Vermont Electric Energy Efficiency Potential Study

Final Report

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Prepared for the Vermont Department of Public Service

Prepared and Submitted by:

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It is important to note that the base case scenario in this final report includes an assessment of the benefits and costs of electric space heat, electric water heater, and electric dryer fuel conversion in the residential sector.

This final report provides valuable and up-to-date electric energy efficiency potential information for decision-makers in the State of Vermont, and it will also be useful to electric energy efficiency program designers and implementers in other States who need a template for their own energy efficiency potential studies. This report includes a thorough and up-to-date assessment of the impacts that energy efficiency measures and programs can have on electricity use in Vermont, the economic costs and benefits of such electric DSM programs, the rate impacts of such programs, and the environmental benefits of the achievable cost effective energy efficiency programs identified by this study. Clearly there is significant cost effective electricity savings remaining to be tapped in Vermont.

Richard F. Spellman, President
GDS Associates, Inc.
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1.0 EXECUTIVE SUMMARY – ELECTRIC ENERGY EFFICIENCY POTENTIAL

This study estimates the achievable cost effective potential for electric energy and peak demand savings from energy-efficiency and fuel conversion measures in Vermont. The primary cost effectiveness test used for screening of energy efficiency measures is the Vermont Societal Test.[1] Energy-efficiency opportunities typically are physical, long-lasting changes to buildings and equipment that result in decreased energy use while maintaining the same or improved levels of energy service. The study shows that there is still significant savings potential in Vermont for cost effective electric energy-efficiency and fuel conversion measures. The technical potential savings for electric energy efficiency measures in Vermont is 35 percent of projected 2015 kWh sales in the State, and the cost effective achievable potential is 19 percent of projected 2015 kWh sales.[2]

Based on cost effectiveness screening using the Vermont Societal Test, capturing the achievable cost effective potential for energy efficiency in Vermont would reduce electric energy use by 19 percent (1,287 GWh annually) by 2015.[3] The magnitude of the potential savings is higher than results reported for recent studies for many other States (see Table 1-7 for the results of other recent studies). Load reductions from load management and demand response measures, which were not analyzed in this study, would be in addition to these energy efficiency savings. Table 1-1 below provides a summary of the achievable cost effective energy efficiency and fuel conversion potential savings for Vermont by the year 2015. In developing the estimates of achievable cost effective savings potential, GDS considered savings opportunities from market driven, retrofit, early retirement[4] and fuel conversion energy efficiency program strategies. This report also presents estimates of the achievable cost effective potential based upon screening using the Total Resource Cost Test, the Utility Test, and the Participant Test.

[1] While the Vermont Societal Test was used as the primary test for screening, the results are robust relative to the choice of tests and would vary little had the Total Resource Cost Test been used as the primary test.

[2] A prior energy efficiency potential study for Vermont completed by Optimal Energy in January 2003 found that the maximum achievable potential savings in Vermont for electric energy efficiency measures was 30.8% by 2012. The title of this 2003 study was “Electric and Economic Impacts of Maximum Achievable Statewide Efficiency Savings, 2003 to 2012, Results and Analysis Summary”.

[3] The stated annual mWh savings targets in the Efficiency Vermont contract for 2006, 2007, and 2008 are 58,000 mWh, 68,000 mWh and 78,000 mWh respectively.

[4] GDS has also examined an additional scenario where equipment replacements are done using an early retirement programmatic strategy. The results of this additional scenario are provided in Appendix G of the final report.

Table 1-1: Achievable Cost Effective Electric Energy Efficiency Potential By 2015 in Vermont			
Sector	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	Percent of Sector 2015 kWh Sales Forecast
Residential Sector	567,511,161	2,659,831,768	21.3%
Commercial Sector	450,383,577	2,115,167,148	21.3%
Industrial Sector	268,928,672	1,851,792,067	14.5%
Total	1,286,823,410	6,626,790,983	19.4%

1.1 Level of Financial Incentives for the Achievable Potential Base Case Scenario

In the base case developed for this Vermont Energy Efficiency Potential Report, GDS selected a target incentive level of 50 percent of energy efficiency measure costs as the incentive level necessary in order to achieve high rates of program participation necessary to achieve the savings potential. This incentive level assumption is based upon a thorough review by GDS of numerous energy efficiency potential studies recently conducted in the US, and a review of the December 2004 National Energy Efficiency Best Practices Study.[5] Examples of the energy efficiency potential studies reviewed by GDS are listed in Table 1-7 of this report. The incentive levels utilized in these other energy efficiency potential studies are described below.

- In February 2006, Quantum Consulting completed an analysis of the maximum achievable cost effective electricity savings for the Los Angeles Department of Water and Power (LAWPD). For the maximum achievable electricity savings potential scenario, this analysis assumed incentives covering 50 percent, on average, of incremental measure costs, and marketing expenditures sufficient to create maximum market awareness over the forecasting period.
- The 2002 California "Secret Surplus" Report examined savings potential scenarios based on incentive levels (incentives as a percent of measure costs) of 33%, 66% and 100% of measure costs.
- The June 2004 Connecticut Energy Conservation Management Board (ECMB) electric energy efficiency potential study assumed incentive levels ranging from 50% to 70% of measure costs.

[5] See "National Energy Efficiency Best Practices Study, Volume NR5, Non-Residential Large Comprehensive Incentive Programs Best Practices Report", prepared by Quantum Consulting for Pacific Gas and Electric Company, December 2004, page NR5-51.

- The Southwest Energy Efficiency Project potential study assumed incentive levels of 15% to 25% of measure costs.
- The January 2003 Vermont energy efficiency potential study assumed an incentive level of 100% of full measure costs for retrofit programs, and 100% of incremental costs for retail and new construction programs.
- The 2005 Big Rivers Electric Cooperative (Kentucky) potential study assumed an incentive level of 50% of incremental measure costs.
- The 2005 Georgia potential study examined scenarios with incentive levels of 25%, 50% and 100%.
- A recent electric energy efficiency achievable potential study in New York state performed by Optimal Energy assumed incentive levels in the range of 20% to 50%.

There are several reasons why an incentive level of 50% of measure costs (and not 100% of measure costs) was assumed for the base case for this study:

1. First, the incentive level of 50% of measure costs assumed in the Vermont Energy Efficiency Potential study for the base case scenario is a reasonable target based on a thorough review by GDS of incentive levels used in other recent technical potential studies. The incentive levels used in the studies reviewed by GDS as well as actual experience with incentive levels in the Northeast and other regions of the country confirm that an incentive level assumption of 50% is commonly used for program planning and implementation. As noted above, the very recent study (February 2006) conducted by Quantum Consulting for the Los Angeles Water and Power Department assumed incentives of 50% of measure costs for its maximum achievable savings scenario. Also, the majority of energy efficiency programs offered by NYSERDA offer no incentives to consumers. In addition, the NYSERDA electric energy efficiency achievable potential study performed by Optimal Energy assumed incentive levels in the range of 20% to 50%.

2. Second, and most important, the highly recognized and recently published National Energy Efficiency Best Practices Study concludes that use of an incentive level of 100% of measure costs **is not recommended as a program strategy**.[6] This national best practices study concludes that it is very important to **limit** incentives to participants so that they do not exceed a pre-determined portion of average or customer-specific incremental cost estimates. The report states that this step is critical to avoid grