficiency utility.*
b) *Evaluate the costs and benefits of re-initiating wood stove trade-up programs.*
c) *Evaluate the costs and benefits of new wood stoves, pellet stoves and central heat with pellets.*

STRATEGY W SUPPORT THE SUSTAINABLE DEVELOPMENT OF A WELL TARGETED BIOMASS SUPPLY IN VERMONT

As a rural state with strong agricultural and forestry sectors, Vermont has the potential to grow, process, and consume biomass resources. Producers and entrepreneurs can utilize the state's predominant energy resource to meet the growing demand for clean, affordable energy in the region.

SUPPORT FOR BIOFUELS SUPPLIERS

There are two classes of agricultural biofuels crops: oil-based crops such as soy and canola for biodiesel production and starch- or sugar-based crops such as corn, barley, and switch grass that are used to produce alcohols, must notably ethanol.

Table VII-4 Estimation of Agricultural Biofuels Potential In Vermont*

Biodiesel

	Yield per Acre		BTU/gallon	Acres	Energy Yield Gallons	Energy Yield mmBTU
Crop	100	gallons	130,000	40,000	4,000,000	520,000

Ethanol

	Yield per Acre		BTU/gallon	Acres	Energy Yield Gallons	Energy Yield mmBTU
Grain	300	gallons	76,000	2,000	600,000	45,600
Cellulosic	100	gallons	76,000	35,000	87,500,000	6,650,000

GROWING

* Vermont 25 x 25 Draft Report (2007). This table provides just one scenario for biofuels development in Vermont. More or less land devoted to each energy crop could increase or decrease the production of each feedstock depicted.

Vermont has a long history as an agricultural state and now has the opportunity to begin a new era in agriculture by supporting farms that grow crops that can be utilized for production of biofuels. Vermont's land area consists of 5.9 million acres, of which approximately 21% (1.24 million acres) is classified as farmland. Of the 1.24 million acres approximately 570,000 acres are in cropland, of which 450,000 acres are harvested.* This leaves approximately 120,000 acres of unused cropland potentially available for biofuels production. Assuming average yields and all acres could be harvested, the Vermont 25 by 25 committee estimates that, using the above scenario, an annual production of approximately 4,000,000 gallons of biodiesel and 88,100,000 gallons of ethanol is technically feasible from crop-based feedstocks in Vermont (see below). This would be enough to substitute all gasoline currently consumed in Vermont with a 10% ethanol blend "E10" and all fuel oil sold (both for transportation and heating) in Vermont with a 2% biodiesel "B2" blend. However, it is not likely that every unharvested acre could be economically harvested or that all yield rates would be reached. Thus, further study is needed to determine the actual cost-effective potential. Nevertheless preliminary investigation suggests there is reason to be optimistic about Vermont's biofuel energy potential.

PROCESSING BIOFUELS

One of the most important R&D initiatives in the biofuels industry is the development of less energy-intensive and more cost-effective ways to create biofuels. Today, biofuels such as ethanol and biodiesel are created by converting the starch and cellulose in the raw biomass feedstock into usable forms of energy. This process generally requires biochemical and thermochemical processes that can still be quite energy intensive. The most prevalent methods for processing these fuels are described below.

Ethanol

Ethyl/grain alcohol, known as ethanol, is the most widely consumed biofuel in the U.S. Ethanol is primarily used in lower-blend amounts (up to 10% ethanol, 90% gasoline) to reduce pollution and increase octane. However, it can also function as an alternative fuel (in blends up to 85% ethanol, 15% gasoline) in specially designed vehicles. In 2006, U.S. ethanol production more than doubled to 4.9 billion gallons and by August of 2007 production capacity had already increased to 6.8 billion gallons with an additional 6.7 billion gallons more capacity under construction. While ethanol is primarily produced from corn, other sources include corn stover (stalks and residues left over after harvest), grain straw, switchgrass, quick-growing tree varieties such as poplar or willow, and municipal wastes.

In dry mill plants, ethanol is produced by grinding corn into flour and then fermenting the flour. The starch in the flour is used to produce ethanol and what remains (distiller's grain) is sold as animal feed and the CO_2 released during processing is used for carbonating soft drinks and dry ice. For a description of the other major ethanol production process called wet milling, visit the Renewable Fuels Association (RFA) resource center. Because the greatest potential for cellulosic ethanol in Vermont currently lies in the forest, see the Biomass section to learn more.

Biodiesel

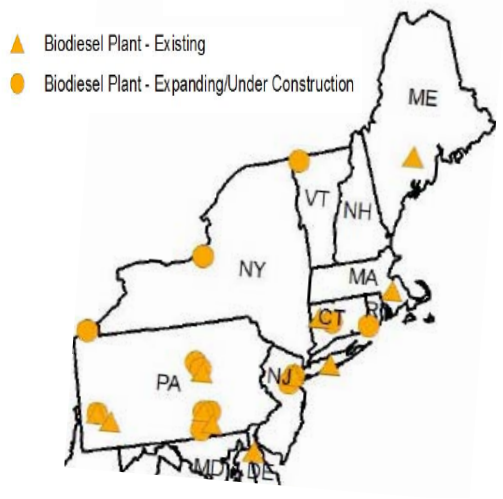
In the U.S. biodiesel is still a small industry, but one that has grown exponentially over the last few years, with production tripling both from 2004 to 2005 and from 2005 to 2006. The largest producers of biodiesel are companies that already make products from vegetable oil and animal fat such as detergent manufacturers. The feedstocks that these producers consume include used cooking grease and other excess oils, but most of the fuel in the U.S. is derived from soybean oil.

* It is assumed in this estimation of Vermont's agricultural biofuels potential that land use patterns remain as they currently exist, that no deforestation occurs and that current production rates of existing crops remain the same.

LOCAL PRODUCTION

Biodiesel production has grown in recent years in Vermont, with several farms now producing their own fuel. The number of dealers selling the fuel has also grown from 2 in 2004 to 26 in 2007.[14] In January 2008, a Quebec company called "Biocardel Vermont" began selling commercial biodiesel from their processing plant in Swanton, Vermont to be mixed in with heating and transportation fuels throughout Vermont and the region.[15] To locate and produce in Vermont, Biocardel received payroll and capital investment tax credits.[16] If the project continues as planned it would be one of the largest biodiesel production and marketing facilities in New England and one of only 65 in the United States. The facility is projected to eventually employ 21 people and produce over 4 million gallons of biodiesel annually, with the capability to double production in the future. As biodiesel processing technologies advance, Vermont may be able to use its forest resources to create biodiesel.

Figure VII-5 United States Biodiesel Production Facilities



Source: U.S. DOE

Biodiesel is still in an emerging phase of development and large production facilities are relatively scarce. Therefore, smaller production facilities such as Biocardel may be viable in the Northeast. It will be essential, however, for biodiesel produced in Vermont to keep up with national certifications (such as the ASTM standard) to maintain compliance with warranties. Unlike biodiesel production, however, there is currently no grain or cellulosic ethanol being produced in Vermont. This is primarily due to the competitive advantage that large distilleries, primarily located in the Midwest, have over the smaller facilities that would be better suited to Vermont. While there may be the potential for cellulosic ethanol facilities in Vermont, as a small state, it would be difficult to come up with the funding and transportation infrastructure to finance such a large facility and to move large amounts of fuel throughout the region. Nevertheless, it is technically feasible for an ethanol facility to be built in state if Vermonters make ethanol production a legislative priority.

INITIATIVES

25 by 25 Initiative—The Vermont 25 by 25 Initiative comprises a broad coalition of agricultural, energy, and policy professionals. Supported by a Vermont legislative resolution, the Initiative's aim is to develop a plan for providing 25% of Vermont's total energy needs from in-state renewable resources by the year 2025—primarily from Vermont's farms, forests, and working lands. The Initiative is a state-level alliance that functions within the framework of the national 25 by 25 program, the vision of which is

as follows: *By 2025, America's farms, forests, and ranches will provide 25% of the total energy consumed in the United States, while continuing to produce safe, abundant, and affordable food, feed, and fiber*. The Vermont 25 by 25 Initiative also officially adopted this national goal and has begun the work of determining specifically how Vermont can achieve these objectives from in-state resources.

Recommendation 56 Support sustainable ethanol and biodiesel production and supply efforts in Vermont.

Timing	NEAR-TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	--
Cost Effectiveness	--
Funding Sources	--
Relation to GCCC	AFW-12, In-State Liquid Biofuels Production
Current Status	Biodiesel plant supported by VEDA and beginning operations
Parties Involved	PSD, ANR, biofuels producers, fuel dealers

a) The Vermont Agency of Natural Resources and Agency of Agriculture should evaluate the most suitable energy crops for Vermont as well as reliable yield values for those crops.

b) The Vermont Agency of Agriculture and biofuels organizations should encourage farmers to grow suitable biofuels feed stocks through education and incentive programs.

c) The Vermont Agency of Natural Resources and Agency of Agriculture Evaluate the costs and benefits of expanding certain areas of land devoted to growing energy crops.

d) The Agency of Natural Resources should continue to evaluate the feasibility of siting biodiesel and ethanol facilities in Vermont.

e) VEDA, Vermont business groups, and community energy organizations should encourage biofuels producers to locate facilities in Vermont and to utilize local, sustainably produced crop material when available.

f) Along with federal partners, state agencies should provide technical assistance to biofuels companies interested in locating in Vermont.[17]

SUPPORT FOR BIOMASS SUPPLIERS

Vermont is a national leader in the research, development, and commercialization of wood energy. Wood is an abundant renewable energy resource and virtually all of Vermont's wood chip usage comes from mill wastes or sustainably harvested chips from low-quality trees. Utilizing Vermont's wood resources can help reduce the state's dependence on fossil fuels and can boost instate economic development. This section of the CEP discusses the steps Vermont can take to increase the sustainable use of wood energy in Vermont.

Vermont has a rich supply of wood resources in its forests. Today about three-quarters of the state is forested and the forest growth rate exceeds the harvest rate.[18] Most of the biomass energy consumed comes from waste materials of the pulp and sawmill industries, the majority of which

is already consumed for energy purposes. Therefore, if Vermont continues on its current path, it could be facing a potential wood energy shortage. To meet the demand for in-state biomass, additional wood supply will need to come primarily from new harvesting and the greater use of efficient wood-burning appliances and generation facilities (see (see *Recommendation* 53—*Encourage the sustainable use of wood energy for heating and* process *uses.*).

Figure VII-6 New England Wood Pellet Facilities

Wood energy is an economically viable source of fuel for heating. Currently, bole wood (the part of the tree trunk between the ground and first limb) chips can be produced for $52–$57 per green ton, equivalent to $0.70–$0.80 per gallon of no. 2 heating oil. Vermont has the capacity to supply additional wood to be consumed for energy purposes. However, to achieve a reliable and stably priced supply of wood energy in Vermont, biomass markets will need to grow. This means that the price of wood will need to increase to a level that can support a biomass fuel industry that supplies wood energy for the variety of seasonal and year-round residential, commercial, industrial, and electric generation demands. Currently, most of the wood pellets used for energy in Vermont come from out of state. It would be much more efficient for pellets to be produced within Vermont, where the resources and the market can continue to expand. The "Vermont Wood Fuel Supply Study" contains several strategies for expanding wood availability as a fuel source.[19] These strategies include the following:

Source: New England Wood Pellet, LLC

- Expand existing initiatives, such as the Current Use taxation program, and develop new incentives that help reduce property tax burdens on private landowners.
- Develop programs and initiatives that facilitate the coordination among the increasing number of small private timberland owners to achieve their forest management objectives and reach the scale necessary to keep small woodlots as "working forests."
- Increase public outreach and education on the benefits of managed forests and highlight examples of well-managed forests.
- Expand public relations efforts to promote the forestry and logging professions as the stewards of Vermont's working forests.
- Work with public and private partners to develop strategies to reduce the parcelization and fragmentation of large forest parcels.

Vermont's wood and other forest residues are not only easily used in wood heating and electric generation facilities, but also can be further processed into liquid fuels such as cellulosic ethanol and even biodiesel. As these technologies become cost effective, Vermont could become a leader in the liquid biomass area.

CELLULOSIC ETHANOL

Production of ethanol from non-food crops is in the pilot phase of development at this time. Non-food crop feedstocks include crop residues, grasses, and wood. Currently, producing cellulosic ethanol is significantly more expensive than producing corn- or grain-based ethanol. However,

the technology to convert cellulosic feedstock is becoming more sophisticated and cost effective. Not only is cellulosic biomass less expensive than corn and other grains as a raw feedstock, it also requires less energy to grow. For a more detailed description of the cellulosic biomass process see the U.S. Department of Energy, Office of Science.[20]

The main focus of biomass development in New England is the use of wood from forests and wood-processing residues. Although there are no plans for a cellulosic ethanol plant in Vermont, neighboring states are aggressively pursuing such plants in their jurisdictions. Should any of these planned plants become operational, competition for wood will increase, thereby creating the potential for rising costs of raw materials to all in the wood energy market. Vermont has a significant number of forest resources that could potentially be used as feedstock for ethanol. However, managing the forests sustainably and to the betterment of all Vermonters is a significant priority for the state and any significant change in forestry management must be monitored and appropriate safeguards implemented.

Pyrolysis

In addition to providing a feedstock for cellulosic ethanol, Vermont's forests also can potentially provide a feedstock for new, more advanced biodiesel processing. As with ethanol, most of the oil used to make biodiesel is obtained from energy-intensive crops such as corn, soy, and oil seed. In the future, other crops and wood may contribute to a greater share of oil production through more advanced processing techniques. The most promising of the techniques for creating bio-crude, a substance that can be easily turned into biodiesel, is call "pyrolysis." It is still in the development phase, but along with gasification has promise to become a prominent bio-oil processing method in the future. Through pyrolysis and gasification, a feedstock is heated with limited oxygen and turned into oil. The resulting pyrolysis oil can be easily refined into biodiesel or, depending on price conditions, used as an intermediate for production of chemicals and other high value products such as plastic. Pyrolysis oil is greenhouse gas neutral, does not produce SO_x (sulfur oxide), and produces approximately half of the NO_x (nitrogen oxide) emissions produced by fossil fuels. It is now being used for the production of chemicals and is being developed for producing liquid fuels. It has about 40% of the heating value of diesel. An experimental pyrolysis oil or bio-oil system has been operating in Massachusetts and other development efforts are underway in a variety of countries. If pyrolysis production becomes viable in the next few years, Vermont should investigate the possibility of siting a processing facility in state.

Finally, the GCCC report has set a goal of achieving a 5% increase in the use and production of biomass energy feedstocks by 2010 and a 30% increase by 2028. In their report, shifting supply away from paper manufacturing, increasing forest volumes harvested, and supporting the development of landowner cooperatives may help to achieve this goal.

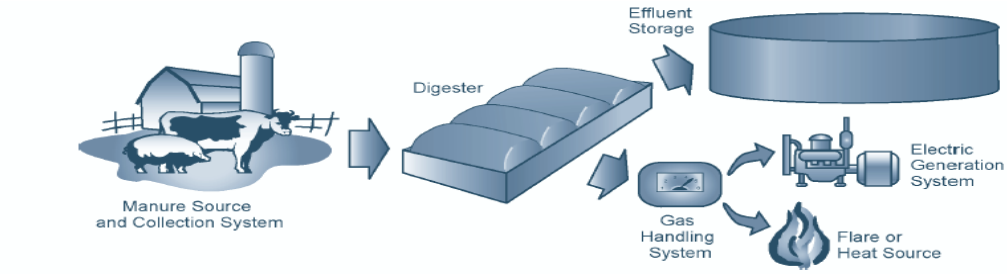
STRATEGY X —SUPPORT THE SUSTAINABLE DEVELOPMENT OF BIOMASS ELECTRIC GENERATION IN VERMONT

ANAEROBIC DIGESTERS

Vermont draws social and economic benefits from its working agricultural sector. Yet dairy farming in Vermont continues to operate under increasing economic stress. Each year the amount of land dedicated to farming in the state decreases.* Capitalizing on energy resources on farms can help the bottom line of Vermont's farms. For example, through the efforts of the PSD, the Vermont Agency of Agriculture, and the USDA, farmers are beginning to appreciate manure as an energy resource.

Methane from manure can be produced through a process called anaerobic digestion. Through this technology, not only are the pollutants and odors resulting from traditional manure management techniques reduced, but also the methane emissions are trapped and used for energy. An additional benefit is that the nutrients in the manure become easier to manage, leading to less groundwater contamination. Anaerobic digestion is the degradation of organic matter including manure, brought about through the action of microorganisms in the absence of elemental oxygen. The resulting product of this digestion is biogas, the principle constituents of which are carbon dioxide and methane.† Methane gas can be combusted directly for heat and/or used to fuel an engine to generate electric power. *Figure VII-7 Biogas Recovery Systems* below is a simplified diagram of the process. An additional by-product of the process is the remaining undigested solids. This sterile material can be used as bedding material for the cows, replacing the need for sawdust.

Figure VII-7 Biogas Recovery Systems



Source: EPA

The environmental benefits to processing manure into fuel include both cleaner air and cleaner water. While manure is traditionally sluiced off to lagoons where it produces methane that escapes into the air, biogas systems capture and utilize methane. The greenhouse gas value of methane in the atmosphere is 21 times that of carbon dioxide, so biogas recovery systems significantly reduce overall greenhouse gas emissions. Furthermore, because the manure that is used in the biogas plant is not washed off or leached through land surfaces by rain and irrigation into local rivers and streams, local watersheds remain cleaner.

The DPS and Vermont Agency of Agriculture recognize the role of anaerobic digestion systems and have taken the lead in helping farmers achieve manure management goals, decreasing their

* The 2002 Census of Vermont agriculture reports that between 1974 and 2002 the number of acres dedicated to farming went from 1,667,561 to 1,244,909.
† For dairy operations, 57.5% of biogas volume is assumed to be methane.

energy requirements and providing a source of additional income. Incentives for farm biogas production facilities are available in Vermont through programs like CVPS's "Cow Power," GMP's "Greener GMP," the state's Clean Energy Development Fund, the Vermont Economic Development Authority, and the USDA. *Table VII-6 Anaerobic Digesters in Vermont* contains additional information on the status of anaerobic digesters in Vermont

Vermont DPS Estimation of Vermont's Biogas Potential

According to the USDA 2002 Census, Vermont had 2,680 dairy farms and a total of 283,619 cows.[21] Each lactating cow produces around 106 pounds of manure daily.[22] That amounts to 5.5 million tons of manure annually. Of the 5.5 million tons, only about 40% is cost effective to use, as it is not presently economical for farms with fewer than 300 cows because of capital costs. Transporting the manure to a central processing site is generally precluded due to added trucking costs. This economic constraint limits the potential for farms with herds greater than 300 cows, reducing the available cow population to approximately 120,300 (see *Figure VII-8 Capital Investment per kWh vs. Herd Size* $ Cap Investment).

Table VII-5 Estimates of Biogas, Methane and Energy Production Per Lactating Vermont Cow

Biogas ft^3/year	Methane ft^3/year	BTU mmBtu /year	Biogas Electricity Generation kWh/year
27,530	15,830	14.6	1,284

On the basis of a herd size of 500 lactating cows, confined to a barn 24 hours a day, AgSTAR FarmWare 3.0* calculates each herd has the potential to produce biogas with a heat content of 7,305 mmBtu annually. When used to generate electricity, this translates to the capacity to generate 642,145 kWh annually using a 30-kW generator. Extrapolating these numbers to 240 similar herds could yield an aggregate statewide potential of 1,758,645 mmBtu annually and a potential theoretical capacity of 18.5 MW.

In actual farming practice, yields would be considerably lower. First, not all of the cows would be lactating; a good proportion would be dry and pastured, reducing manure recovery. Second, it is unrealistic to assume that all farms are suitable or capable of participation. A real world best-case scenario would be to strive to cost effectively capture 10–15% of the theoretical potential yield, a goal of in the range of **175,864–263,796 mmBTU and 1.8–2.4 MW of generating capacity**. The net environmental benefits would be the prevention of **1,555 tons of methane**

* The AgSTAR Program is a voluntary effort jointly sponsored by the U.S. Environmental Protection Agency, the U.S. Department of Agriculture, and the U.S. Department of Energy. The program encourages the use of biogas capture and utilization at animal feeding operations that manage manures as liquids and slurries. A biogas system reduces emissions of methane, a greenhouse gas, while achieving other environmental benefits. In addition, converting livestock wastes into an energy source may increase net farm income. AgSTAR FarmWare 3.0 is a computerized decision support program that assesses whether or not a methane production, capture, and utilization system can be integrated into your farm's existing or planned manure management system. FarmWare estimates how much the system will cost and the financial benefits that may be gained by producing energy for on-farm use or sale or both. Data and assumption contained in the model are based on over 100 digesters in operation throughout the U.S.. Available at: http://www.epa.gov/agstar/resources/handbook.html#farmware

entering the atmosphere and a **45% reduction of total Nitrogen** from influent entering Vermont's waterways.

Figure VII-8 Capital Investment per kWh vs. Herd Size

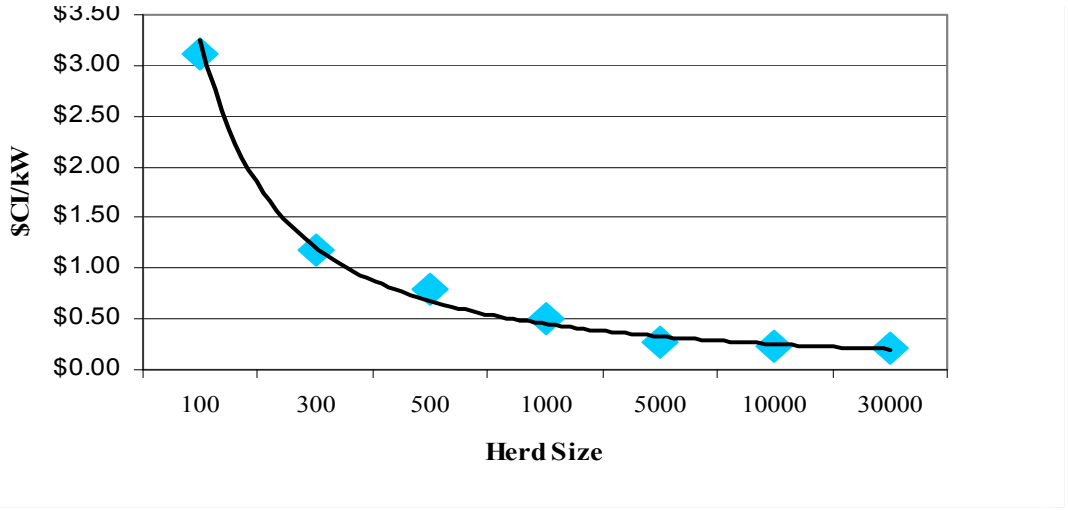


Table VII-6 Anaerobic Digesters in Vermont[23]

Montagne Farm	Green Mountain Dairy, LLC	Pleasant Valley Farms - Berkshire Cow Power, LLC	Foster Brothers Farms	Blue Spruce Farm, Inc.
Blue Spruce Farm, Inc.	Sheldon	Berkshire	Middlebury	Bridport
Bridport				
Franklin	Frankin	Franklin	Addison	Addison
VT	VT	VT	VT	VT
Horizontal Plug Flow	Horizontal Plug Flow	Horizontal Plug Flow	Horizontal Plug Flow	Horizontal Plug Flow
Construction	Startup	Steady State	Steady State	Steady State
2007	2007	2007	1982	2005
Dairy	Dairy	Dairy	Dairy	Dairy
1,200	1,050	1,950	340	1,100
Cogeneration	Cogeneration	Cogeneration		Cogeneration; Boiler/Furnace Fuel
300	300	600	85	240
GHD, Inc.	GHD, Inc.	GHD, Inc.	Hadley and Bennett	GHD, Inc.
Storage Tank or Pond or Pit	Storage Tank or Pond or Pit	Storage Tank or Pond or Pit	Storage Tank or Pond or Pit	Storage Tank or Pond or Pit
	64	119	21	67
	1,345	2,498	436	1,409

Mixed-substrate Anaerobic Digesters.

In addition to anaerobic digesters that use only manure as an input, the so-called "mixed-substrate" anaerobic digesters can utilize as inputs various livestock manures, crops directly harvested or stored as silage, food scraps, and many other food-processing wastes or agricultural waste products. The biogas yields per ton of crops or food wastes are much higher than that of cow manure (for example, grass silage, corn silage, and food scraps yield approximately 8 times that of cow manure, and waste grease and baking wastes can yield as much as 25 times that of cow manure).

The mixed-substrate digesters require cow manure as a source of methane-producing bacteria at start-up, but can then theoretically run without additional cow manure. This technology is relatively new to the United States, but is mature (decades old) in Europe, which has several thousand operating systems with generating capacities ranging from approximately 20 kW to several MW. One farm in Vermont has received approval from the Public Service Board to construct a 630-kW mixed-substrate anaerobic digester, but, as of this writing, has not yet started construction of the project.

Mixed-substrate digesters offer a new flexibility because their generating capacity and economic feasibility are not solely dependent upon the number of cows on the farm, but rather on the number of tons of crops or food waste that are available. Thus, a farm that has only a small number of cows (or no cows at all), but owns or has access to cropland, could install a mixed-substrate anaerobic digester. Presently, anaerobic digester systems that can generate a few hundred kW or more are economically feasible in Vermont, but systems below approximately 200 kW are not economically feasible in Vermont. However, from a technological standpoint, any size system is feasible. The Department of Public Service should continue working with the Agency of Agriculture, Food and Markets to identify the economic barriers to installing smaller anaerobic digesters, and should also work towards attempting to make smaller systems economically feasible.

Recommendation 57 Continue to support the development of anaerobic digester electric generation facilities.

Timing	NEAR-TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	--
Cost Effectiveness	--
Funding Sources	--
Relation to GCCC	AFW-3, Manure Management Methods to Achieve GHG Benefits
Current Status	Ongoing
Parties Involved	PSD, electric utilities, Independent Power Producers, VT Agency of Agriculture

a) *Vermont state agencies and electric utilities should continue to support development of biogas recovery systems through incentives programs.*
b) *As resources permit, the DPS and Agency of Agriculture and Vermont utilities should conduct a study to identify geographic areas in which centrally located digesters might be economically feasible to operate.*
c) *The Vermont DPS and PSB should support utility efforts to establish voluntary renewable pricing programs for farm-generated renewables.*
d) *The DPS and Agency of Agriculture should collaborate to develop cost-effective small-scale farm methane systems.*

BIOFUELS IN ELECTRIC GENERATION

Biofuels have great potential to serve Vermont's peak electrical demands. Several utilities in Vermont own their own diesel generation that is operated during peak periods. Some of these facilities produce power with diesel engines, similar to the ones that exist in cars. Vermont utilities are already beginning to use biofuel blends in their diesel generating facilities. For example, GMP has started to use a B5 blend in some of its peaking facilities and other utilities have initiated efforts to incorporate biofuels into their diesel supply. In addition, the Village of Swanton has proposed to build a natural gas peaking unit that is also capable of burning biodiesel. There are, however, barriers to using biodiesel in some facilities. One problem is that certain diesel units do not have combustion engines and instead utilize complex jet turbines. The safe use of biodiesel in these facilities has not yet been evaluated. Similarly, the use of biodiesel in facilities with cogeneration has also not been evaluated and it is likely that using biofuels in these systems would require costly upgrades.

Recommendation 58 Encourage the use of biofuels in Vermont's diesel peaking generators.

Timing	NEAR-TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	--
Cost Effectiveness	--
Funding Sources	--
Relation to GCCC	AFW-12, In-State Liquid Biofuels Production
Current Status	Starting
Parties Involved	PSD, PSB, NEPOOL GIS, electric utilities, fuel dealers

a) *Vermont utilities should evaluate which blends of biodiesel can be used in electric generation systems.*
b) *Vermont utilities should use biodiesel blends where cost effective and reliable.*
c) *Vermont utilities should explore opportunities to fund additional fuel/facility improvements through green pricing programs or relying on the CEDF.*

WOOD ELECTRIC POWER

Wood and wood waste electric energy generation account for 5.5 trillion BTU or 317,465 MWh of electrical energy, 3% of total energy consumed in Vermont in 2004.[26] Consuming wood to generate electricity has many benefits, including greater reliability through dependence on local resources, utilizing an affordable and plentiful resource for in-state generation, providing a constant demand for by-products of wood processing, and stabilizing energy costs. There are challenges, however, for wood electric generation in the future.

While the overall net carbon emissions of wood combustion are minimal, localized emissions of NO_x and CH_4 rise relative to fossil fuel alternatives. Furthermore, movement of wood is possible only through rail or truck transport. An additional power generation facility would likely need to be located next to a major open transportation network, such as a railway. Not only would this limit the location options to areas farther from main load centers, but also it might require a significant upgrade to the current transportation system to meet reliability needs (see *Strategy S Better Use and Efficiency of Vermont's Rail Networks*).

Table VII-9 Emissions from Biomass Electric Generation*[27]

CO_2 (Lbs/MWh)	**NO_x** (Lbs/MWh)	**CH_4** (Lbs/MWh)
3,400**	0.55	0.14

* Average emissions. Emissions vary on the basis of the type of Biomass and the type of generator used. Biomass combustion also releases a small amount of sulfur dioxide.
** Because biomass sequesters carbon during its growing cycle, combustion of the resource is considered to have no net increase in carbon emissions.

Vermont's Two Wood Electric Generation Facilities:

- Burlington's 53-MW McNeil Station was the first in-state wood-fired generator, providing a market for low-grade wood and insulation from oil price volatility, and creating jobs and economic benefits throughout the state. McNeil does not operate as a base-load facility as was envisioned; instead it operates at a 50–60% capacity due to wood supply and emissions permitting issues. At McNeil it takes 1.45 tons of wood to produce 1 MWh.[28] In 2006 with wood chip prices of $31.92/ton, the cost of wood-generated electricity per MWh was $46.28. With other variables for operation (ash, rail, yard, maintenance) adding $6.31/ton, the cost per MWh dispatched was $52.59.

- The Ryegate wood-fired generation plant came online in 1992 with a nameplate capacity of 20 MW. It is the only independent power producer that sells through the VT purchasing agent and is not a hydroelectric facility. The plant burns 250,000 tons of wood per year.[29]

Table VII-10 Ryegate - Wholesale rate $/kWh[30]

1996	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*
0.1083	0.1118	0.1152	0.1180	0.1238	0.1265	0.1272	0.1343	0.1416
2005	2006	2007	2008	2009	2010	2011	2012	2013
0.1430	0.1534	0.1632	0.1738	0.1760	0.1782	0.1806	0.1832	K ends

A review of an application for a 25-MW wood-burning plant in Ludlow is currently ongoing. If approved, plans call for operation to commence in the beginning of 2009. The plant would burn approximately 300,000 wet tons of wood per year, 75% of which would be transported by rail. Four southern counties in VT were studied and it was concluded that two to three times the amount of wood is available for sustainable harvest than what is currently being used in the area.[31] The proposed Ludlow plant is expected to cost approximately $45 million.[32] The

projected economic benefits of a 20-MW wood-fired plant include approximately 20 permanent jobs, approximately 150 jobs during construction, and 50–100 jobs associated with wood transportation and procurement.[33]

Wood **combined heat and power** also represents a significant potential energy resource in Vermont. Recently, the DPS secured a Department of Energy (DOE) grant to fund development of industrial biomass cogeneration projects, and the DPS, FPR, and the Department of Economic Development (DED) have been working intensively with several Vermont businesses to develop specific proposals.

In addition, the DPS also secured a major DOE grant to promote development of biomass cogeneration at Vermont ski areas. This grant has allowed the DPS, FPR, and the DED to continue working with Smuggler's Notch ski area on a project that could be up to 2 MW in size. As with all of the wood-fired cogeneration opportunities, the business stands to save a significant amount on energy costs, thereby improving their competitiveness.

The **Vermont Gasification Project (VGP)**, located at the McNeil Plant in Burlington, is currently one of the world's largest wood-fired power stations. The DPS and Burlington Electric Department (BED) have cooperated on this project for years. The DPS has helped with grant writing and administration, bringing substantial DOE research and development investment to Burlington to help demonstrate a biomass gasification process invented by Battelle.

The McNeil station was uniquely qualified to be the host of this demonstration project. If successful, the VGP could nearly double the efficiency of biomass-fueled generation technology. It will have applicability nationally and worldwide. The DPS continues in its commitment to support this important research, development, and demonstration project.

Recommendation 59 Foster the development of wood-fired electric generation facilities in Vermont and New England.

Timing	NEAR-TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	--
Cost Effectiveness	--
Funding Sources	--
Relation to GCCC	AFW-6, Increased Forest Biomass Energy Use
Current Status	Ongoing
Parties Involved	PSD, ANR, NGOs, electric utilities, local governments, electric generation companies, wood suppliers

Recommendations:

a) Vermont agencies, utilities, and community groups should support wood electric generation and co-generation projects deemed to be beneficial to the welfare of VT.

b) ANR should evaluate and consider pre-approving wood electric generation sites around the state to encourage more private entities to consider locating in Vermont.

ENDNOTES

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[20] U.S. DOE (2007), Fuel Ethanol Production. http://genomicsgtl.energy.gov/biofuels/ethanolproduction.shtml.
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[23] http://www.epa.gov/agstar/pdf/operational_all.xls.
[24] http://www.epa.gov/agstar/pdf/operational_all.xls.
[25] http://www.epa.gov/agstar/pdf/operational_all.xls.
[26] EIA and DPS information, see "Utility Facts" 2006.
[27] U.S. DOE: *Sector-Specific Issues and Reporting Methodologies Supporting the General Guidelines for the Voluntary Reporting of Greenhouse Gases under Section 1605(b) of the Energy Policy Act of 1992.* Appendix Tables. www.eia.doe.gov/oiaf/1605/guidelns.html.
[28] BED Rate Case, filed March 16, 2006—Cost projections through April 2007.
[29] Narrative from VT Electric plan, 2005.
[30] From DPS files.
[31] DPS meeting with DOB, Sarah H., Dave Lamont, Kevin Elliss, and Bill Behling 3/15/06.
[32] "Company Plans Wood Chip Plant," Times-Argus, July 10, 2005.
[33] As estimated by Access Energy, for the proposed Ludlow power plant "Company Plans Wood Chip Plant," Times-Argus, July 10, 2005, and www.accessenergy.net.

SECTION VIII STATE GOVERNMENT ENERGY USE

REDUCE ENERGY USE AND EMISSIONS OF STATE GOVERNMENT OPERATIONS

Vermont state government provides services for the public ranging from human services to road maintenance and beyond, delivered by operations that use a significant amount of energy. In fiscal year 2006, state government operations consumed 1,617,231 MMBtu, or approximately 1% of the state's total energy consumption. The energy used cost nearly $24 million and emitted over 126,000 tons (~1.3% of total state emissions) of carbon dioxide equivalent (CO_2e). The energy was consumed in infrastructure owned and leased by the state, in the appliances and machinery used in and around that infrastructure, and in work vehicles and the transportation of employees on state business. Roughly another 398,700 MMBtu was consumed by state employees commuting to work. The state has the opportunity and responsibility to lead by example by reducing energy use and accompanying costs and emissions. Policymakers have recognized this fundamental duty, and there is a long history of policy related to reducing the state's operational energy needs.

In 2001, the Conference of New England Governors and Eastern Canadian Premiers (NEG/ECP) adopted a *Climate Change Action Plan*. This resulted in the issuance of executive orders creating the Vermont Climate Neutral Working Group ("CNWG") and establishing specific and aggressive greenhouse gas reduction goals. The intent of the CNWG is to "provide a clear summary of the ongoing energy consumption and greenhouse gas emissions inventory" of state operations, and provide emissions reduction strategies and case studies. The CNWG adopted the goals of the NEG/ECP Climate Change Action Plan—to reduce greenhouse gas emissions from a 1990 baseline by 25% by 2012, 50% by 2028, and 75% (if practicable) by 2050.[1] Two biennial reports have been released detailing recommendations and next steps for state government operations.

Before the CNWG came into existence, Act 259 of the Acts of 1992 resulted in the first *State Agency Energy Plan for State Government* ("SAEP") released in May of 1993. Over the dozen years that followed its release, the plan was used with varying degrees of success. Energy baselines or savings had never been tracked; measurements of success or failure never documented. In 2003 the Department of Buildings and General Services was required by the governor to create the *Comprehensive Environmental and Resource Management Program* (CERMP), intended to advance the "sustainability of state government."[2] Specific strategies were outlined and guidance was given to address energy resource consumption issues in building infrastructure development (including existing infrastructure), state purchasing, and contract administration, and transportation—including both state fleet and employee personal vehicle commuter use. The CERMP initiated statutory changes that resulted in revision of the SAEP in 2005. The 2005 SAEP aims to use energy more efficiently and also promotes resource conservation and pollution reduction measures. Specific goals are set in the plan to reduce energy use by 20% in building infrastructure and 10% in state transportation, with an overall

goal for statewide energy reductions of 15% by 2012, from the base year 2004. Tracking and measurement guidelines were offered, and policy recommendations were made.[3] The SAEP is now required by statute to be updated every 5 years. In the future, it is recommended that the CERMP become a part of the Climate Neutral Working Group biennial report, with the purpose of informing and recommending policy for the State Agency Energy Plan.

Ambitious, attainable goals have been set in the SAEP to reduce the impact of state government operations. To meet these goals, state agencies and employees will need to put significant effort into implementing the policies and actions outlined in this Energy Plan. Reductions in consumption will need to come from both the building infrastructure and transportation sectors. Currently, building infrastructure accounts for approximately 64% of state operations energy consumption; the other 36% comes from transportation related consumption—work-related mobility needs and non-passenger transportation needs such as highway maintenance and plowing.[*] (See *Table VIII-1 State Operations Energy Usage*).

Table VIII-1 State Operations Energy Usage

	Buildings		*Transportation*		*Total*
Total Expenditure	$12,543,356	52.3%	$11,438,835	47.7%	$23,982,192
Total MMBtus	1,038,025	64.2%	579,206	35.8%	1,617,231
Total GHG (tons CO_2 equivalent)	80,935	63.9%	45,688	36.1%	126,623

To make these significant reductions, the state has at its disposal the resource management revolving fund. The 2004 session of the General Assembly established this fund to be used for financing resource conservation measures that will generate a life-cycle cost benefit to the state. Resource conservation measures include, but are not limited to, equipment replacement, studies, weatherization, and the construction of improvements affecting the use of energy resources.[4] Using this fund, the Agency of Transportation (VTrans) is currently in the process of upgrading all of their garages with more efficient lighting. Increasing the capped limit for the revolving fund could allow more agencies to take advantage and invest in efficiency improvements.

While state operations are implicated in many of the policy recommendations throughout this Plan, further strategies and policy recommendations are presented below that will enable the state to reach its goals and to continue to set an example for businesses and residents. The State Agency Energy Plan and the Climate Neutral Working Group provide mechanisms to implement these policies; this section of the Energy Plan is not intended to duplicate those efforts—it is intended to continue to elevate the issues and opportunities within state government to ensure efficient operations in all areas. Similarly, the Governor's Commission on Climate Change

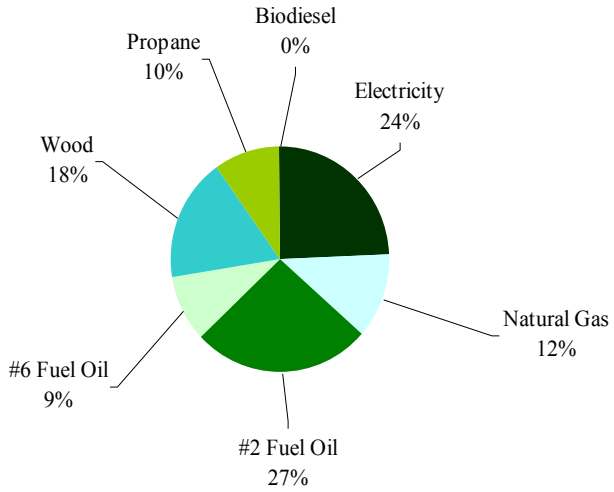
[*] This data does not include the employee commute.

(GCCC) noted that the mechanisms above should be leveraged to reach Vermont's aggressive goals.* Strategy Y immediately below summarizes the policy recommendations in this section.

STRATEGY Y INCREASE THE EFFICIENCY AND REDUCE FOSSIL FUEL CONSUMPTION FROM STATE GOVERNMENT BUILDING INFRASTRUCTURE

The State of Vermont owns, operates, and maintains over 7,000,000 square feet of building infrastructure. The space used by the state currently increases by approximately 100,000 square feet per year. The energy used to heat and power this space accounts for about 64% of the state government's operational energy consumption, 52% of the government's energy expenditures, and over 63% of its greenhouse gas emissions. Of this infrastructure usage, fuel oil accounts for 27%, electricity accounts for 24%, and other fuels (natural gas, propane, kerosene, and wood) account for 49%. Biodiesel accounted for less than 1%. Although electricity accounts for only one-quarter of usage (on a BTU basis), it accounted for 56% of expenditures—fuel oil accounted for 16% and wood 4%. (*See Figure VIII-1 Vermont State Building Fuel Supplied 2006* and *Figure VIII-1 Vermont State Building Fuel Supplied 2006*).

Figure VIII-1 Vermont State Building Fuel Supplied 2006



There are 8 agencies or departments that combined, have jurisdiction over most of the state's buildings; each of these agencies is required by the 2005 SAEP to develop specific Agency Implementation Plans as part of the State Agency Energy Plan.† The Agencies are in various stages of implementing these plans. Significant opportunity exists to reduce the state's energy consumption in building infrastructure and Agency Implementation Plans should provide a clear path to acquire energy savings.

BUILDING EFFICIENCY

Over the last two decades the state has achieved significant reductions in the amount of energy used in its building infrastructure. In 1990, state buildings used an average of approximately 127 BTU per square foot. In 2004, average energy consumption in state buildings was measured to

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* The GCCC addressed "the State's Own GHG Emissions" in cross-cutting policy #7. Specific recommendations in this section of the Comprehensive Energy Plan will all refer to this section.

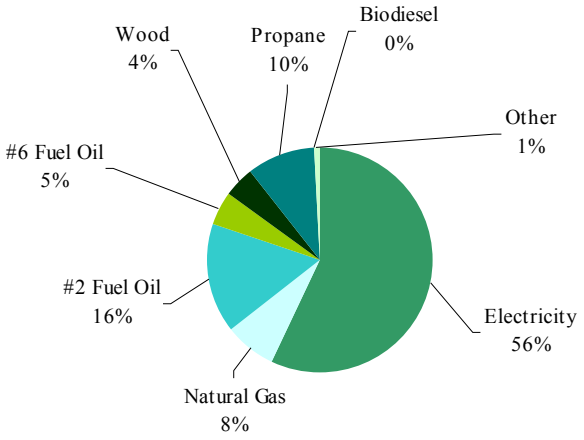
† Buildings and General Services owns or leases nearly 50% of the State's square footage. The other agencies to own space include the Agency of Transportation (17%), Department of Corrections (10%), Forests, Parks and Recreation (9%), Office of the Adjutant General (7%), Vermont Veterans Home (3%), the Division for Historic Preservation (2%), the Department of Labor (1%), and miscellaneous others (4%).

be 118 BTU per square foot. While this reduction in energy consumed is not insignificant, the goals set in the 2005 SAEP are to reduce the average energy consumption to 102 BTU per square foot. Opportunities exist to continue increasing the efficiency of state-owned and leased buildings to meet the goals of the 2005 SAEP.

Ideally, all state buildings would be efficient enough to receive an EPA ENERGY STAR™ rating of at least seventy-five.* To achieve this rating, buildings would have to consume only 68 MMbtu per square foot per year. The SAEP requires all new state offices to meet or exceed this Energy Star rating, meaning that they will be performing better than 75% of the buildings of their type in the U.S. Any new state buildings meeting this goal will save energy to the extent that they displace older, less efficient buildings. However, the state often operates out of existing, older buildings that likely cannot be upgraded enough to meet the Energy Star standard.

In these older buildings, updating the energy consumption baselines to measure progress toward the SAEP goals will determine the level of investment necessary to meet those goals. To this end, VTrans and BGS are already installing meters to improve tracking of energy use. The other agencies that operate buildings should follow suit in order to capture cost-effective efficiency opportunities. Further, comprehensive energy audits for each building operated by the state can identify cost-effective energy efficiency measures that can be taken to reach the SAEP goals.

Figure VIII-2 Vermont State Building Fuel Expenditures 2006



Despite ambitious goals, state government investment in efficiency improvements can often be delayed or worse due to a lack of appropriated capital. An attractive method to remove this barrier is by "performance contracting," where a building owner (in this case the state) can make needed improvements with little up-front investment by using the energy cost savings of new equipment to pay for the cost of the equipment. Generally, an energy service company (ESCO) is paid based on the performance of equipment it installs. Contracts can be arranged in a number of ways, varying the amount of risk placed on each party. A negotiated contract would allow the state to assume the proper amount of risk for the situation, and ensure the most energy and cost savings in buildings.

For a broad discussion of efficiency opportunities and implementation mechanisms that go beyond state operations, see Section V. Benchmark efficiency levels of all state operated

* The ENERGY STAR™ program scores commercial and industrial facilities on a 1-100 scale, and facilities that achieve a score of 75 or higher are eligible for the ENERGY STAR™ rating, indicating that they are among the top 25% of facilities in the country for energy performance.

buildings—identify and acquire cost-effective efficiency opportunities through performance contracting and other efficiency investment.

a) *BGS should benchmark efficiency levels (electric and other fuels) for each building owned and/or operated by the State by completing a comprehensive energy audit.*
b) *BGS should evaluate and if practicable, enter into a performance contract for energy services to increase the efficiency of the State's building infrastructure.*
c) *State Agencies should continue to leverage the State Resource Management Revolving Fund to make cost-effective investments in energy efficiency.*
d) *BGS and the Climate Neutral Working Group should assess the cost-effective potential for the State to increase the use of renewable energy for its Building infrastructure.*

RENEWABLE ENERGY OPPORTUNITIES

As noted in *Figure VIII-1*, fuel oil, natural gas, propane, and kerosene account for approximately 58% of energy consumed in state-owned and leased buildings, while wood resources account for 16%. However, the State's energy expenditure for wood totaled only 4% of all spending on infrastructure energy needs. As a fuel, sustainably harvested wood energy products (as described in 0), are carbon neutral local resources that have both economically and environmentally positive attributes. Two of the largest state complexes—in Montpelier and Waterbury—use wood chips as a source of fuel for their centralized heat plants. Other locations include the Pittsford Training Academy, the Newport State Office Building, and Mahady Courthouse. Two correctional facilities and a work camp also use wood chunk as a source of fuel. Where cost-effective in the long term, state buildings should be fueled by sustainably harvested, in-state wood resources.

The state can also use biodiesel in its heating operations to reduce consumption of distillate diesel fuel (A discussion of biodiesel emissions characteristics can be found in 0). The state has been using B20 at the Brattleboro State Office Building since 2004. Existing opportunities to expand the use of low blends of biofuels in state buildings should be evaluated.

Recommendation 60 Evaluate the further purchase and use of renewable fuels to heat and power State Government buildings.

Timing	NEAR/LONG TERM
Emissions Impact	--
Energy Impact	--
Capital Cost	--
Cost Effectiveness	HIGH
Funding Sources	ESCOs, shared savings
Relation to GCCC	Addressed broadly in CC-7
Current Status	Ongoing

Parties Involved	BGS, Climate Neutral Working Group

STRATEGY Z REDUCE PETROLEUM FUELS CONSUMPTION FROM STATE GOVERNMENT TRANSPORTATION NEEDS

State government transportation energy use can be divided into two parts. The first includes state-owned vehicles and employee-owned vehicles used for State business—the State fleet. The State fleet consumes 579,206 MMBtu of energy, resulting in expenditures of over $11.4 million and over 45,000 tons of greenhouse gas emissions. The second part of State government transportation energy needs involves State employees' use of their personal vehicles to commute to and from the work site. State employees travel an estimated 33 miles to work roundtrip and consume approximately 400,000 MMBtu of energy in the process.[5] There are no direct costs to the state for commuting; however, the large State workforce creates opportunities to reduce the amount of commuting miles traveled and energy consumed.

FLEET VEHICLES

The state transportation fleet includes state-owned passenger cars, light- and heavy-duty trucks, and on-and-off-road vehicles and equipment. The Department of Buildings and General Services (BGS) manages the passenger fleet and light-duty trucks (with the exception of the state police and other public safety entities), while VTrans has jurisdiction over most of the state's heavy-duty trucks and equipment. The Secretary of Administration and all agency heads control how the vehicles are used on the job, including setting policies and educating managers and staff about the importance of saving energy in the transportation sector. The state fleet also includes the use of employee owned vehicles for state business. When employees use their personal vehicles for state business, they are reimbursed a per-mile rate based on federal accounting of costs associated with owning a vehicle. Due to the high cost of this program, BGS set up a state-owned passenger car fleet. When a car is available, employees are required to use a vehicle from the state fleet rather than using their personal vehicle for trips over a certain distance. In addition to reducing reimbursement payments, state-owned fleet passenger vehicles are typically high efficiency. The program has the effect of reducing overall fuel consumption from what would otherwise be needed.

Vehicles purchased for the state fleet are chosen for their ability to obtain the greatest level of efficiency, while meeting the needs of users. Input from the leasing agency on what type of work will be expected from the vehicle is taken into consideration during the purchase. Currently, the State fleet supports 30 hybrids and 69 partial zero emissions vehicles (PZEV).* The passenger vehicle fleet is powered by gasoline, while the heavy-duty fleet generally uses diesel fuel. A significant amount B5 (5% biodiesel blended diesel) is used in heavy-duty trucks and in some of the lawn tractors around the state. As plug-in hybrid vehicles become commercially available, the State will have an opportunity to purchase vehicles that rely even

* PZEV is a designation used to describe vehicle type under the Vermont low emission vehicle (LEV) standards. For more information on LEV, please see the **Low Emission Vehicle Program** section under **Strategy M: Regulatory Policy**.

less on petroleum. By continuing to follow purchasing guidelines and using alternative fuel where feasible, Vermont's state fleet can lead by example to reduce petroleum consumption.

Last but certainly not least, state employees can reduce petroleum consumption by completing work more efficiently and driving less. Vermont has state-of-the-art video and online conferencing capabilities that are not fully utilized by employees. Information and training for employees can both raise awareness of teleconferencing capabilities and ease concerns about perceived ineffectiveness of such meetings. These capabilities allow employee trips for in-person meetings to be reduced, saving time and energy.

Recommendation 61 Continue to reduce State fleet petroleum consumption.

Timing	NEAR-TERM
Influence	STATE
Energy Impact	--
Capital Cost	--
Cost Effectiveness	HIGH
Funding Sources	Vermont Taxpayers
Relation to GCCC	Addressed broadly in CC-7
Current Status	Ongoing
Parties Involved	BGS, AOT, DII, Climate Neutral Working Group

a) *Continue current practices of purchasing vehicles that have the highest available fuel efficiency in its respective vehicle class.*
b) *Purchase plug-in hybrid vehicles as they become available commercially (Recommendation 39).*
c) *Expand current program for fueling State heavy-duty vehicles with B5 or greater blend of biodiesel (Recommendation 61).*
d) *Department of Information and Innovation should comprehensively train all state employees to use video and teleconferencing capabilities.*

STATE EMPLOYEE COMMUTING

The average home-to-work roundtrip commute for all Vermont State employees is approximately 33 miles. In 2007, the Climate Neutral Working Group analyzed the State employee commute and the results supported the expectation that the majority of state-vehicle miles traveled center around the state offices in Waterbury and Montpelier. The CNWG recommended that the state work with the Green Mountain Transit Agency (GMTA), who operates bus routes in Washington County, to increase the efficiency of the state's commuter trips to these two offices. In addition, the CNWG recommended investigating the possibility of an Unlimited Access program with GMTA in order to increase ridership levels. An Unlimited Access Program operates a transit service for an organization in exchange for a lump sum yearly payment from that organization. To use the bus, employees would simply show their state identification card rather than paying out of pocket. The Chittenden County Transportation Authority (CCTA) has successfully run a similar program with the University of Vermont for years, resulting in significant ridership and

energy and emissions reduction. This Plan supports the Unlimited Access initiative; the State should continue to seek opportunities to reduce energy use from employee commuter miles through the CNWG.

Agencies should also coordinate to use extra office space in order to allow those who commute, to work from a "satellite" state office, when duties permit. For example, someone who lives in Waterbury but travels to work every day to Burlington could use an extra office space in the Waterbury complex on occasions when their duties do not demand that they be in the main office. Using the "satellite office" concept instead of a telecommuting program keeps employees in State offices, for insurance purposes, but reduces the need for unnecessary travel.

Recommendation 62 Encourage state government employees to commute efficiently.

Timing	NEAR-TERM
Emissions Impact	LOW
Energy Impact	LOW
Capital Cost	LOW
Cost Effectiveness	HIGH
Funding Sources	--
Relation to GCCC	Addressed broadly in CC-7
Current Status	Ongoing
Parties Involved	BGS

a) *The Climate Neutral Working Group should continue to work with GMTA and CCTA to develop an Unlimited Access program and other programs that will remove barriers to State employee use of public transit.*
b) *The Climate Neutral Working group should continue to investigate creating availability of "satellite offices" where the employee does not need to make their entire trip to employer's office.*

It is clear that Vermont State Government Operations have made much progress in reducing the State's need for energy and its dependence on petroleum. Mechanisms are in place through the State Agency Energy Plan and the Climate Neutral Working Group to track energy savings and coordinate agencies' efficiency improvements for both building infrastructure and transportation needs. However, more opportunity exists; State agencies and departments should make every effort to achieve the most efficient operations feasible for the benefit of affordable, reliable, and environmentally sound energy.

ENDNOTES

[1] First Biennial Report of the Climate Neutral Working Group, 2005, and Second Biennial Report of the Climate Neutral Working Group, 2007. The second report is available at http://www.anr.state.vt.us/air/Planning/docs/CNWG%202nd%20%20Biennial%20Report%204-2007.pdf
[2] Comprehensive Environmental & Resource Management Program, 2004. Available at http://www.bgs.state.vt.us/pdf/CERMP.pdf
[3] Vermont State Agency Energy Plan for State Government, Department of Buildings and General Services, July 2005. Available at http://www.bgs.vermont.gov/pdf/VTStateEnergyPlan.pdf
[4] 29 VSA § 168(b)
[5] Second Biennial Report of the Climate Neutral Working Group, 2007.

SECTION IX CROSS CUTTING ISSUES

BACKGROUND

The Governor's Commission on Climate Change identified six issues of cross-cutting concern related to Vermont's role in addressing climate change, covering establishment of a sound inventory and program for registering GHG emission, the development of adaptation plans, and improving the opportunities for public and stakeholder engagement on GHG issues.

STRATEGY AA SUPPORT THE DEVELOPMENT OF A STRONG AND BROAD-BASED GHG REGISTRY AND INFORMATION SYSTEM

GHG INVENTORIES AND FORECASTS

Greenhouse Gas inventories are necessary to guide policy and leadership on energy issues. As noted in the report of the Governor's Commission on Climate Change, primary responsibility for the creation of GHG inventories and forecasts will need to reside with the Department of Environmental Conservation (DEC). The DEC has the expertise needed to compile information on GHG sources, using federal guidelines to ensure consistency with neighboring states and allowing for cross-state and national comparisons. The DEC's role will, however, require assistance from sister agencies. On energy issues, the Department of Public Service will need to support the DEC's efforts, especially in relation to the State's contribution to its emissions profile from electricity, which seldom lies within its borders. Accounting for and analysis of energy-related issues and associated GHG emissions is a matter of ongoing concern.
This Comprehensive Energy Plan provides estimates and forecasts of energy-related GHG emissions. Due to regional commitments, the DEC should periodically update the inventories consistent with the work of the New England Governors/Eastern Canadian Premiers under the Climate Change Action Plan.

Recommendation 63—The Department of Environmental Conservation should coordinate with the Department of Public Service in periodically updating the State's GHG inventories to include energy-related emissions.

STATE GHG REPORTING

Greenhouse Gas reporting is the measurement and reporting of emissions by sources to support the tracking and management of emissions. Reporting efforts will support early preparation for potential future GHG reduction requirements. GHG reporting will also improve the development of inventories and serves as a preliminary stage to the development and implementation of a full GHG reduction registry. Cooperation with neighboring states will help foster consistent treatment across states and nationally will engender consistency and reciprocity.

Recommendation 64—The DEC should work with the Department and regional and national energy-related organizations to promote regional protocols or common measurement and reporting of energy-related GHG emissions.

STATE GHG REGISTRY

Measuring greenhouse gas emissions* is an important step toward the quantification of baseline emissions. Policies to reduce greenhouse gases must rely on a system to collect emissions data from facilities, such as power plants, factories, and refineries, so we know how much they emit and can track progress as they reduce their emissions. This is especially relevant for emissions trading, where monetary value is placed on emission credits by the marketplace. The data tracked in a regional or national registry would support climate policies and economic decisions at all levels: private investment, national, state, and local.

A Greenhouse Gas Registry is a bottom-up approach to emissions accounting, where emitting entities quantify and report their emissions from various individual sources according to a uniform accounting standard verified by third-party verifiers that have been accredited as qualified to undertake the verification process. A registry is intended to quantify and submit greenhouse gas (GHG) emissions and reduction actions to a database. The standard for reporting must be consistent and transparent for the measurement, verification, and public reporting of greenhouse gas emissions.

Registries can be established to account for direct GHG emissions, indirect emissions, and offsets (i.e., carbon sequestration measures). Direct emissions include those from onsite combustion, manufacturing processes, and company-owned transportation fleets. Indirect emissions are those associated with electricity and steam consumption.

State and Regional Registries:

Some states and provinces have adopted or are in the process of adopting mandatory reporting requirements, either individually or as part of regional GHG reduction programs

In October 2003, the Northeast States for Coordinated Air Use Management (NESCAUM) began the development of the Regional Greenhouse Gas Registry (RGGR) for the Northeast. RGGR is a key piece of the infrastructure necessary for the northeastern states to move ahead in meeting their climate change commitments under the New England Governors–Eastern Canadian Premiers Climate Change Action Plan, adopted in August 2001, and individual targets set by New York and New Jersey. Beyond the NESCAUM states, RGGR participants also include Delaware and Pennsylvania, with several other states outside of the Northeast observing the process.[1] The establishment of the registry led to the establishment of the Regional Greenhouse

* Carbon dioxide, methane, nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6).

Gas Initiative (RGGI), a cooperative effort by nine Northeast and Mid-Atlantic states to design a regional cap-and-trade program covering carbon dioxide emissions from power plants in the region. In the future, RGGI may be extended to include other sources of greenhouse gas emissions and greenhouse gases other than CO_2.

The 2008 session of the Vermont legislature passed S. 350.[2] Included in the bill is provision for the establishment of a Greenhouse Gas Registry. The secretary of the Agency of Natural Resources is directed to work, in conjunction with other states or a regional consortium, to establish a periodic and consistent inventory of greenhouse gas emissions and publish a Vermont greenhouse gas emission inventory and forecast by no later than June 1, 2010, with updates annually until 2028, or until a regional or a national inventory and registry program is established in which Vermont participates, or until the federal National Emissions Inventory includes mandatory greenhouse gas reporting. The forecasts are to be for a 5- and a 10-year period based on the inventory data and other publicly available information.

The information collected for the inventory is to be standardized to reflect the emissions in tons per CO_2 equivalent; shall be set out in the inventory by sources or sectors such as agriculture, manufacturing, automobile emissions, heating, and electricity production; shall be compatible with the inventory included with the governor's commission on climate change final report; and shall include, but not be limited to, the following sources:

- information collected for reporting in the national emissions inventory, which includes air toxics, criteria pollutants, mobile sources, point sources, and area sources;
- in-state electricity production using RGGI and state permit information;
- vehicle miles travelled and vehicle registration data; and
- agricultural activities, including livestock and crop practices.

Additionally the bill directs the secretary to work, in conjunction with other states or a regional consortium, to establish a regional or national greenhouse gas registry and any registry in which Vermont participates shall be designed to apply to the entire state and to as large a geographic area beyond state boundaries as is possible, accommodating as broad an array of sectors, sources, facilities, and approaches as is possible, and shall allow sources to start as far back in time as is permitted by good data, affirmed by third-party verification.

Recommendation 65—The ANR should fulfill its responsibilities under State and federal law to work cooperatively with state and regional interests and with the EPA to establish a sound GHG registry of energy concerns capable of supporting a framework of trading and accountability on as large a geographic scale as possible.

STRATEGY BB —SUPPORT THE DEVELOPMENT OF EFFECTIVE PUBLIC ENGAGEMENT ON ENERGY AND GHG ISSUES

STATE CLIMATE PUBLIC EDUCATION AND ENGAGEMENT

Public education will serve as the foundation for state actions and the success of programs and initiatives in that State that are designed to reduce GHG emissions. Public education and engagement effort will need to integrate with and build upon the many existing efforts. This Plan itself is one of the first steps toward helping to broaden understanding of GHG challenges and opportunities related to energy issues. Other broad-based initiatives related to public engagement and energy included the Department's Participatory Energy Planning initiative describe in Appendix B and the Department's engagement efforts on Vermont Yankee connected to the Act 160 process. The public engagement efforts will continue as this Plan is reviewed by the public.

Four policies were advanced through the GCCC related to public education and engagement, and are adopted here as recommendations, and are covered below as recommendations and actions.

Recommendation 66—The State Climate Change Advisory Group and the Vermont ANR should rely on the variety of methods to advance an environment of inclusion, coordination, participation, and empowerment to the public and key stakeholders to advance state goals for GHG reduction from energy sources.

a) Vermont should establish a web-based presence to provide critical support to the many broad educational activities already underway in line with the recommendations of the GCCC.
b) Vermont should establish a state funding mechanism to help support coordinated education, engagement, marketing, and technical assistance programs.
c) Vermont should identify and establish best practices for public and private use to educate students, staff, and parents about sustainable building environments.
d) Vermont should encourage, foster, and promote the research and academic excellence necessary to advance statewide solutions to climate change.
e) The Department should continue efforts to engage and educate the public on energy issues as part of the development of this Plan.

ADAPTATION

Substantial buildup of GHGs in the atmosphere has already occurred. Some impacts of Climate Change are already inevitable and require some degree of adaptation to the change. Adaptation and mitigation will both be needed in the years to come. The GCCC recommended the development of a Climate Change Adaptation Plan, the elements of which include the following:

- Development of a comprehensive list of impacts associated with climate change.
- Recommendations to manage the risk to humans, natural and economic systems, water resources, temperature-sensitive populations and systems, energy systems, transportation

systems, communications systems, vital infrastructure and public facilities, natural lands (such as wetlands, forests, and farmland), and other affected sectors or areas of concern.

- Coordination through state, local, and federal agencies, organizations, or other entities or initiatives.

Recommendation 67 The Department of Public Service and the Vermont ANR should assist the State Climate Change Advisory Group establishment of adaptation plans through coordination with neighboring states and provinces around energy systems consistent with the goals established for the Plan by the GCCC.

ENDNOTES

[1] http://www.rggi.org/docs/rggr_update_6_24_04.pdf.
[2] http://www.leg.state.vt.us/docs/legdoc.cfm?URL=/docs/2008/bills/house/S-350.HTM.

APPENDIX A SUMMARY OF RECOMMENDATIONS

STRATEGY A MAKE EFFECTIVE USE OF ADVANCED GRID AND METER TECHNOLOGY

RECOMMENDATION 1 ENCOURAGE ADVANCED TIME-BASED RATES, REVIEW RATE DESIGNS, AND SPUR APPROPRIATE USE OF ADVANCED METERING INFRASTRUCTURE.

a) To help improve metering technology, data management, and provide effective price signals, Vermont regulators should foster coordination, collaboration, and mutual assistance among Vermont utilities, especially the smaller utilities to realize scale economies necessary to render the technology more cost effective.

b) The PSB should establish minimum capability requirements for advanced metering infrastructure (AMI).

c) The PSB should establish guidelines for rate designs enabled through smart metering technology.

d) The PSB should review rate designs designed to encourage energy efficiency consistent with Act 92 and the goals for the Board's advanced metering investigation.

e) Vermont regulators should work with neighboring jurisdictions and regional associations to spur more price sensitivity and response to high wholesale prices through innovative pricing programs and the deployment of advancements in metering technology in the New England region.

STRATEGY B FOSTER DISTRIBUTED RENEWABLE ENERGY RESOURCES

RECOMMENDATION 2 REVISE INTERCONNECTION AND ESTABLISH FAIR TARIFFS FOR CUSTOMER-SITED GENERATION THROUGH NET METERING OR WHOLESALE MARKET-BASED PRICING.

a) The Public Service Board will update the net-metering program to include contiguous customer clusters, measured departures from contiguous customer arrangements to promote community projects, and allow up to 2% of a distribution utility's capacity consistent with recent statutory revisions.

b) The DPS, with distribution utilities, should work to address and mitigate ratepayer equity concerns and administrative burdens on utilities associated with expanding net metering through appropriate rate designs.

c) The PSB should also update the net-metering rule to incorporate new fossil fuel or biomass combined heat and power systems that are already close to market.

d) Vermont should revise interconnection standards for small non-net-metered projects.

e) The DPS and PSB, through rate design, should foster the development of customer-sited projects which can be compensated for their energy production at market-based rates.

RECOMMENDATION 3 LEVERAGE CLEAN ENERGY DEVELOPMENT FUND (CEDF) TO PROMOTE DEVELOPMENT OF CLEAN ENERGY TECHNOLOGIES IN VERMONT CONSISTENT WITH THE CEDF STRATEGIC PLAN.

a) The Clean Energy Development Fund should be administered consistent with the Clean Energy Development Strategic Plan; the programs and funding approaches should be reviewed annually to ensure the greatest possible long-term impact from investments and grants.

b) The DPS and the Legislature should evaluate the ongoing effectiveness of the CEDF to determine whether to continue to seek revenue streams to sustain available funds for the CEDF beyond 2012.

c) In the course of its annual review, Vermont should explore opportunities to strategically direct funds in a manner that complements and leverages other regional resources available and federal renewable fund programs and initiatives for the greatest ratepayer long-term benefit.

RECOMMENDATION 4 ENCOURAGE MORE RENEWABLE ENERGY INVESTMENTS THROUGH ESTABLISHED INCENTIVES AND PROGRAMS.

a) Vermont utilities should offer pricing programs that empower customers through rate-differentiated renewable electricity tariffs.

b) The DPS, with Vermont utilities, should explore innovative ways to develop effective and efficient programs to encourage renewable energy by leveraging existing discretionary green-pricing programs and funds.

c) Vermont utilities and the Department should explore strategies for developing statewide green-pricing programs that can be marketed more effectively on a statewide basis.

STRATEGY C CREATE OPPORTUNITIES TO CONTINUE AND EXPAND VERMONT'S PORTFOLIO OF LOCAL LOW-CARBON ELECTRICITY RESOURCES

RECOMMENDATION 5 VERMONT'S ELECTRIC UTILITIES TO REPLACE THE SUN-SETTING RULE 4.100 CONTRACTS WITH STABLY PRICED CONTRACTS OR ACQUIRE RESOURCES BASED ON PORTFOLIO CONSIDERATIONS.

a) Vermont's distribution utilities should explore opportunities to extend purchased power agreements with current Rule 4.100 contract holders at more favorable terms.

b) Vermont's distribution utilities should explore opportunities to purchase former Qualifying Facilities (QFs).

c) Vermont distribution utilities should rely on existing institutions, such as the SPEED facilitator, for efficiencies in acquiring and assigning costs and allocating energy through new contracts.

RECOMMENDATION 6 REGULATORS AND THE SPEED FACILITATOR SHOULD WORK WITH VERMONT ELECTRIC UTILITIES TO FULFILL THEIR STATUTORY RESPONSIBILITIES UNDER THE SPEED PROGRAM.

a) Vermont regulators and legislators should foster a stable and predictable regulatory environment for encouraging contracts and investments in renewable energy; the SPEED Facilitator should take appropriate steps to foster the development of contracts between Vermont utilities and new renewable energy producers, including standard contracts/terms and conditions, requests for proposals, and effective use of the technology and the internet to facilitate contracts between prospective purchasers and sellers of SPEED resources.

b) In 2012 the Public Service Board should evaluate whether Vermont electric utilities have met their SPEED obligations consistent with statutory obligations.

c) Consistent with Section V

d) .of this Plan, Vermont energy efficiency programs should be employed to help meet statutory objectives for SPEED programs.

RECOMMENDATION 7 REGULATORS SHOULD ENSURE THAT INTERCONNECTION ARRANGEMENTS, BUSINESS RESPONSE TIMETABLES, AND RELEVANT TARIFFS ARE FAIR AND NONDISCRIMINATORY.

a) The Department of Public Service should monitor utility activity and performance as they relate to interconnection.

b) Vermont utilities and the Department should work to establish guidelines or principles for fair and non-discriminatory tariffs.

c) Vermont utilities should propose backup service and interconnection tariffs consistent with the above guidelines.

RECOMMENDATION 8 VERMONT ELECTRIC UTILITIES AND DEVELOPERS SHOULD PURSUE ENVIRONMENTALLY AND FINANCIALLY SOUND IN-STATE HYDROELECTRIC PROJECTS AND IMPROVEMENTS TO EXISTING FACILITIES.

a) The ANR should continue to foster a predictable and environmentally sound process for issuing water quality certifications for hydroelectric projects by continuing to provide applicants with prefeasibility site assessments.

b) As resources, permit ANR and the DPS should update the 1980 New England River Basins Commission's study to identify the most viable sites for small hydro site development at existing dams.

c) ANR should examine ways to better integrate the FERC and state permitting process for small low-impact hydroelectric projects.

d) The DPS should work with Vermont utilities to investigate additional opportunities for increasing hydropower production at existing operating sites.

e) As resources permit, the Department of Public Service, the PSB, and ANR should develop better guidance for towns and individuals that are interested in developing small hydropower projects.

RECOMMENDATION 9 ACTIVELY FACILITATE THE REVIEW OF LOCAL, VERMONT-SCALE WIND PROJECT DEVELOPMENT CONSISTENT WITH STATUTORY FRAMEWORK.

a) As resources permit, ANR and PSD should foster a predictable and environmentally sound process for locating wind by identifying areas that are likely to meet statutory requirements and permitting requirements.

b) As resources permit, the PSD, PSB, and ANR should develop better guidelines for towns and individuals that are interested in developing community wind projects.

RECOMMENDATION 10 ENCOURAGE VERMONT UTILITIES TO ENGAGE IN REGIONAL WIND PROJECT DEVELOPMENT.

a) Vermont utilities should participate in regional and international wind projects through contract arrangements, equity participation, and/or the purchase of attributes.

b) Vermont should support the strategic expansion of the region's electric grid to gain access to lower-cost and more environmentally responsible resources and to further diversify the regional mix of generation resources.

STRATEGY D EVALUATE OPPORTUNITIES TO CONTINUE AND EXPAND VERMONT'S PORTFOLIO OF LOW-CARBON ELECTRICITY RESOURCES

RECOMMENDATION 11 SHOULD VERMONT YANKEE BE RELICENSED AND RECEIVES A CPG TO OPERATE BEYOND 2012, SUCH CONTINUED OPERTATIONS MUST INCLUDE A PURCHASE POWER AGREEMENT THAT CONFERS MATERIAL BENEFIT TO THE STATE AND VERMONT RATEPAYERS.

a) Vermont electric utilities must manage portfolio risk and explore strategies for source diversification to reduce the exposure to ratepayers from a unit-contingent contract.

b) Vermont utilities should continue planning for alternatives to power from the facility, including utility generation projects, system power contracts, or through merchant power obtained through market solicitations.

c) Vermont utilities and agents that are party to the negotiations of major contracts should ensure that the smaller municipal and cooperative utilities gain access to those resource contracts on similar terms and conditions.

d) To the extent that the facility is licensed and certified for operation beyond its existing license, Vermont utilities should phase down their purchase commitments toward alternative forms of clean energy, including renewables.

e) In light of the challenges associated with VY's ongoing operation, Vermont utilities should, over time, diversify their resource mix toward renewable energy and alternative low-carbon base load resources

RECOMMENDATION 12 VERMONT UTILITIES MUST CONTINUE TO DEVELOP OPTIONS FOR LOCAL GENERATION THAT COMPLEMENT VERMONT'S NEED FOR GENERATION CLOSER TO LOADS TO REDUCE LOSSES AND IMPROVE SYSTEM RELIABILITY AT LOWEST COST.

a) Vermont utilities should work to develop options for generation located in Vermont.

b) Vermont electric utilities should look to partner with other load servers or other plant developers to add diversity to any proposal.

c) Vermont utilities should cooperate in developing in-state generation resources so smaller utilities can take advantage of economies of scale that are associated with large utilities.

RECOMMENDATION 13 ENCOURAGE MORE CHP THROUGH TECHNICAL ASSISTANCE, TARGETED INCENTIVES LEVERAGING, AVAILABLE FUNDING SOURCES, AND THROUGH FURTHER EFFORTS TO REDUCE OR ELIMINATE REGULATORY BARRIERS TO COST-EFFECTIVE CHP PROJECT DEVELOPMENT.

a) As resources permit, the DPS and Vermont utilities should identify sites where CHP is likely feasible, and encourage systems where appropriate. Locations should include those where CHP could be powered by natural gas supported by a possible expansion of pipeline or with ready access to appropriate transportation infrastructure for biomass (See also Strategy H covering natural gas).

b) Vermont electric utilities should annually review and strategically promote the development of power purchases from CHP projects within their service territories.

c) The DPS should work with Vermont utilities to strategically remove or mitigate remaining regulatory barriers to the introduction of cost-effective CHP projects.

d) The role of the Energy Efficiency Utility (EEU) should expand to allow provision of technical assistance and limited incentives for customers potentially interested in pursuing cost-effective CHP projects below a size threshold established by the Board.

e) The regulatory framework for Vermont's utilities should de-couple growth in sales from profits to ensure an alignment of interests between utilities and cost-effective customer-sited generation.

f) The DPS and Vermont utilities should establish nondiscriminatory rates for backup and interconnection (to be addressed in future rate design proceedings).

g) The CEDF should be leveraged to foster the development of CHP projects.

STRATEGY E SECURE BALANCING-RESOURCE COMMITMENTS FROM LOW-CARBON REGIONAL PROJECT DEVELOPMENTS AND EXPLORE NEW OPPORTUNITIES WITH LONG-STANDING STRATEGIC PARTNERS

RECOMMENDATION 14 VERMONT ELECTRIC UTILITIES SHOULD PURSUE OPPORTUNITIES FOR CLEAN AND RENEWABLE ENERGY THROUGH LONG-TERM STABLY PRICED POWER CONTRACTS WITH NEIGHBORING PROVINCES AND POWER MARKETERS

a) DPS should continue to work with Canadian resources and neighboring states to ensure transmission capacity from Canada into the region.

b) Vermont utilities should explore the competitive opportunities for securing stable long-term power supply through purchase power agreements potentially available from Quebec, New Brunswick, Newfoundland, and/or marketers of clean energy products.

c) Vermont utilities should benchmark agreements against competitive market opportunities.

d) Vermont utilities should work to establish, as a goal, a carbon-emissions or intensity profile that is consistent with the performance under existing contracts.

e) Vermont utilities and agents that are party to the negotiations of major contracts should ensure that the smaller municipal and cooperative utilities gain access to those resource contracts on similar terms and conditions.

STRATEGY F ENSURE ACCESS TO CLEAN, EFFICIENT, AFFORDABLE, AND RELIABLE ENERGY SUPPLY THROUGH REGIONAL COOPERATION AND COLLABORATION

RECOMMENDATION 15 WORK WITH NEIGHBORING STATES AND PROVINCES TO FOSTER STRATEGIES FOR ACQUIRING IMPORTS OF CERTAIN NON-CARBON-PRODUCING ALTERNATIVES TO NEW ENGLAND FOSSIL GENERATION, INCLUDING THE DEVELOPMENT OF NEW TRANSMISSION CORRIDORS.

RECOMMENDATION 16 WORK COOPERATIVELY WITH NEIGHBORING STATES TO ENSURE THE SUCCESS OF THE RGGI PROGRAM THROUGH SOUND AUCTIONS, TRANSPARENT AND PREDICTABLE MARKETS, AND AN EFFECTIVE OVERSIGHT OF RGGI INC.

RECOMMENDATION 17 THE NORTHEAST OR U.S. SHOULD INSTITUTE A SOUND MULTI-SECTOR REGIONAL OR NATIONAL GHG CAP-AND-TRADE PROGRAM, RELYING ON RGGI AS A FOUNDATION.

RECOMMENDATION 18 VERMONT SHOULD CONTINUE TO WORK WITH OTHER NEW ENGLAND STATES TO ENSURE THAT DEMAND-SIDE RESOURCES ARE APPROPRIATELY INTEGRATED INTO REGIONAL MARKETS LIKE THE ISO-NE FORWARD CAPACITY MARKET (FCM).

a) Vermont should continue to lead the region in the utilization of energy efficiency resources in the FCM.

b) Vermont and regional partners should continue to monitor and encourage a stable market design that delivers adequate capacity.

c) Vermont should encourage regional adoption of a competitive market system (like the FCM) for the electric reserve and other electric supply resources.

d) Vermont should support the adoption of recommendations related to the FCM that are proposed in the ISO regional plan.

RECOMMENDATION 19 VERMONT SHOULD WORK WITH ISO AND APPROPRIATE REGIONAL ORGANIZATIONS TO FOSTER SOUND PLANNING AND PLANNING PROCESSES WITHIN THE NEW ENGLAND REGION CONSISTENT WITH THE REGIONAL SYSTEM PLAN.

STRATEGY G ESTABLISH A UTILITY PLANNING AND REGULATORY ENVIRONMENT THAT COMPLEMENTS AND ENCOURAGES POLICY OBJECTIVES FOR COST-EFFECTIVE RELIANCE ON ENERGY EFFICIENCY, RENEWABLE ENERGY, AND CHP

RECOMMENDATION 20 CONTINUE TO ASSIST THE LONG-TERM PLANNING EFFORTS OF VERMONT UTILITIES AND IMPROVE THE OVERALL PLANNING PROCESS AND REVIEW.

a) Vermont Department of Public Service should revisit the existing planning efforts of Vermont utilities and the associated regulatory review for improvements.

RECOMMENDATION 21 EVALUATE THE PERFORMANCE OF VERMONT UTILITIES UNDER EXISTING AND PROPOSED ALTERNATIVE REGULATION PLANS AND MODIFY PLANS TO BETTER SERVE THE LONG-TERM INTERESTS OF VERMONT CONSUMERS.

RECOMMENDATION 22 CONTINUE TO BUILD AND FOSTER THE DEVELOPMENT OF A TRANSPARENT, COMPREHENSIVE, AND INTEGRATED PLANNING FRAMEWORK FOR VERMONT'S BULK AND SUBTRANSMISSION RESOURCES CONSISTENT WITH THE GOALS ESTABLISHED IN PUBLIC SERVICE BOARD ORDERS AND VERMONT STATUTES.

a) The VSPC should continue to make progress toward the establishment of an effective and transparent integrated transmission planning process in Vermont.

b) EVT should establish a long-term forecast of efficiency improvements consistent with Board guidance and direction.

c) VELCO should work with the VSPC to establish a statewide forecast of peak load growth that integrates long-term projections of EVT efficiency programs.

d) Vermont utilities should work collaboratively with VELCO to ensure that demand-response capabilities are effectively utilized during the summer peak seasons from 2008 to 2010, to help relieve reliability concerns associated with Vermont and regional transmission projects in process.

e) The VSPC should establish and modify as appropriate the planning framework and committee/study group process to allow timely consideration of transmission and non-transmission alternatives in a transparent planning environment.

f) The VSPC should move to organize the study groups needed to support timely consideration of reliability concerns.
g) VELCO, Vermont utilities, and the VSPC should regularly update and review their strategic priority project list to provide timely NTA consideration for the growing list of reliability deficiencies and concerns.
h) VELCO, Vermont utilities, and the VSPC should establish implementation plans and schedules to ensure timely review of projects consistent with the priority list.
i) Vermont planners and utilities should strategically encourage the location of generation (merchant or utility projects) and geotargeting of DSM in areas of the state, and in seasons that are likely to create the greatest long-term project deferral or avoidance benefits.

RECOMMENDATION 23 ELECTRIC UTILITIES SHOULD IMPLEMENT CONSERVATION VOLTAGE REGULATION WHERE APPROPRIATE.

STRATEGY H ENCOURAGE GREATER FUEL CHOICE THROUGH THE EXPANSION OF THE NATURAL GAS SYSTEM

RECOMMENDATION 24 FOSTER OPPORTUNITIES FOR SUBSTITUTION OF NATURAL GAS FOR OTHER FOSSIL FUELS.
a) The DPS and PSB should continue to support the marketing and development efforts of Vermont Gas to enable cost effective service expansion and increase consumer opportunities for greater choice.
b) The Efficiency Utility and Vermont Gas should continue to provide incentives for fuel switching from electric to natural gas, and from fuel oil and propane to natural gas.

RECOMMENDATION 25 ENCOURAGE COST-BASED EXPANSION OF AND UPGRADES TO NATURAL GAS INFRASTRUCTURE
a) VGS should continue to evaluate the long-term feasibility of building new pipelines to connect Vermont with U.S. pipeline systems.
b) The DPS and PSB should encourage the construction and extension of natural gas transmission and distribution systems that enhance system reliability, reduce costs, and expand natural gas service to more Vermonters.

RECOMMENDATION 26 ENCOURAGE THE DEVELOPMENT OF STRATEGICALLY LOCATED NATURAL GAS ELECTRIC GENERATION CLOSER TO ELECTRIC LOADS.
a) State agencies, VGS and electric utilities should continue to evaluate opportunities to develop natural gas or dual-fuel electric generation facilities to meet capacity requirements.
b) The DPS, PSB, and VGS should continue to evaluate and take advantage of cost effective opportunities to extend the natural gas service territory and/or site additional natural gas pipelines within Vermont's borders.

RECOMMENDATION 27 ENCOURAGE THE EXPANDED USE OF NATURAL GAS AS A VEHICLE FUEL.
a) Regulators should continue to allow cost recovery for expenses associated with research testing and market development as is currently done in Vermont to encourage further natural gas substitution for other liquid fossil fuels.
b) As resources allow, the DPS and VGS should investigate the feasibility of providing natural gas fuel filling stations along heavily traveled highways in the Northeast such as the Interstate 89 and Interstate 91 corridors linking Montreal, Boston, and Hartford.

STRATEGY I IMPROVE THE SYSTEM RELIABILITY OF NATURAL GAS DELIVERY

RECOMMENDATION 28 ENCOURAGE THE CONSTRUCTION OF ADDITIONAL NATURAL GAS STORAGE FACILITIES TO SUPPORT AND EXPAND EXISTING NATURAL GAS INFRASTRUCTURE.
a) VGS should evaluate construction of LNG storage facilities in areas of Vermont where capacity is constrained and transmission expansion is difficult.
b) Vermont should evaluate construction of LNG facilities where they would allow for the entrance of additional LDCs or expand natural gas distribution service.

STRATEGY J CONTINUE TO FOSTER SOUND INVESTMENT IN END-USE ELECTRIC ENERGY EFFICIENCY PROGRAMS

RECOMMENDATION 29 EVALUATE AND IMPROVE COST-EFFECTIVE ENERGY EFFICIENCY OPPORTUNITIES, THE EEU STRUCTURE, AND PROGRAM DELIVERY MECHANISMS
a) Electric utility planners and the Department should annually revisit and review the key technical assumptions and estimates of ratepayer benefits and tailor assumptions to T&D planning efforts through the VSPC subcommittee process.

b) The Vermont PSB should revisit the geotargeted areas at least every 3 years to ensure future investment is aimed at the areas of the state that will provide the greatest value.

STRATEGY K PROMOTE GREATER EFFICIENCY INVESTMENTS FOR UNREGULATED FUEL CONSUMPTION

RECOMMENDATION 30 IMPLEMENT THE HEATING AND PROCESS FUEL EFFICIENCY PROGRAM CREATED IN ACT 92 OF 2008.

a) Collaborate with all interested parties to refine options for implementing programs to acquire, as funding allows, all cost-effective unregulated fuels energy efficiency resources.

RECOMMENDATION 31 PROMPTLY INITIATE ADOPTION OF INTERNATIONAL ENERGY CONSERVATION CODE FOR BOTH COMMERCIAL AND RESIDENTIAL BUILDINGS, AND ENCOURAGE ABOVE-CODE BUILDING DESIGN.

a) The Department of Public Service should continue to promptly initiate updates to residential and commercial codes.

b) The Department of Public Service should continue to encourage above-code building design, such as Efficiency Vermont's Core Performance Guide.

c) As resources permit, the DPS should evaluate the effectiveness of existing self- certification mechanisms and consider further the need for additional strategies for strengthening energy-code enforcement or compliance based on its evaluation.

RECOMMENDATION 32 STRENGTHEN ENERGY EFFICIENCY CRITERIA BY ADOPTING UNIFORM AND TRANSPARENT ABOVE-CODE STANDARDS THAT COULD BE APPLIED THROUGH ACT 250 REVIEWS.

a) As resources permit, the DPS should create a task force to consider above-code guidelines for commercial building, such as the Core Performance Guide for commercial buildings, to be used to satisfy the Act 250 energy efficiency criteria.

RECOMMENDATION 33 CONTINUE PROCESS TO SEEK A WAIVER FROM FEDERAL APPLIANCE STANDARDS WHERE VERMONT ENACTED STANDARDS INCREASE MINIMUM EFFICIENCY.

a) Continue active involvement in DOE's appliance efficiency standard process, and advocate for stricter appliance standards.

RECOMMENDATION 34 INVESTIGATE TIME-OF-SALE ENERGY CONSUMPTION DISCLOSURE REQUIREMENTS.

a) As resources allow, the Department of Public Service should create a task force to investigate the feasibility, desirability, and potential timeframes for the establishment of a Time-of-Sale disclosure requirements at time-of-sale.

b) Before Vermont attempts to establish any time-of-sale requirements, Vermont should address the fundamental workforce constraints associated with any audit or verification mechanism employed.

STRATEGY L ENSURE A COMMITMENT TO SOUND PROGRAM DESIGN AND EFFECTIVE SAVINGS CHARACTERIZATION OF VERMONT GAS SYSTEMS ENERGY EFFICIENCY PROGRAMS

RECOMMENDATION 35 UPDATE POTENTIAL FOR AND ACQUIRE ALL COST-EFFECTIVE NATURAL GAS EFFICIENCY SAVINGS; UPDATE MONITORING AND VERIFICATION PROCESS

a) Vermont Gas should periodically complete a natural gas efficiency potential evaluation that is independently reviewed by the DPS or its experts, and acquire available efficiency resources that are cost effective. Savings claims should be verified by the DPS.

b) VGS should reevaluate the appropriate mechanisms to deliver natural gas efficiency into the future in light of the evolving nature of all-fuels program delivery.

STRATEGY M FUEL ECONOMY AND EMISSIONS STANDARDS

RECOMMENDATION 36 CONTINUE TO SUPPORT CAFE STANDARDS AND ADVOCATE FOR THE ENACTMENT OF INCREASINGLY TOUGHER STANDARDS.

RECOMMENDATION 37 CONTINUE TO ADOPT THE MOST STRINGENT LEV STANDARDS AVAILABLE.

STRATEGY N OTHER EFFORTS TO IMPROVE OPERATIONAL EFFICIENCY OF NEW AND EXISTING VEHICLES

RECOMMENDATION 38 EVALUATE OPPORTUNITIES TO ENCOURAGE VEHICLE EFFICIENCY THROUGH TARGETED INCENTIVES.

a) AOT and Dept. of Taxes should work with the business community to evaluate various incentives and possible "best-in-class" requirements for encouragement of efficient company fleets.

RECOMMENDATION 39 ENCOURAGE PROPER VEHICLE MAINTENANCE THROUGH INFORMATION DISSEMINATION AND EFFICIENT TECHNOLOGIES.

a) Evaluate aftermarket tire efficiency labeling requirement, and/or tire efficiency requirements.

b) Conduct education and information outreach, led by AOT and PSD, to inform consumers of the choices available concerning replacement tires, low viscosity oil, and tire inflation.

RECOMMENDATION 40 CONTINUE TO ENCOURAGE EFFICIENCY IN THE HEAVY-DUTY DIESEL FLEET

a) ANR should consider the establishment of anti bus/truck idling standards.

b) Work with the EPA Smartway Partnership and Vermont companies to achieve fuel consumption and emissions reductions from freight operations.

STRATEGY O SUPPORT R&D AND OUTREACH TO IMPROVE THE EFFICIENCY OF PLUG-IN HYBRID VEHICLES

RECOMMENDATION 41 ENCOURAGE PLUG-IN HYBRID-ELECTRIC VEHICLE TECHNOLOGY.

a) DPS should continue to encourage electric utilities to research effects of plug-in hybrid technology on the electric infrastructure.

b) Vermont utilities and regulators should ensure that the metering technology and rate designs are in place to ensure that plug-in vehicles improve the load profile of Vermont's electric utilities.

c) As resources permit, the DPS should establish an educational and outreach campaign providing basic facts to consumers and retailers through an information clearinghouse. Continue to study the costs and benefits of plug-in hybrids and V2G technology.

d) The State of Vermont should lease or acquire plug-in hybrid vehicles for state-use as they become commercially available under reasonable terms to further improve the emissions profile and economics of government use.

STRATEGY P SHIFT TRANSPORTATION FUEL DEMAND TO LOW-CARBON FUELS

RECOMMENDATION 42 EVALUATE THE POTENTIAL FOR A STATE OR REGIONAL LOW-CARBON FUEL STANDARD.

a) AOT, ANR, and DPS should continue to work within the context of the Conference of New England Governors/Eastern Canadian Premiers to investigate the feasibility of a Low-Carbon Fuel Standard for Vermont and the region.

STRATEGY Q FACILITATE RENEWABLE FUEL DEMAND

RECOMMENDATION 43 ENCOURAGE BIODIESEL USE IN COMMERCIAL HEAVY DUTY VEHICLES.

a) Promote existing guidebooks and promote technical assistance available from the National and State biodiesel associations for commercial enterprises (companies or fuel dealers) wishing to install a biodiesel-specific fuel tank.

b) Adopt governor's biodiesel transportation tax reduction proposal as prevailing fiscal and economic conditions permit.

RECOMMENDATION 44 EVALUATE COSTS AND BENEFITS OF ENCOURAGING REFORMULATED OR OXYGENATED FUEL AS A WAY TO SUPPORT THE USE OF ETHANOL AS AN ADDITIVE.

a) Vermont should consider a differential tax regime between gasoline and ethanol-supplemented gasoline (including reformulated and oxygenated fuels).

b) ANR, with PSD, should report on how to best measure the current amount of ethanol delivered to Vermont in its motor gasoline.

c) ANR, with PSD, should evaluate the costs and benefits to requiring reformulated and/or oxygenated gasoline.

STRATEGY R ENCOURAGE ALTERNATIVES TO SINGLE-OCCUPANCY VEHICLES

RECOMMENDATION 45 CONSIDER ENERGY IMPLICATIONS IN LAND-USE PLANNING BY FACILITATING MIXED-USE, PUBLIC TRANSIT-ORIENTED DEVELOPMENT THAT LIMITS SPRAWL.

a) Continue to encourage development in downtowns, village centers, and growth centers through continued and/or increased funding of state programs, offering financial incentives and ensuring state infrastructure provides support for designated centers.

b) Target Growth Center and other incentives to projects that facilitate transit service and infrastructure development and availability. State owned infrastructure projects should be targeted similarly.

RECOMMENDATION 46 ENCOURAGE INCREASED PUBLIC TRANSIT RIDERSHIP BY SUPPORTING TARGETED EXPANSION OF SERVICES THROUGHOUT THE STATE.

a) Investigate and, if practicable given fiscal and economic circumstances, institute an energy tax credit program for businesses that will allow them to partner with public transportation providers to encourage home-to-work use of public transportation.

b) Investigate other funding strategies to increase public transit ridership during the home-to-work commuter trip.

c) Continue to regularly evaluate service routes and target new or revised public transit routes to serve home-to-work trips and to increase connectivity between services.

d) Work to eliminate the public transit vehicle replacement backlog.

RECOMMENDATION 47 MAINTAIN AND INCREASE THE DEVELOPMENT OF PARK-AND-RIDE FACILITIES AROUND VERMONT AND SUPPORT THEIR USAGE BY PUBLIC TRANSIT PROVIDERS.

a) AOT should complete a comprehensive survey of usage patterns to determine the most effective locations for expansion and upgrades of current lots, and potential future lots, including potential partnership with bordering states.

b) Increase public transportation facilities in Park-and-Ride lots and coordinate route schedules to coincide with the busy commuting hours.

RECOMMENDATION 48 INCREASE PARTICIPATION IN RIDESHARE/VANPOOL PROGRAMS.

a) Implement recommendations of Rideshare and Vanpool review conducted by the Agency of Transportation.

RECOMMENDATION 49 SUPPORT THE VERMONT TELECOMMUNICATIONS AUTHORITY EFFORTS TO FACILITATE ADVANCED COMMUNICATION NETWORKS THAT ALLOW FOR TELECOMMUTING.

a) The VTA should ensure stable, reliable communications networks to enable telecommuting.

b) As part of "e-state" initiative, the state should provide outreach and information concerning the benefits of using telecommunications networks to reduce inefficient miles traveled.

STRATEGY S BETTER USE AND EFFICIENCY OF VERMONT'S RAIL NETWORKS

RECOMMENDATION 50 —FACILITATE IMPROVED USE OF RAILROADS FOR THE MOVEMENT OF FREIGHT SHIPMENTS AROUND THE STATE THROUGH STRATEGIC INVESTMENTS IN INFRASTRUCTURE UPGRADES.

a) Secure and spend federal and other funding to upgrade freight rail infrastructure, focusing on increasing the weight limit of railroads, ensuring appropriate accommodation of double-stacked railcars, and upgrading intermodal facilities.

b) Collaborate in the NEG/ECP process to engage private industry to develop the long-term connectivity of the Northeast's rail networks.

RECOMMENDATION 51 —FACILITATE INCREASED PASSENGER RAIL RIDERSHIP LEVELS.

a) Continue to support Amtrak service in Vermont, and use the NEG/ECP and other collaborative processes to further interconnect Vermont passenger rail stations with neighboring jurisdictions.

b) Continue support for freight rail, as it is essential to a successful passenger rail future.

STRATEGY T ENCOURAGE EFFICIENT VEHICLE TRIPS THROUGH ECONOMIC INCENTIVES/DISINCENTIVES

RECOMMENDATION 52 ENCOURAGE COMPANIES, ORGANIZATIONS, AND INSTITUTIONS TO OFFER COMMUTER BENEFITS PROGRAMS.

a) Provide education and technical assistance to any company or public institution seeking to offer commuter benefits to their employees.

b) The State of Vermont should lead by example (see Recommendation 63).

RECOMMENDATION 53 —THE STATE SHOULD SUPPORT AOT CONSIDERATION OF ALTERNATIVE FORMS OF TRANSPORTATION FUNDING.

STRATEGY U DISPLACE CONSUMPTION OF FOSSIL FUELS BY ENCOURAGING A SUSTAINABLE BIOMASS ENERGY DEMAND

RECOMMENDATION 54 ENCOURAGE THE SUSTAINABLE USE OF WOOD ENERGY FOR HEATING AND PROCESS USES.

a) State and municipal government should encourage the development and expansion of cos-t effective district wood heating systems.

b) The Vermont Superintendents Association's School Energy Management Program (SEMP), Department of Education, Department of Forests, Parks & Recreation, Biomass Energy Resource Center (BERC), and Department of Public Service should work together to investigate the feasibility of installing additional wood heating systems in Vermont's schools and institutions.

c) ANR, DPS Clean Energy Development Fund, and EVT should provide assistance to businesses interested in utilizing wood energy in commercial, and industrial applications in Vermont for CHP.

d) Advocate for increased public outreach and wood energy education programs.

RECOMMENDATION 55 ENCOURAGE SUSTAINABLE BIOFUELS DISPLACEMENT OF FOSSIL FUEL HEAT AND PROCESS USE IN THE RESIDENTIAL, COMMERCIAL, AND INDUSTRIAL SECTORS.

a) State agencies and Vermont community groups should support regional and national efforts to negotiate for warranties on heating systems and equipment that utilize biofuels.

b) The Vermont Agency of Natural Resources should evaluate the effects (environmental, mechanical, safety, etc.) of using B5 and greater blends of biodiesel in heating and industrial processing systems in Vermont.

c) Vermont consumers and community groups should encourage fuel dealers to supply biofuels in an environmentally sustainable manner.

d) The Vermont legislature should consider tax credits for homeowners that use biodiesel blends for home heating as prevailing fiscal and economic considerations permit.

e) Vermont state agencies should continue to lead biofuels initiatives by utilizing biofuels in state buildings and vehicles (See Recommendation 61 and Recommendation 62).

RECOMMENDATION 56 FACILITATE AND SPEED THE TRANSITION TO CLEANER, MORE EFFICIENT WOOD BURNING BY PROMOTING THE TRANSITION TO NEW RESIDENTIAL STOVES AND APPLIANCES.

a) Evaluate the effectiveness of including wood energy-efficiency programs as part of an all fuels efficiency utility.

b) Evaluate the costs and benefits of re-initiating wood stove trade-up programs.

c) Evaluate the costs and benefits of new wood stoves, pellet stoves and central heat with pellets.

STRATEGY V SUPPORT THE SUSTAINABLE DEVELOPMENT OF A WELL TARGETED BIOMASS SUPPLY IN VERMONT

RECOMMENDATION 57 SUPPORT SUSTAINABLE ETHANOL AND BIODIESEL PRODUCTION AND SUPPLY EFFORTS IN VERMONT.

a) The Vermont Agency of Natural Resources and Agency of Agriculture should evaluate the most suitable energy crops for Vermont as well as reliable yield values for those crops.

b) The Vermont Agency of Agriculture and biofuels organizations should encourage farmers to grow suitable biofuels feed stocks through education and incentive programs.

c) The Vermont Agency of Natural Resources and Agency of Agriculture Evaluate the costs and benefits of expanding certain areas of land devoted to growing energy crops.

d) The Agency of Natural Resources should continue to evaluate the feasibility of siting biodiesel and ethanol facilities in Vermont.

e) VEDA, Vermont business groups, and community energy organizations should encourage biofuels producers to locate facilities in Vermont and to utilize local, sustainably produced crop material when available.

f) Along with federal partners, state agencies should provide technical assistance to biofuels companies interested in locating in Vermont.

STRATEGY W —SUPPORT THE SUSTAINABLE DEVELOPMENT OF BIOMASS ELECTRIC GENERATION IN VERMONT

RECOMMENDATION 58 CONTINUE TO SUPPORT THE DEVELOPMENT OF ANAEROBIC DIGESTER ELECTRIC GENERATION FACILITIES.

a) Vermont state agencies and electric utilities should continue to support development of biogas recovery systems through incentives programs.

b) As resources permit, the DPS and Agency of Agriculture and Vermont utilities should conduct a study to identify geographic areas in which centrally located digesters might be economically feasible to operate.

c) The Vermont DPS and PSB should support utility efforts to establish voluntary renewable pricing programs for farm-generated renewables.

d) The DPS and Agency of Agriculture should collaborate to develop cost-effective small-scale farm methane systems.

RECOMMENDATION 59 ENCOURAGE THE USE OF BIOFUELS IN VERMONT'S DIESEL PEAKING GENERATORS.

a) Vermont utilities should evaluate which blends of biodiesel can be used in electric generation systems.

b) Vermont utilities should use biodiesel blends where cost effective and reliable.

c) Vermont utilities should explore opportunities to fund additional fuel/facility improvements through green pricing programs or relying on the CEDF.

RECOMMENDATION 60 —FOSTER THE DEVELOPMENT OF WOOD-FIRED ELECTRIC GENERATION FACILITIES IN VERMONT AND NEW ENGLAND.

a) Vermont agencies, utilities, and community groups should support wood electric generation and co-generation projects deemed to be beneficial to the welfare of VT.

b) ANR should evaluate and consider pre-approving wood electric generation sites around the state to encourage more private entities to consider locating in Vermont.

STRATEGY X INCREASE THE EFFICIENCY AND REDUCE FOSSIL FUEL CONSUMPTION FROM STATE GOVERNMENT BUILDING INFRASTRUCTURE

a) BGS should benchmark efficiency levels (electric and other fuels) for each building owned and/or operated by the State by completing a comprehensive energy audit.

b) BGS should evaluate and if practicable, enter into a performance contract for energy services to increase the efficiency of the State's building infrastructure.

c) State Agencies should continue to leverage the State Resource Management Revolving Fund to make cost-effective investments in energy efficiency.

RECOMMENDATION 61 EVALUATE THE FURTHER PURCHASE AND USE OF RENEWABLE FUELS TO HEAT AND POWER STATE GOVERNMENT BUILDINGS.

a) BGS and the Climate Neutral Working Group should assess the cost-effective potential for the State to increase the use of renewable energy for its Building infrastructure.

STRATEGY Y REDUCE PETROLEUM FUELS CONSUMPTION FROM STATE GOVERNMENT TRANSPORTATION NEEDS

RECOMMENDATION 62 CONTINUE TO REDUCE STATE FLEET PETROLEUM CONSUMPTION.

a) Continue current practices of purchasing vehicles that have the highest available fuel efficiency in its respective vehicle class.

b) Purchase plug-in hybrid vehicles as they become available commercially (Recommendation 41).

c) Expand current program for fueling State heavy-duty vehicles with B5 or greater blend of biodiesel (Recommendation 62).

d) Department of Information and Innovation should comprehensively train all state employees to use video and teleconferencing capabilities.

RECOMMENDATION 63 ENCOURAGE STATE GOVERNMENT EMPLOYEES TO COMMUTE EFFICIENTLY.

a) The Climate Neutral Working Group should continue to work with GMTA and CCTA to develop an Unlimited Access program and other programs that will remove barriers to State employee use of public transit.

b) The Climate Neutral Working group should continue to investigate creating availability of "satellite offices" where the employee does not need to make their entire trip to employer's office.

STRATEGY Z SUPPORT THE DEVELOPMENT OF A STRONG AND BROAD-BASED GHG REGISTRY AND INFORMATION SYSTEM

RECOMMENDATION 64 —THE DEPARTMENT OF ENVIRONMENTAL CONSERVATION SHOULD COORDINATE WITH THE DEPARTMENT OF PUBLIC SERVICE IN PERIODICALLY UPDATING THE STATE'S GHG INVENTORIES TO INCLUDE ENERGY-RELATED EMISSIONS.

RECOMMENDATION 65 —THE DEC SHOULD WORK WITH THE DEPARTMENT AND REGIONAL AND NATIONAL ENERGY-RELATED ORGANIZATIONS TO PROMOTE REGIONAL PROTOCOLS OR COMMON MEASUREMENT AND REPORTING OF ENERGY-RELATED GHG EMISSIONS.

RECOMMENDATION 66 —THE ANR SHOULD FULFILL ITS RESPONSIBILITIES UNDER STATE AND FEDERAL LAW TO WORK COOPERATIVELY WITH STATE AND REGIONAL INTERESTS AND WITH THE EPA TO ESTABLISH A SOUND GHG REGISTRY OF ENERGY CONCERNS CAPABLE OF SUPPORTING A FRAMEWORK OF TRADING AND ACCOUNTABILITY ON AS LARGE A GEOGRAPHIC SCALE AS POSSIBLE.

STRATEGY AA —SUPPORT THE DEVELOPMENT OF EFFECTIVE PUBLIC ENGAGEMENT ON ENERGY AND GHG ISSUES

RECOMMENDATION 67 —THE STATE CLIMATE CHANGE ADVISORY GROUP AND THE VERMONT ANR SHOULD RELY ON THE VARIETY OF METHODS TO ADVANCE AN ENVIRONMENT OF INCLUSION, COORDINATION,

PARTICIPATION, AND EMPOWERMENT TO THE PUBLIC AND KEY STAKEHOLDERS TO ADVANCE STATE GOALS FOR GHG REDUCTION FROM ENERGY SOURCES.

a) Vermont should establish a web-based presence to provide critical support to the many broad educational activities already underway in line with the recommendations of the GCCC.

b) Vermont should establish a state funding mechanism to help support coordinated education, engagement, marketing, and technical assistance programs.

c) Vermont should identify and establish best practices for public and private use to educate students, staff, and parents about sustainable building environments.

d) Vermont should encourage, foster, and promote the research and academic excellence necessary to advance statewide solutions to climate change.

e) The Department should continue efforts to engage and educate the public on energy issues as part of the development of this Plan.

RECOMMENDATION 68 —THE DEPARTMENT OF PUBLIC SERVICE AND THE VERMONT ANR SHOULD ASSIST THE STATE CLIMATE CHANGE ADVISORY GROUP ESTABLISHMENT OF ADAPTATION PLANS THROUGH COORDINATION WITH NEIGHBORING STATES AND PROVINCES AROUND ENERGY SYSTEMS CONSISTENT WITH THE GOALS ESTABLISHED FOR THE PLAN BY THE GCCC.

APPENDIX B - VERMONT'S ENERGY FUTURE

Public Engagement Process - January 2008

I. BACKGROUND

Vermont remains the only deregulated, vertically integrated state in New England. The 350,000 electric customers generate an annual peak load of just under 1100 MW. There are 20 utilities providing service to customers—15 municipals, 2 Coops, and 3 IOUs. Seventy-five percent of the energy sales in Vermont are supplied by two large IOU utilities.

Since 1995, Vermont has relied on two contracts for about two-thirds of its energy. Most Vermont utilities have a part of a system contract with Hydro-Quebec, which supplies energy and capacity at just under 7 cents/kWh. The two large IOUs have a unit contingent contract with the Vermont Yankee Nuclear Power Plant for about 300 MW, which supplies power at about 4 cents/kWh. In part, because of the favorable price terms of these contracts, Vermont has the lowest rates in New England.

The operating license for the Vermont Yankee plant expires in 2012. A portion of the HQ contract expires in 2012 and the bulk of it expires in 2016. There is some concern around the state that the lights will go out, and while that will not happen, it is clear that most of Vermont ratepayers are heading toward a time of price uncertainty.

Given this situation, the legislature felt it was appropriate to ask Vermonters about their feelings concerning future power supply options for Vermont utilities. As a result, they passed legislation requiring the Department of Public Service to conduct a comprehensive statewide public process to determine the attitudes of Vermonters regarding future electric supply choices.

I. OVERVIEW

The Department of Public Service was tasked with conducting a comprehensive, statewide public engagement process on energy planning focused on energy supply choices facing the state beginning in 2012. The purpose of the process was to educate the public about the energy supply challenges facing the state; to gather meaningful and informed public input about values and preferences of Vermonters regarding energy supply; and, by doing so, to foster a broader base of public support for the resulting choices and inform all stakeholders, including the public advocate, about the feelings of Vermonters on this issue.

Initially, members from the Department of Public Service worked with legislators and stakeholders to create a request for proposal(s) for the project. In the end, a series of proposals were selected that engaged the public through three separate and distinct methods: Regional Workshops, Deliberative Polling, and online conferences. An

Advisory Committee for the project developed educational materials that provided a foundation for the discussions.

The regional workshops were a series of evening meetings lasting 4 hours (and including a light dinner for early arrivals), which were well advertised and open to anyone who cared to attend. The Deliberative Polling event represented a gathering of a random sample of Vermonters and was designed to measure changes in attitudes resulting from education about a certain issue. The online conferences were made available for individuals who were unable to attend in person. There was a concerted effort to prevent participation more than once by an individual.

II. CONTROLLING LEGISLATION

Act 208, which mandated the efforts, called for the engagement efforts

(1) to provide a strong information dissemination component, to develop a shared foundation of credible information that may serve as a basis for engaging in a meaningful dialogue;

(2) to be conducted in a manner that recognizes that potential choices for Vermont's electric energy supply may be precluded by the passage of time;

(3) to engage a broad base of Vermonters, including those who are currently engaged in energy issues as well as those who have not yet been engaged; and

(4) to reach throughout the state, as all Vermonters are stakeholders in this issue, and to establish a model for educating the public about the electric energy supply challenges facing the state.

III. EDUCATIONAL WHITEPAPERS & MATERIALS

The Department organized an Advisory Committee and Resource Panel consisting of 15 stakeholders to work with our consulting team to design materials explaining the various sources for energy generation and their impacts on costs, the environment, and other factors. These representatives were widely recognized as experts in fields that were deeply interconnected with Vermont's energy situation. The members were as follows:

Bob Griffin, Green Mountain Power
Richard Sedano, Regulatory Assistance Project
Patty Richards, Vermont Public Power Supply Authority
James Moore, VPIRG
James Matteau, Windham Regional Planning Commission
David Lamont, Department of Public Service
Steve Blair, IBM
Pat Haller, Efficiency Vermont
Andy Perchlik, Renewable Energy Vermont
John Zimmerman, Vermont Environmental Research Association
David McElwee, Vermont Yankee
Sylvie Racine, Hydro-Quebec
Eileen Simolardes, Vermont Gas Systems

John Irving, Burlington Electric Department
Kerrick Johnson, VELCO.

This group was charged with completion of an 80-page background document, through which general consensus was reached about the facts surrounding the State's energy situation and future options. The consensus nature of this document proved valuable in dispelling some preconceived notions regarding power sources and allowing the discussion to move beyond arguments about facts and into a discussion of preferences.

These background materials were distributed to participants at five Regional Workshops (800 people) and at the deliberative poll (200 people) and made available through a website (http://www.vermontsenergyfuture.info/).

IV. REGIONAL WORKSHOPS

Dr. Jonathan Raab of Raab Associates in Boston, Massachusetts, in partnership with the Consensus Building Institute, the contractors, ran the five regional workshops that would be based on materials developed with the Advisory Committee and Resource Panel for the project.

Dr. Raab was the facilitator of the meetings of these groups and was responsible for the drafting of the background materials. He also co-facilitated the development of polling questions with Dr. Robert Luskin and his team from the Center for Deliberative Research at the University of Texas.

The completion of the polling questions was no small feat, given the environment in which they were created. The nature of the committee and the panel was purposely designed to create a forum where "champions" from various sources of generation could debate with one another. During this process, it was quite common for opposing viewpoints on energy sources and their attributes to be the source of intense discussion. Additionally, the members subjected the polling questions and background materials to several revisions.

Five locations across the state served as "hosts" for the regional workshops. Each of these locations was selected because of its proximity to a population center. Several distribution utilities further contributed to the effort by paying for the space and meals for participants. In October of 2007, meetings were held at the following locations:

Oct. 3, 2007, St. Johnsbury Elementary School, St. Johnsbury (Hosted by DPS)
Oct. 17, 2007, Tuttle Middle School, So. Burlington (Hosted by GMP)
Oct. 18, 2007, Montpelier Elks Club, Montpelier, (Hosted by VELCO)
Oct. 29, 2007, Dean Educational Center, Springfield (Hosted by WRPC)
Oct. 30, 2007, Holiday Inn, Rutland (Hosted by CVPS).

The agenda of the meeting incorporated a presentation by the Department's senior power planner, professionally facilitated discussions of small groups of citizens, a question-and-answer panel with members from the Advisory Committee and Resource Panel, a public comment period where the Commissioner of Public Service fielded comments from the audience, and a polling session utilizing "key pad" technology that immediately registered and displayed the results for the audience.

The following highlights emerged from the polling and discussions at the regional workshops:

The overarching theme expressed by the participants was a great concern for the environment and the effects of energy decisions on global climate change. In particular, the participants held the following views:

Environment: Participants indicated a strong concern for the environment, especially air pollution and greenhouse gas emissions.

Resource Prioritization: Energy efficiency, wind power, and hydroelectric power were identified as the most desirable resource categories, while coal, oil, and nuclear power were identified as the least desirable.

Energy Efficiency: Participants expressed a strong desire for an increase in funds for efficiency measures (82%); over 75% believed Vermont should meet as much of its electricity needs as possible through efficiency.

Renewables: 94% believed that Vermont should obtain the majority of its energy from renewable sources of energy; 84% believed that there should be a mandated minimum percentage of electricity that comes from renewables.

Wood: While wood ranked fifth overall in resource prioritization, many discussions regarded wood as an attractive, larger source of generation.

Hydro-Quebec: 80% of the participants believed that Vermont should continue to purchase from HQ. When asked to choose between HQ or oil, coal, gas, and out-of-state nuclear, support for HQ grew to 93%.

Vermont Yankee: When asked if Vermont should continue to purchase power from VY, 63% opposed further purchases. When asked to choose between Vermont Yankee or gas, oil, coal, and out-of-state nuclear, opposition changed to modest support with 54% of participants supporting commitments toward the resource.

Rate Issues: Participants expressed strong support for daily time-differentiated rates to reflect real underlying cost differentials. However, participants were relatively undecided between stable monthly bills versus access to market rates.

Generation: Participants showed a small preference for acquiring power from Vermont utility-owned generation vs. contracting for power.

Size: Participants showed a preference for smaller decentralized generation relative to centralized generation.

Location: About two-thirds of participants believed Vermont's power should be generated in state.

V. DELIBERATIVE POLLING EVENT

The Deliberative Polling event was designed to bring a random sample of Vermonters together for a weekend to discuss energy issues. An initial random sample of Vermonters was polled to determine their pre-event attitudes regarding energy choices. They were then recruited to spend the weekend deliberating the issues of how Vermont should meet its future electricity needs and then questioned again at the conclusion of the weekend sessions. The post-deliberation distribution of opinion gives a picture of what Vermonters would think about these issues if they knew, thought, and talked more about them. The contrast between the pre- and post-deliberation distribution suggests how opinions move and vary from the less considered ones that are visible in ordinary surveys.

The results address a large number of policy issues: for example, what reliance should be placed on energy efficiency and on energy from various sources like wind, nuclear, and hydro in meeting Vermont's future electricity needs; whether the state should continue to buy energy from existing suppliers like Vermont Yankee and Hydro-Quebec; and whether the state should rely more on a few large central facilities or a larger number of smaller and more geographically distributed ones.

After deliberating, the participants' considered opinions on these matters included the following:

- More than a quarter of the state's electricity should come from hydro, about 20% from wind, around 15% from solar, and just a tad less from wood and nuclear. They wanted almost none of it, however, to come from oil or, especially, coal.

- Eighty-six percent of them agreed (49% of them strongly) that Vermont should continue buying electricity from Hydro-Quebec, and 97% agreed (76% strongly) that it should continue buying electricity from the Vermont-based independent Power Producers, while a slender plurality (50% versus 48%, with 2% in the middle) agreed that it should continue buying electricity from the Vermont Yankee nuclear plant.

- Ninety percent supported (74% strongly) a wind farm's being built if it were visible from where they live.

- Sixty-nine percent wanted to see the electricity used by Vermonters produced mostly or entirely (13% entirely) inside Vermont.

- Seventy percent preferred seeing Vermont's electricity produced by smaller facilities, spread across the state, compared to 10% who preferred seeing it produced by a few large, centralized plants (20% in the middle).

- In many cases the deliberative experience shifted the participants' policy attitudes to a statistically significant degree. For example:

- The support for continuing to buy from Hydro-Quebec increased by 20%, and the support for continuing to buy from the Independent Power contracts improved by 8%, although the support for continuing to buy from the Vermont Yankee nuclear plant did not change significantly in either direction.

- The percentages of the state's electricity the participants wanted to see come from hydro and wood increased, while the percentage they wanted to see come from oil decreased.

The support for increasing efficiency as much as possible versus buying or generating power increased. The results also address many of the empirical premises (for example, how much reduction in usage can be gained by energy efficiency, and what percentage of the state's power could be supplied by each of various sources) and values or goals (for example, reducing greenhouse gas emissions, ensuring a reliable electricity supply, avoiding facilities that detract from the scenic beauty of Vermont, or keeping electric rates stable) that may underlie these policy attitudes. Knowing what goals the public wants energy choices to achieve and how well (before and after deliberation) it thinks given choices serve given goals sheds light on why it holds the policy preferences it does (before and after deliberation).

Some examples of the sample's post-deliberation opinions on relevant empirical premises are the following:

- Majorities of 55% and 64% thought that power not purchased from Hydro-Quebec or from Vermont Yankee would not have to be replaced by natural gas, coal, out-of-state nuclear, or oil.

- The participants thought that increased efficiency in the use of electricity could reduce Vermont's need for electricity by an average of 22% over the next 10 years.

- Wind, solar, and efficiency were seen as extremely friendly to the environment; methane, hydro, and wood, as slightly less but still very friendly; nuclear and natural gas as somewhat unfriendly; and coal and oil, in that order, as extremely unfriendly.

- Majorities thought that cleaner energy will cost more in the short run, but will not do so in the long run.

Here too, deliberation brought some significant changes, among them the following:

- The percentage by which the participants thought the need for electricity could be reduced over the next 10 years declined by 9%.

- The percentages thinking that power not purchased from Hydro-Quebec or from Vermont

- Yankee would not have to be replaced by natural gas, coal, out-of-state nuclear, or oil increased.

- Wood and methane came to be seen as significantly friendlier, and oil, coal, and natural gas as significantly unfriendlier to the environment.

The percentage thinking that cleaner energy would cost more in the short run increased. Some examples of relevant values held by the participants include the following:

"Minimizing air pollution," "getting electricity from resources that will never be used up," "reducing the emission of gases that may contribute to climate change," and "ensuring a reliable supply of electricity" were regarded as the most important of a series of possible goals to be considered in deciding how Vermont might meet its future electricity needs and "keeping electric rates stable for consumers" and, especially, "avoiding facilities that detract from the scenic beauty of Vermont" as the least important.

As among several possible "threats," the level of concern was highest for "greenhouse gases produced by burning fuel to make electricity" and for "other air pollution produced by burning fuel to make electricity," somewhat lower but still high for "radioactive waste from nuclear power plants" and "damage to river habitats from building hydro power facilities," and much lower for "the visual impact of wind farms on the scenery of Vermont."

Unlike policy attitudes and empirical premises, values are not expected to change much from deliberation, and by and large these did not, although the importance attached to "getting electricity from resources that will never be used up" and "minimizing air pollution" did increase.

The participants learned a great deal, improving their average score on a series of factual knowledge questions by a whopping 39.5%. They also expressed appreciation for the process, overwhelmingly regarding it as valuable and fair. They came to care (still) more about how the electricity they use is produced.

VI. WEB-BASED CONFERENCES

The language in Act 208 directed the Department not only to provide education for participants on energy, but also to create a methodology that could be readily duplicated for other issues under consideration. Given the nature of the Internet and the increasing role technology plays in all Vermonters' lives, a web-based approach was identified as an innovative means of reaching out to people who may not have been able to participate in a traditional meeting. To maintain as much consistency as possible, the regional workshop survey was re-created in the online environment. Preceding topics were drafted that were designed to be open-ended and engender discussion.

After review of the demographic information of participants at the regional workshops and the deliberative polling event, it became clear that the residential rate class was well represented; business and industry representation was much lower. Given that information, it was decided that the conferences would be made available to the general public that had registered through Raab Associates and would not be able to attend a workshop, as well as to associations and organizations that could reach out to verifiable Vermont populations who were interested in participating. This turned out to be a necessary step, as at least one out-of-state anti-nuclear organization attempted to flood the conferences with their membership. After all conferences were complete, the DPS staff identified two additional participants who resided out of state. Because of this, their results were removed from the sample.

The people who participated in the 10 online conferences represented a sample of people best identified as business or industry related. In total, 75 people participated in the online conferences and provided results that paralleled the regional workshops.

It should be noted that these conferences were conducted in December of 2007, during a time when the holiday season was reported to have greatly decreased people's ability to participate. Also, some groups did not have an interest in participating due to time commitments or other factors. Nonetheless, 75 participants do provide a depth of insight that should be considered and in fact represent a larger audience than attended the St. Johnsbury regional workshop.

The participants' comments recorded in the online conferences were captured and documented in the detailed report for the online conferences. They can be summarized as having a deep regard for Vermont's environmental resources and are associated with a concern for the role of energy in global climate change.

Environment: Participants related that they were concerned about pollutants, greenhouse gases, and sustainability.

Resource Prioritization: The highest priorities identified were hydro, wind, and efficiency; the lowest priorities were identified as coal, solar, and nuclear power.

Energy Efficiency: Participants indicated a preference (53%) for increased spending on efficiency measures.

Renewables: 23% thought the current levels of renewables was acceptable, while 72% believed that Vermont should increase the amount of renewables used.

Wood: Wood was a relatively innocuous topic in the online conferences. It was neither selected nor de-selected as a potential source of future generation.

Hydro-Quebec: 94% of the conference participants believed the state should continue to purchase power from Hydro-Quebec. Additionally, a large majority believed hydroelectric power is environmentally friendly.

Vermont Yankee: As with the other components of the public engagement process, nuclear power is a divided issue. While the topic was initially divided, support grew to 73% when participants were confronted with a choice between VY and oil, coal, gas, or out-of-state nuclear power. Issues considered positive, no greenhouse gases and price; negative, radiological waste.

Rate Issues: Participants tended to favor choice and economy in regard to rate issues. There was slight support for dynamic or cost-based time-of-use pricing.

Generation: A majority preferred contracts or had no preference for new power vs. utility-owned facilities.

Size: Participants appeared to prefer smaller, decentralized facilities that were suggestive of a renewable strategy.

Location: Conference participants appeared to be indifferent to the location where power was generated.

The use of Internet conferences is unique to governance in Vermont. The technology can play an increasingly important role, if used and facilitated correctly. In this case, we learned lessons that can help future deliberations: shorter polling questions, better advertisement, and hosting by organizations that have the capacity and time to participate. As we proceed forward, the low cost of the software and the ease of use could help other state agencies and organizations engage the people of our state in a way not previously explored.

VII. CONCLUSIONS

The work of the members of the advisory committee, the resource panel, consultants, and the staff of the Department of Public Service has resulted in the largest known sample of opinion regarding energy, through various methods, within the nation. It has provided a statistically large percentage of Vermonters with the venue for learning about energy and

expressing their opinions about how we should forge ahead into Vermont's Energy Future.

We have learned that regardless of how we engage Vermonters, there is an underlying appreciation for our natural resources that impacts the decisions we make. We have learned that people have a desire to embrace clean sources of energy, even if at an additional cost. Finally, we have learned that many of the desires expressed in these processes either are part of our existing energy strategy or have been identified as actionable in the future.

APPENDIX C - RESOURCES

Alliance for Climate Action/10% Challenge: Community energy organizing and programs including motivating behavior change, raising public awareness, and celebrating community progress to achieve target goals to reduce greenhouse gas emissions, 802-865-7375, www.10percentchallenge.org.

American Council for an Energy-Efficient Economy: *Consumer Guide to Home Energy Savings* (including listings of most efficient products), *Green Book: The Environmental Guide To Cars and Trucks* (yearly), *Guide to Energy-Efficient Office Equipment*, 202-429-0063, http://aceee.org.

Apollo Alliance Vermont: A coalition of labor, business, community, and environmental groups dedicated to increasing Vermont's energy independence by advocating for clean energy policies in the state legislature. Learn more at http://wwww.apolloalliance.org/state_and_local/Vermont/index.cfm

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE): Provides training for staff in proper maintenance and operation of mechanical systems. Jay Pilliod, President of the Champlain Valley Chapter, jpilliod@veic.org,www.ashraevt.com.

Association of Vermont Conservation Commissions: A network of conservation commissions working in communities across Vermont to steward the state's natural resources. Visit avccvt.org for more information.

Association of Vermont Recyclers: Provides technical assistance to communities and schools, 802-454-8400, admin@vtrecyclers.org.

Building Green, Inc.: Authoritative information on environmentally responsible building design and construction. Refer to *GreenSpec Directory: Product Listings & GuidelineSpecifications*, February 2006. Learn more at www.buildinggreen.com.

Burlington Electric Department: Burlington's municipally owned electric utility, offering residents and businesses energy-efficiency programs. For more information visit www.burlingtonelectric.com, email bedwebmail@BurlingtonElectric.com, or call 802-658-0300.

Biomass Energy Resource Center: Consults on biomass and cogeneration projects. Tim Maker, 802-223-7770, tmaker@biomasscenter.org.

Burlington Climate Protection Task Force: "The Climate Action Plan," http://www.burlingtonelectric.com/SpecialTopics/Reportmain.htm or Debra Sachs, 802-865-7330.

Citizen Works: This nonprofit works to strengthen citizen participation in community decision making and has one of the most complete grassroots organizing guides available on the Internet - *Introduction to Organizing*. Read more about how to structure, build, and sustain a group: http://www.citizenworks.org/tools/town/tools-town.php.
Clean Air-Cool Planet: Assists municipalities, universities, and businesses with greenhouse gas assessments and action. Visit: www.cleanair-coolplanet.org for more information.

COMMUNITY ENERGY-EFFICENCEY RESOURCES *

ARLINGTON, Arlington Shaftsbury, Sandgate, East & West Arlington, Sunderland; utility representatives (electric and gas)—CVPS

COLCHESTER, Colchester Village and Bay; utility representatives (electric and gas)—GMP, VGS

ESSEX, Essex Jct, Essex Town, Essex Center; utility representatives (electric and gas)—GMP, VGS; Existing Energy Committees, Essex Energy Committee

LONDONDERRY, Londonderry, Jamaica, Stratton, Winhall, Landgrove, Andover, Bondville, Windham, Peru, Weston, South Londonderry; utility representatives (electric and gas)—CVPS; Existing Energy Committees, Conservation Commission, Londonderry Energy Committee

MILTON, Milton, Westford; utility representatives (electric and gas)—CVPS, VGS

ST. ALBANS, St. Albans, Swanton, Sheldon, Fairfax, Georgia, East Fairfield, Bakersfield, Fletcher; utility representatives (electric and gas)—CVPS, VGS

WINOOSKI, Winooski; utility representatives (electric and gas)—GMP, VGS; Existing Energy Committees, Winooski Falls Development, St. Michael's College "Green Up" Club

BRATTLEBORO, Brattleboro, West Brattleboro, West Dummerston, Townshend, West Wardsboro, Newfane, Brookline, Wardsboro; utility representatives (electric and gas)—CVPS; Existing Energy Committees, Brattleboro Climate Protection, Putney Energy Committee

Compost Center—From backyard composting to understanding Vermont's laws, the State of Vermont Department of Environmental Conservation helps inform, provide technical assistance, and network to promote composting and source separated organic

* Source: James Massie, Geographic Targeting Manager, Efficiency Vermont

waste. Visit: http://www.anr.state.vt.us/dec/wastediv/compost/main2.htm. For school composting programs, contact: Association of Vermont Recyclers at ww.vtrecyclers.org.

"EarthRight's Guide to Town Energy Planning in Vermont with Model Town Energy Plan" by Bob Walker, Chris Mason, and Alan Aaron. Developed by EarthRight Institute, 1992. For copies of this guide contact: VT Department of Public Service at 802-828-2811.

Efficiency Vermont—Financial and technical assistance for energy savings for Vermont residents, businesses, and towns, efficient lighting and appliance rebates, EnergySmart home energy analysis CD, list of home energy auditors and weatherization contractors, municipal services, commercial efficiency standards, energy efficiency improvements to school facilities and operations, and more. In addition, explore professional development and training opportunities online. For general information, call 888-921-5990 or visit http://efficiencyvermont.org and ask for specific program contact.

Empowerment Institute—*Low-Carbon Diet, A 30-Day Program to Lose 5000 Pounds* by David Gershon. The book helps determine CO_2 footprints, organize a campaign, and work on this issue in communities, schools, and workplaces. For more information visit: empowermentinstitute.net.

Energy Federation Inc. (EFI)—A nonprofit selling energy-efficient products and weatherization supplies, 800-876-0660, info@efi.org, www.efi.org.

Energy Guide—Information on efficiency and appliances, www.energyguide.com

Energy Star—Appliance efficiency ratings, www.energystar.gov/products/

Energy Star—"Do It Yourself Guide To Home Energy Sealing." Free. Download from http://www.energystar.gov/index.cfm?c=home_sealing.hm_improvement_sealing or order a copy by calling 888-782-7937.

Entities Providing Energy Audits and Assessments

- Burlington Electric Department (for Burlington only)
- Home Performance with Energy Star Contractors
- Efficiency Vermont
- Sustainable Energy Resource Group
- Vermont Gas Systems
- Vermont High Performance Schools Initiative
- Vermont Interfaith Power & Light
- Vermont Office of Economic Opportunity
- Vermont Small Business Development Center
- Vermont Superintendents Association--School Energy Management Program

Fairwind Vermont—Vermont citizens groups supporting development of sensible wind power in the state. For more information contact: Rob Roy MacGregor, windfair@sover.net or 802-824-3642.

Green Community Technologies—An inventory and assessment service to help identify and implement appropriate alternative options to infrastructure investment. Contact Shanna Ratner, Principal, Yellow Wood Associates, shanna@yellowwood.org, 802-524-6141.

Home Energy Assistance Teams—Existing energy committees offer a great network of leaders who train volunteers to assess local building needs. For more information, contact SERG at 802-785-4126 or SERG@valley.net.

Home Performance with Energy Star Contractors—Provides audits and retrofit services on a fee-for-service basis throughout Vermont. For a list of certified Home Performance with Energy Star contractors, contact Efficiency Vermont at 888-921-5990 or www.efficiencyvermont.com.

Idle-Free Vermont—A nonprofit, grassroots campaign to raise awareness of needless idling while collecting petition signatures to advance enactment of state law. Visit idlefreevt.com or contact Wayne Michaud at wmichaud@gmavt.net.

International Council for Local Environmental Initiatives (ICLEI) Cities for Climate Protection Program—Assists communities with a five-part program, including establishment of municipal emissions reduction targets, emissions inventory via online software and progress. To learn more, visit: www.iclei.org/us.

Kilawatt Partners—Offers a seven-step procedure for institutions to reduce their energy use and bills. Call 802-985-2285 or visit www.kilawatt.com for more information.

Municipal Energy Program—This program funds a Municipal Energy Specialist (MES) who provides assistance identifying ways municipally owned buildings can reduce energy costs through conservation and efficiency. Services include facility energy evaluation, assistance identifying contractors to install efficiency upgrades and rebates, and financing to pay for upgrades. MES can work with energy committees and municipal planners to prioritize projects and get them incorporated into the Town Plan. Program funded by Rebuild America until August 2007. Call Alison Hollingsworth at 1.888.921.5990 extension 1105.

New England Grassroots Environment Fund—A small grants program designed to foster and give voice to grassroots environmental initiatives in the Northeast. Visit www.grassrootsfund.org or call 802-223-4622.

Northeast Energy Efficiency Partnerships—Works with press throughout Northeast. Tracks policy moves in energy efficiency. 781-860-9177, www.neep.org.

Public Engagement and Grassroots Organizing Resources—*Engaging Citizens in Vermont's Energy Future*, prepared by the Snelling Center for Government, Burlington, Vermont, 2006. For more information, visit http://www.snellingcenter.org/filemanager/filedownload/phpyipE7U/EnagagingCitizensinVermontsEnergyFuture.pdf

Regional Planning Commissions

- Addison County Regional Planning Commission
- Bennington County Regional Planning Commission
- Central Vermont Regional Planning Commission
- Chittenden County Regional Planning Commission
- Lamoille County Planning Commission
- Northeastern Vermont Development Association
- Northwest Regional Planning Commission
- Southern Windsor County Regional Commission
- Two Rivers-Ottauquechee Regional Commission
- Upper Valley Lake Sunapee Regional Planning Commission
- Windham Regional Commission
- VAPDA - Vermont Association of Planning and Development Agencies

Renewable Energy Vermont—Trade association for Vermont renewable energy dealers. Contact REV at 802-229-0099, perchlik@REVermont.org, www.REVermont.org.

Rocky Mountain Institute—Energy consultants, researchers, and program developers. RMI offers many excellent free energy studies and resources. 970-927-3851, www.rmi.org.

School Energy Management Program—Provides free assessments of a school's energy efficiency and life-cycle cost analysis for various renewable projects. Contact Norman Etkind, Director, at 802-229-1017, VSASEMP@yahoo.com, or www.vtvsa.org.

Solid Waste—For tips on managing solid waste disposal, recycling products, and how to handle hazardous waste, contact your local solid waste district. Find out more at: http://www.anr.state.vt.us/dec/wastediv/solid/swmdlist.htm 3 2

Sustainable Energy Resource Group—Consults with communities on energy organizing, planning, and programs. Conducts energy audits. Provides discounts on efficiency and renewable products and services through its Energy Alliance. Bob Walker, 802-785-4126, SERG@valley.net, www.SERG-info.org.

USDA Rural Development—Community Development Program—Makes loans and loan guarantees for renewable and energy efficiency improvements including grants. For more information visit: http://www.rurdev.usda.gov/rbs/farmbill/what_is.html

Vermont Association of Planning and Development Agencies—These regional planning entities provide technical assistance, GIS mapping, and data sources for community and regional planning and economic development. For more information, visit www.vapda.org.

Vermont Biodiesel Project—A public/private collaboration designed to help accelerate growth of the emerging biofuels industry in Vermont. Netaka White, 802-388-1328, netaka@vermontbiofuels.org, www.vtbiodieselproject.org.

Vermont Green Building Network—Promoting green building in Vermont and the benefits of high performance building design and construction. To learn more and to obtain helpful contact information visit: www.vgbn.org

Vermont Community Action Programs—There are several Vermont programs that provide low-income weatherization and fuel assistance as well as fee-for-service energy audits to non-income-qualifying residents. Find out more about these programs from the following organizations (refer to Vermont Office of Economic Opportunity for more information).

Vermont Green Purchasing Contracts—Assists schools and municipalities in obtaining environmentally preferable products, made from non-toxic or recycled materials, at a lower cost. Judith Jamison 802-828-2211, Judith.jamieson@state.vt.us, www.bgs.state.vt.us/facilities/engineering.htm.

Vermont Department of Housing and Community Affairs—Provides information on housing, land use, brownfields initiatives, community development, historic preservation, and a downtown program for community growth and infrastructure development. For more information, visit http://www.dhca.state.vt.us/.

Vermont Department of Public Service—Public advocate on energy issues, efficiency resources, offers free "Guide to Municipal Energy Planning." 802-828-2811

Vermont Earth Institute—Promotes sustainability and grassroots activism through Eco-Parties, Sustainable Living Networks, and Discussion Courses, including a four-session climate change course. Contact Barbara Duncan, VEI@valley.net, 802-333-3664.

Vermont Energy Education Program—In-school energy education curriculum and hands-on learning tools. Fran Barhydt, veep@kingcon.net 802-626-8346 or Andy Shapiro, 802- 229-5676, andy@energybalance.us. www.veep.org.

Vermont Energy Investment Corp. —VEIC helps communities and individuals reduce the economic, social, and environmental costs of energy consumption through the promotion of 3 3 cost-effective energy efficiency and renewable energy technologies. Contact Beth Sachs, Executive Director, bsachs@veic.org, 800-639-6069, www.veic.org.

Vermont Energy Star Homes—A joint service of Efficiency Vermont and Vermont Gas offering financial and technical assistance to build energy-efficient homes. Jeff Gephart, contact, 800-893-1997, www.vtenergystarhomes.com

Vermont League of Cities and Towns—A non-profit, non-partisan membership-based organization serving communities across Vermont. VLCT offers a variety of professional development and services to municipal officials. To learn more visit: www.vlct.org

Vermont Gas Systems—Supplies natural gas to customers in Chittenden and Franklin counties and offers energy efficiency programs. For more information, visit http://www.vermontgas.com. Call 802.863.4511 or visit www.vermontgas.com.

Vermont High Performance Schools Initiative—A resource to improve the design, construction, and operations of schools. Call 802-865-7375 or visit www.vthps.org.

Vermont Interfaith Power & Light—Promoting conservation, efficiency, and renewables in congregations and communities across Vermont. Learn more about how to undertake an energy audit in your place of worship by calling 802-434-7307 or visiting www.vtipl.org.

Vermont Natural Resources Council—A statewide education, research, and advocacy organization working at the local, state, and national levels to promote greater investment in clean, renewable energy supplies and action to combat climate change. VNRC is a partner in the VECAN project, focusing on outreach and grassroots organizing and serves on the Governor's Climate Change Commission. Contact 802-223-2328 or visit www.vnrc.org.

Vermont Office of Economic Opportunity—Low-income weatherization and fuel assistance programs. For a list of eligibility guidelines and services, contact Jules Junker, 802-241-2452, julesj@wpgate1.ahs.state.vt.us, www.ahs.state.vt.us/oeo/weather.htm Refer to office in your area:

- **Bennington-Rutland Opportunity Council, Inc. (BROC)** serving Bennington: 802-447-7515; Rutland: 802-775-0878 or 1-800-717-2762
- **Central Vermont Community Action Council, Inc. (CVCAC)** (serving Lamoille, Orange and Washington counties) 802-476-2093
- **Champlain Valley Office of Economic Opportunity, Inc. (CVOEO)** (serving Addison, Chittenden, Franklin, and Grand Isle counties) 802-862-2771 or 1-800-287-7971
- **Champlain Valley Weatherization Service** 802-660-3452-or 1-800-545-1084; Middlebury: 802-388-0373 or 1-800-639-1614 St. Albans: 802-524-6804 or 1-800-639-2319
- **Northeast Employment and Training Organization, Inc. (NETO)** (serving Caledonia, Essex and Orleans counties) St. Johnsbury: 802-748-8935, Newport: 802-334-7378

- **Southeastern Vermont Community Action, Inc. (SEVCA)** (serving Windham and Windsor counties) Westminster, VT 05158, 802-722-4575

Vermont Peak Oil Network—A statewide network of individuals and groups working regionally across Vermont on issues of relocalization and sustainability. Annie Dunn Watson, www.vtpeakoil.net. Or email newsletter@vtpeakoil.net.

Vermont Planning Information Center—A clearinghouse of information for planning commissions, zoning boards, development review boards, and their staff and all others involved in land use planning and regulation in Vermont. Offers planning guidance and small education grants. Learn more at http://www.dhca.state.vt.us/Planning/MEG.htm.

Vermont Public Interest Research Group—Statewide energy and consumer interest advocates. 802-223-5221 ext. 4787.

Vermont Rideshare—Promoting commuter carpooling. 800-685-7433, www.VermontRideShare.org.

Vermont Sierra Club—Works on environmental and energy issues. Denis Rydjeski, DRR@Dartmouth.edu, 802-885-4826.

Vermont Small Business Development Center Environmental Assistance Program—Offers energy assessments free of charge for any Vermont small business. Contact Peter Crawford at 802-802-728-1423 or www.vtsbdc.org.

VT Trails / Bicycle Organizations

- VT Bicycle & Pedestrian Coalition (www.vtbikeped.org)
- VT Trails & Greenways Council (www.state.vt.us/anr/fpr/greenways)

VT Transportation Links

- Chittenden Co. Metropolitan Planning Organization (www.ccmpo.org)
- Chittenden Co. Transportation Authority (www.cctaride.org)
- Lake Champlain Transportation Company (www.ferries.com)
- Northwest Regional Planning Commission (www.nrpcvt.com)
- VT Agency of Transportation (www.aot.state.vt.us/progdev/documents/ltf/bicycle%26pedestrianprogram.htm)

Vermont Public Transit Association (VPTA) www.vpta.net

Vermont Forum on Sprawl Vermont Forum on Sprawl

Vermont League of Cities & Towns Municipal Assistance Center
http://www.vlct.org/municipalassistancecenter/

Vermont Land Use Institute at the Vermont Law School
http://www.vermontlaw.edu/elc/landuse/index.cfm?doc_id=1182

Vermont Smart Growth Collaborative www.vtsmartgrowth.org

Weatherization Assistance Program Technical Assistance Center—Information and resources for professionals and homeowners (especially low-income, elderly, and people with disabilities) interested in saving energy by weatherizing their homes or businesses. For more information about the Weatherization Assistance Program visit www.waptac.org.

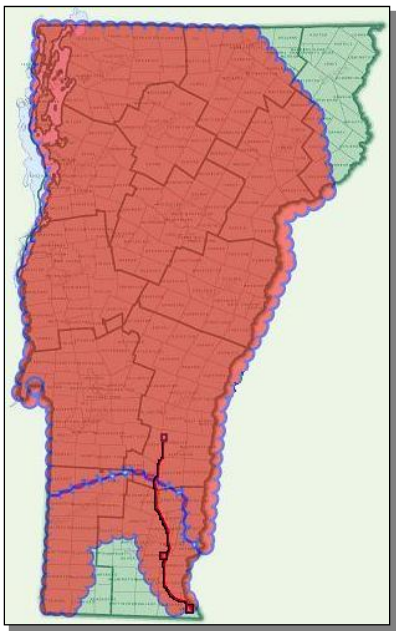
APPENDIX D - VERMONT SYSTEM PLANNING COMMITTEE RELIABILITY DEFICIENCIES IDENTIFIED

EXCERPTED FROM - VERMONT SYSTEM PLANNING COMMITTEE ANNUAL REPORT TO THE PUBLIC SERVICE BOARD AND PUBLIC SERVICE DEPARTMENT JANUARY 15, 2008

The Public Service Board opened Docket 7081 in response to concerns regarding the Northwest Reliability Project that there was insufficient time to adequately consider non-transmission alternatives. The Board's charge to participants in conducting Docket 7081 was to develop an approach to addressing transmission system reliability issues that would ensure "full, fair and *timely* consideration of cost-effective non-transmission alternatives."1 The Board's requirements reinforced and extended provisions adopted by the legislature in Act 61 of the 2005 General Assembly requiring the Vermont Electric Power Company (VELCO) to institute a long-range planning process, the objective of which is "to identify the potential need for transmission system improvements as early as possible, in order to allow sufficient time to plan and implement more cost-effective non-transmission alternatives to meet reliability needs, wherever feasible."

As part of Docket 7081, the Board approved an MOU that an Attachment F with is list of reliability deficiencies. MOU Attachment F comprised a transition plan for the treatment of reliability deficiencies that had already been the subject of some analysis and planning prior to the adoption of the Docket 7081 MOU. The purpose of Attachment F was to delineate the degree to which these projects would be subject to, Step 3, Preliminary NTA Screening,[*] and to identify projects for which NTA screening, analysis, solution selection, implementation planning and cost allocation must be completed by July 1, 2010.[†] These provisions constitute exceptions to the timelines the MOU otherwise establishes. The following section describes the status of each reliability deficiency included in Attachment F.

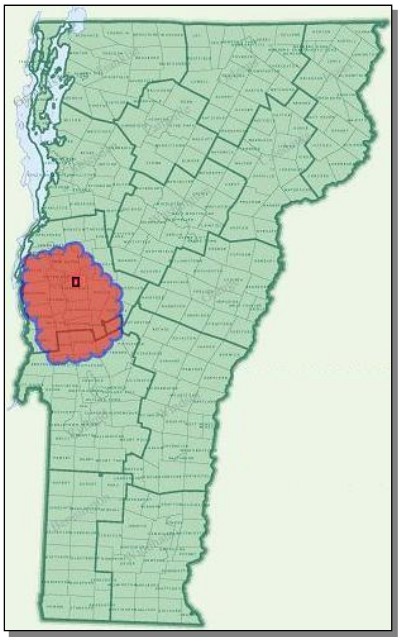
[*] Docket 7081 MOU ¶3.
[†] Docket 7081 MOU ¶ 31.



Southern Loop Study Area

The LRTP and the distribution utility have identified several reliability deficiencies in the Southern Loop Study in the LRTP and by Central Vermont Public Service (CVPS). At the VELCO system level, they include potential loss of the 345/115 kV transformer at Vermont Yankee, which affects parts of New Hampshire. . At the distribution utility, subsystem level, deficiencies in CVPS's system include 46kV line contingencies between Bennington and Brattleboro, loss of 115/46 kV and 115/69 kV transformers into Bennington or Brattleboro at Woodford Road and Vernon Road, and loss of the N186, which has the same impacts as loss of transformers at Vernon Road. These impacts are localized to the 46 kV and 69 kV subsystem load between Brattleboro and Bennington.

Detailed NTA analysis for the Southern Loop Study Area was completed in December, 2006, and, following an extensive public involvement processes, VELCO and CVPS completed solution selection and cost allocation and filed for Section 248 approval with the PSB in November 2007. The Board has opened Docket 7373 to consider the Southern Loop 248 petition.



The proposal submitted to the Board in Docket 7373 includes a commitment by CVPS to implement NTAs in Southern Vermont to defer an approximately 49 mile 115kV upgrade along CVPS' existing 46kV Southern Loop. CVPS has raised the matter of this component of the Southern Loop with the VSPC and has requested that the VSPC form a project study group to begin reviewing the relevant NTA analysis. Action on the recommendation will be taken by the VSPC at or before its next meeting, March 11, 2008.

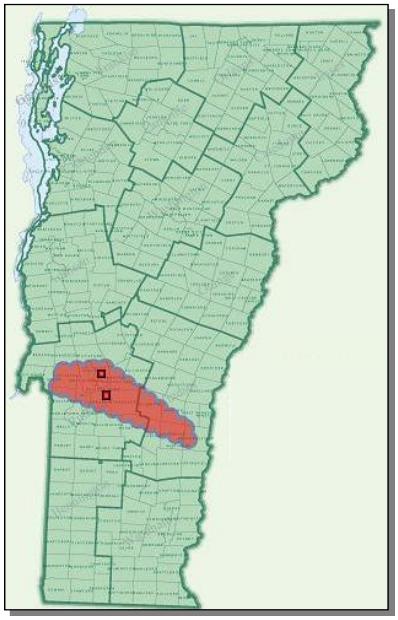
Middlebury Study Area

VELCO and CVPS have identified reliability deficiencies in the Middlebury Study Area. VELCO system issues include the impacts of loss of the transformers at New Haven and Middlebury. The CVPS subsystem deficiency concerns contingencies on the 46 kV radial line from Salisbury to Weybridge.

NTA screening was completed by CVPS in July, 2007, and resulted in the exclusion of NTAs for this project. The NTA screening and exclusion were presented to the VSPC Transmission Subcommittee at its December 10, 2007, meeting. The NTA screening and conclusion to exclude the Middlebury deficiencies from further NTA consideration will be presented to the full VSPC for its input at the March 11, 2008, meeting.

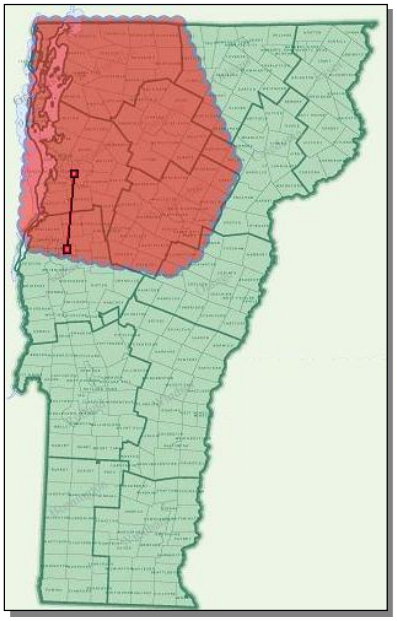
St. Albans-Fairfax-Georgia study Area

VELCO has identified reliability deficiencies associated with the potential loss of the St. Albans transformers and East Fairfax transformer at the subsystem level. Breaker failures at the Georgia substation affect the subsystem, and interrupt bulk power flows from Highgate south. At the subsystem level, CVPS has identified as reliability deficiencies the potential loss of the East Fairfax transformer, 34.5 kV line contingencies, and decommissioning of hydro facilities at Peterson Dam.
The scope of study for this group of reliability deficiencies has been completed, and transmission and distribution (T&D) analysis has been started. NTA screening has not yet been conducted. The utilities project presenting NTA analysis to the VSPC in May, 2008, and solution selection, implementation plans, and cost allocation to the VSPC in May, 2009.



Rutland Area/Central study Area

VELCO has identified bulk system reliability deficiencies associated with the overload of the Coolidge to Cold River 115 kV line, and loss of the Coolidge 345/115 kV transformer. Subsystem deficiencies are associated with loss of the North Rutland or Cold River transformers, and include inadequate all-lines-in service due to load growth. Analysis has not yet been completed on these projects. The NTA analysis is projected to be presented to the VSPC in July, 2008, and solution selection, implementation plans, and cost allocation to the VSPC in July, 2009.



New Haven/Williston Study Area

VELCO has identified potential overload of the New Haven to Williston 115 kV line as a reliability deficiency. No NTA analysis has yet been completed on this deficiency. VELCO projects presenting the NTA analysis to the VSPC in July, 2009, and solution selection, implementation plans, and cost allocation to the VSPC in July 2010.

Reliability Deficiencies Identified in the 2006 Long-Range Transmission Plan

The 2006 LRTP identifies 14 reliability deficiencies that are not addressed in Attachment F. Under the terms of the MOU, the VSPC must develop a priority list for these projects that establishes a timeframe for completion of the steps in the MOU. The VSPC prioritization must include: (a) the reason for the priority assigned to the deficiency; (b) if no likely transmission solution has yet been identified, the date by which further analysis of transmission solutions to the deficiency is proposed to be completed; (c) the date by which NTA analysis is proposed to be completed; and (d) the date by which a decision will be made concerning solution selection, implementation strategy, and cost allocation.* Once established, this list will guide the further consideration of the projects it addresses.

An initial draft of the project list required by ¶ 51 was presented to the VSPC on October 16, 2007, and an updated version was presented December 4, 2007. The VSPC has not yet formally adopted a priority list, but will do so in 2008. Once the list is adopted by the Committee, it will be submitted to the Board in accordance with ¶ 51. The following section summarizes the status of reliability deficiencies that were identified in the 2006 LRTP, but were not addressed in Attachment F of the MOU. These matters, together with the Attachment F list, will be included in the priority and timeline document to be submitted by the VSPC in 2008.

Loss of St. Johnsbury 115/34.5 kV transformer

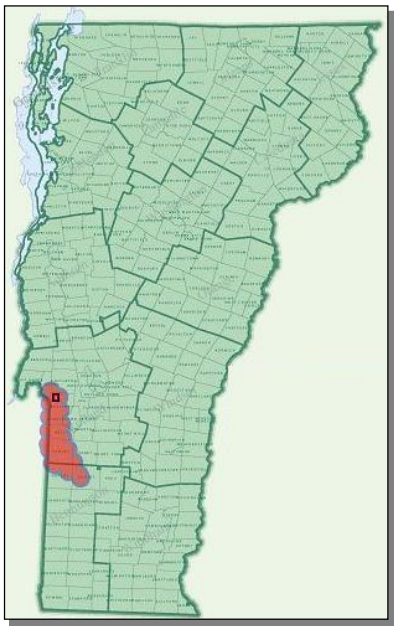
The loss of the St. Johnsbury transformer would result in the loss of all load at St. Johnsbury. This reliability deficiency is a CVPS subsystem issue. Proposed load growth at Burke Mountain, fed off Lyndonville Electric, prompted the completing of a first draft transmission analysis for this area in November, 2007. The transmission solutions examined in the analysis conducted thus far are to install a second 115/34.5 kV

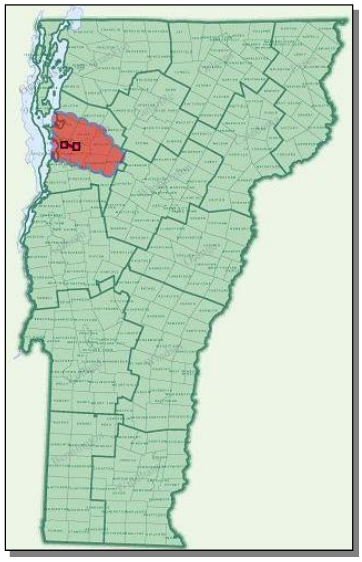
* Docket 7081 ¶ 51. However, ¶ 102 further modifies the applicability of MOU provisions to the area-specific collaborative addressing Tafts Corners and the City of Burlington waterfront.

transformer at St. Johnsbury with requisite substation expansion or the construction of a new substation, with one or two transformers, closer to the Lyndonville 34.5 kV feed. This project will be brought to the VSPC in 2008.

Loss of West Rutland-Blissville 115 kV line

The loss of the West Rutland-Blissville 115 kV line would cause unacceptable low voltage locally. This reliability deficiency is a CVPS subsystem issue. The transmission solution examined in the analysis conducted thus far is to install 16.2 MVAR of capacitor banks at Blissville. CVPS will apply the NTA screening tool to the project to determine whether it is applicable to the VSPC process since the capacitor bank.



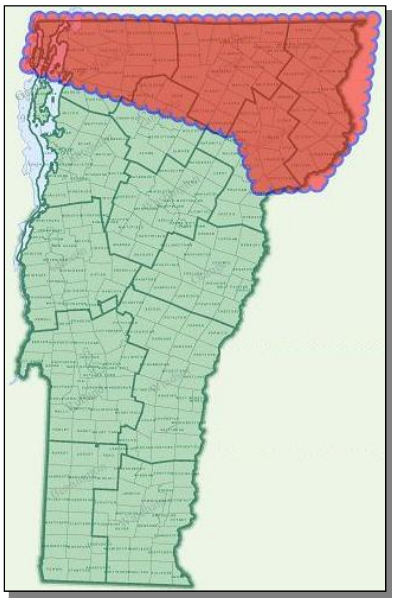


Loss of one Essex 115/34.5 kV transformer (East avenue)

Loss of one Essex 115/34.5 kV transformer may overload the other resulting in load shedding. This is a Green Mountain Power subsystem issue that was the subject of a previous area-specific collaborative, and for which the company, together with VELCO and Burlington Electric Department (BED), has applied for Section 248 approval in Docket 7314. Many transmission and non-transmission solutions were evaluated to supply the BED and Green Mountain Power (GMP) loads out to 2020. This analysis was reviewed as part of an Area Specific Collaborative, and the preferred project has been filed. As a result, the project will not be brought before the VSPC.

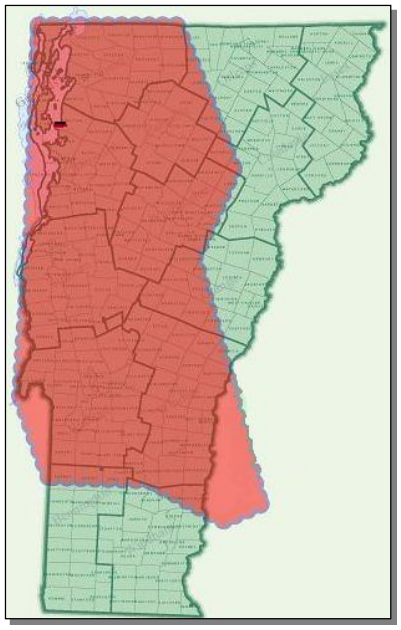
Loss of Hartford 115/46 kV transformer

Loss of the Hartford 115/46 kV transformer could cause unacceptable low voltages locally. The transmission solution examined in the analysis conducted thus far is installation of a second 115/46 kV transformer at Hartford with requisite substation expansion. This is a CVPS subsystem issue that will be revisited in the 2009 study cycle.



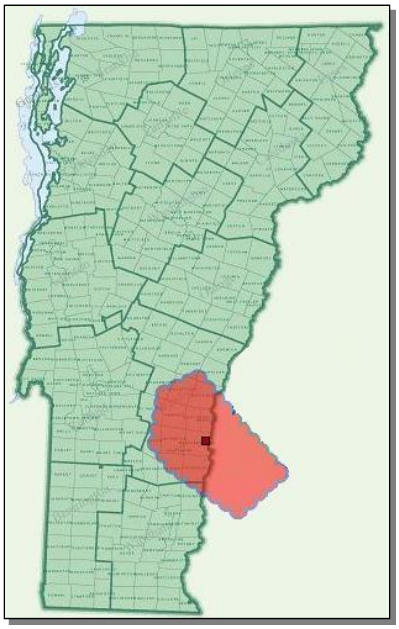
Low voltage or voltage collapse in Northern Vermont for loss of transmission at either end

The potential for low voltage or voltage collapse in northern Vermont due to loss of transmission at either end of the state will begin to be addressed as part of the Lyndonville study listed above. The transmission solution examined in the analysis conducted thus far is installation of a reactive power device at Irasburg substation with requisite substation expansion. The Lyndonville study proposes to improve the voltage by installing capacitor banks. This is primarily a bulk system issue that is the responsibility of VELCO.



Long-term loss of PV20 underground causeway cable

Long-term loss of the PV20 underground causeway cable, with many other outages, can cause severe and widespread voltage and thermal concerns. The transmission solution examined in the analysis conducted thus far is to install a second parallel PV20 causeway underground cable. This is a bulk system issue that is the responsibility of VELCO. The planning study has not yet begun. VELCO will revisit the issue in the 2009 study cycle.

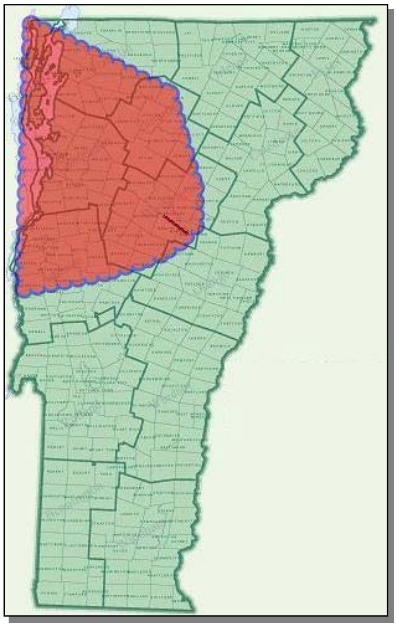


Breaker failure at Ascutney substation

Breaker failure at the Ascutney substation would result in unacceptable voltage and thermal performance locally. The transmission solution examined in the analysis conducted thus far is to improve the Ascutney substation from the current radial bus configuration to a breaker-and-a-half configuration with 115 kV capacitor banks and a second 115/46 kV transformer. This is primarily a bulk system issue that is the responsibility of VELCO and CVPS. The planning study has not yet begun and will be undertaken in the 2009 study cycle.

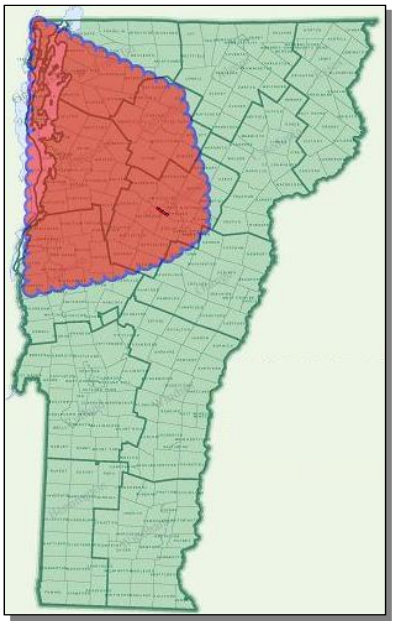
Loss of Williston to Tafts Corners 115 kV line

Loss of the Williston to Tafts Corners 115 kV line, with heavy flows from south to north, would overload the Queen City 115/34.5 kV transformer. The transmission solution examined in the analysis conducted thus far is to install a second 115/34.5 kV transformer at Queen City with requisite substation expansion. An alternative would be to sectionalize the underlying subtransmission network. This is primarily a bulk system issue that is the responsibility of VELCO and GMP. These constraints have been addressed by a proposal to automatically sectionalize the 34.5 kV system. Consequently no additional upgrades are needed at this time and no consideration by the VSPC will be required.



Loss of Barre to Berlin 115 kV line

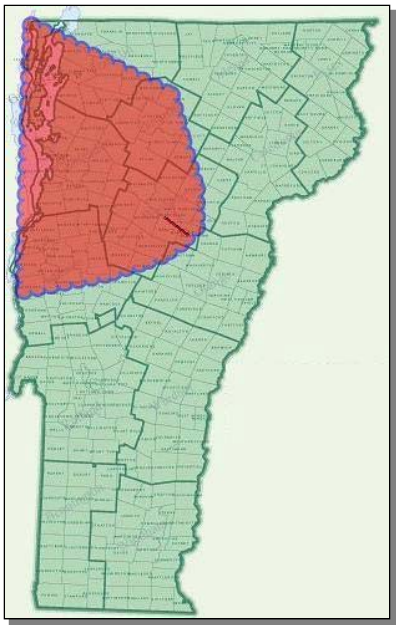
The loss of the Barre to Berlin 115 kV line section, when heavily loaded from east to west, would overload the Berlin transformer. The transmission solution examined in the analysis conducted thus far is to install either a larger transformer or a second 115/34.5 kV transformer at Barre with requisite substation expansion. An alternative would be to sectionalize the underlying subtransmission network. This is primarily a bulk system issue that is the responsibility of VELCO and GMP. These constraints have been addressed by a proposal to automatically sectionalize the 34.5 kV system. Consequently no additional upgrades are needed at this time and no consideration by the VSPC will be required.



Loss of Berlin to Middlesex 115 kV line

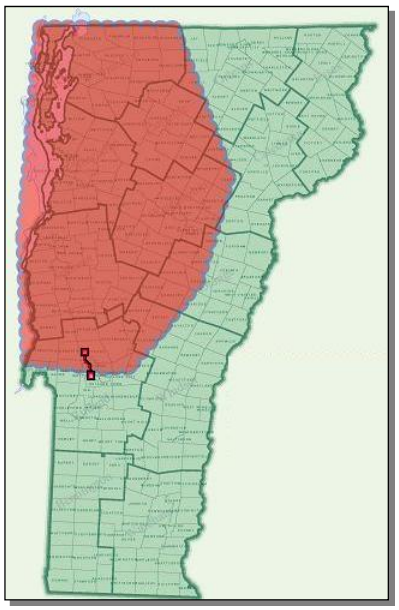
The loss of the Berlin to Middlesex 115 kV line section, when heavily loaded from east to west, would overload the Berlin transformer. The transmission solution examined in the analysis conducted thus far is to install a second 115/34.5 kV transformer at Berlin with any requisite substation expansion. An alternative would be to sectionalize the underlying subtransmission network. This is primarily a bulk system issue that is the responsibility of VELCO and GMP. These constraints have been addressed by a proposal to automatically sectionalize the 34.5 kV system. Consequently no additional

upgrades are needed at this time and no consideration by the VSPC will be required.



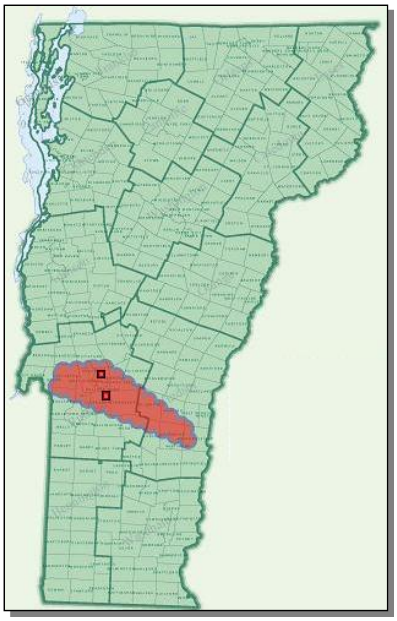
Overload of Barre to Berlin 115 kV line

Overload of the Barre to Berlin 115 kV line has been identified as a reliability deficiency at load levels projected to be reached in 2016. The transmission solution examined in the analysis thus far is to rebuild the Barre to Berlin line. This is a bulk system issue that is the responsibility of VELCO and will be addressed in the 2009 study cycle.



Overload of Florence to West Rutland 115 kV line

Overload of the Florence to West Rutland 115 kV line has been identified as a reliability deficiency at load levels projected to be reached in 2016. The transmission solution examined in the analysis thus far is to rebuild the line. This is a bulk system issue that is the responsibility of VELCO and will be addressed in the 2009 study cycle.



Overload of Cold River to North Rutland 115 kV line

Overload of the Cold River to North Rutland 115 kV line has been identified as a reliability deficiency at load levels projected to be reached in 2016. The transmission solution examined in the analysis thus far is to rebuild the line. This is a bulk system issue that is the responsibility of VELCO and will be addressed in the 2009 study cycle.

APPENDIX E - VERMONT COMPREHENSIVE ENERGY PLAN RELATION TO THE GOVERNOR'S COMMISSION ON CLIMATE CHANGE

Table IX-1 Recommendations from the Governor's Climate Change Commission Cross-Referenced to the Comprehensive Energy Plan Recommendations

GCCC	GHG Reductions (MMtCO2eq)			Net Present Value 2008–2028 (Million $)	Cost Effectiveness ($/tCO$_2$e)	Policy Option	CEP 2009
	2012	2028	Total 2008–2028				Rec. #
Energy Supply and Demand							
ESD-1	0.7	1.7	21.5	−$850.00	−$40.00	Evaluation and Continuation / Expansion of Existing DSM for Electricity and Natural Gas	37, 64
ESD-2	0.1	0.5	5.3	−$335.00	−$64.00	Evaluation and Expansion of DSM to Other Fuels	31,34 enacted into law S.209, S.350
ESD-3	0.02	0.2	2	−$107.00	−$55.00	Building Efficiency Codes, Commissioning, Training, Tracking	32, 33
ESD-4						Evaluate Potential for Contracting Nuclear Power	11
Scenario 1	0.5	1.1	16.7	−$140.00	−$8.00		
Scenario 2	0.3	0.7	10.2	−$70.00	−$7.00		
ESD-5	0.1	0.2	2.6	−$86.00	−$34.00	Support for Combined Heat and Power	13
ESD-6						Incentives and/or Mandate for Renewable Electricity	3, 4, 6, 8, 9, 10
Scenario 1	0.1	0.4	5.4	$9.00	$2.00		
Scenario 2	0.2	1.2	15.7	$38.00	$2.00		
ESD-7	Refer to the GCCC as Primarily a Funding Mechanism					GHG Cap-and-Trade and/or GHG Tax	17
ESD-8						Incentives for Clean Distributed Technologies for Electricity or Heat	3, 8, 9, 10, 23, 25
Natural Gas Fuel Switching	0.1	0.1	2.2	$15.00	$7.00		
Solar Thermal Water Heating	0.05	0.2	2.3	$67.00	$29.00		
ESD-9							10

GCCC	GHG Reductions (MMtCO2eq)			Net Present Value 2008–2028 (Million $)	Cost Effectiveness ($/tCO$_2$e)	Policy Option	CEP 2009
	2012	2028	Total 2008–2028				Rec. #
Scenario 1	0.03	0.2	2.1	−$6.00	−$3.00	Wind-Specific Support Measures	
Scenario 2	0.1	0.5	6.3	$10.00	$2.00		
ESD-10						Hydro-Specific Support Measures	9
Continued Large Hydro, Scenario 1	0.02	1.1	14.9	$0.00	$0.00		
Continued Large Hydro, Scenario 2	0.01	0.6	8.7	$0.00	$0.00		
New Hydro, Scenario 1	0.01	0.06	0.8	−$22.00	−$27.00		
New Hydro, Scenario 2	0.03	0.2	2.4	−$64.00	−$27.00		
Total							
Scenario 1 (Generation of Nuclear and Hydro at Historic Levels)	1.56	5.48	72.75	−$1,427.00	−$20.00		
Scenario 2 (Generation of Nuclear and Hydro at %50 of Historic Levels)	1.56	5.37	70.35	−$1,328.00	−$19.00		
Transportation and Land Use							
TLU-1	0.26	0.99	10.88	Net Savings		Compact and Transit-Oriented Development Bundle	48, 49, 52, 53
TLU-2	0.28	0.32	6.57	Net Savings		Alternatives to Single-Occupancy Vehicles (SOVs)	49, 50, 51, 54, 57
TLU-3	0.11	0.63	7.73	−$42.00	−$10.00	Vehicle Emissions Reductions Incentives	40, 66
TLU-4	0.2	0.32	5.3	Net Savings		Pay-as-You-Drive Insurance	Concept rejected by Leg. during 2008 session
TLU-5	0.12	0.42	5.75			Alternative Fuels and Infrastructure (LCFS)	26, 27, 43, 44

GCCC	GHG Reductions (MMtCO2eq)			Net Present Value 2008–2028 (Million $)	Cost Effectiveness ($/tCO$_2$e)	Policy Option	CEP 2009
	2012	2028	Total 2008–2028				Rec. #
TLU-6	0.05	0.2	2.22			Regional Intermodal Transportation System – Freight and Passenger	****
TLU-7	0.06	0.19	1.86	−$1.00	−$1.00	Commuter Choice/Commuter Benefits	****
TLU-8						Plug-in Hybrids [part of TLU-5]	43
TLU-9						GHG-Related Transportation Funding Mechanisms	
Sector Total Before Adjusting for Overlaps	1.09	3.07	40.31				
Sector Total Plus Recent Policy Actions							
****						Additional Recommendations Not Covered in GCCC	38, 39, 41, 42, 46
Agriculture, Forestry, and Waste Management							
AFW-1	0.004	0.02	0.2	Not Quantified	Not Quantified	Programs to Support Local Farming / Buy Local	Not Directly Energy Related
AFW-2	0.08	0.1	1.6	$4.20	$3.00	Agricultural Nutrient Management Programs	Not Directly Energy Related
AFW-3	0.01	0.02	0.3	$34.00	$136.00	Manure Management Methods to Achieve GHG Benefits	60
AFW-4	0.06	0.11	1.8	$56.00	$31.00	Protect Open Space / Agricultural Land	Not Directly Energy Related
AFW-5	0.03	0.12	1.3	$4.00	$3.00	Forestry Programs to Enhance GHG Benefits	56
AFW-6	Quantified Under ESD Options					Increased Forest Biomass Energy Use	62

GCCC	GHG Reductions (MMtCO2eq)			Net Present Value 2008–2028 (Million $)	Cost Effectiveness ($/tCO$_2$e)	Policy Option	CEP 2009
	2012	2028	Total 2008–2028				Rec. #
AFW-7	0.4	2	22	$34.00	$2.00	Forest Protection – Reduced Clearing and Conversion to Non-Forest Cover	Not Directly Energy Related
AFW-8	0.09	0.05	1.4	Not Quantified	Not Quantified	Expanded Production and Use of Durable Wood Products (especially from Vermont sources)	Not Directly Energy Related
AFW-9	0.16	0.88	9.1	$37.00	$4.00	Advanced/Expanded Recycling and Composting	
AFW-10	0.34	0.73	10	Not Quantified	Not Quantified	Programs to Reduce Waste Generation	Not Directly Energy Related
AFW-11	0.004	0.01	0.14	−$19.00	−$133.00	Waste Water Treatment – Energy Efficiency Improvements	Programs in Place
AFW-12						In-State Liquid Biofuels Production - Ethanol, Biodiesel	57, 59
Ethanol Production	0.03	0.42	3.7	$5.00	$1.00		
Biodiesel Production	0.004	0.24	2.2	$40.00	$18.00		
Sector Total After Adjusting for Overlaps	1.2	4.7	54	$210.00	$4.00		
Reductions From Recent Actions	0	0	0	$0.00	$0.00		
Sector Total Plus Recent Actions	1.2	4.7	54	$210.00	$4.00		
Cross-Cutting Issues							
CC-1	Not Quantified					GHG Inventories and Forecasts	67, 68
CC-2	Not Quantified					State GHG Reporting	67, 68
CC-3	Not Quantified					State GHG Registry	67, 68
CC-4	Not Quantified					State Climate Public Education and Engagement	Ongoing

GCCC	GHG Reductions (MMtCO2eq)			Net Present Value 2008–2028 (Million $)	Cost Effectiveness ($/tCO$_2$e)	Policy Option	CEP 2009
	2012	2028	Total 2008–2028				Rec. #
CC-5	Not Quantified					Adaptation	
CC-6	Not Quantified					Options for State GHG Goals or Targets	Goals in Law S.350
CC-7	Not Quantified					The State's Own GHG Emissions	Action Enacted in Law S.350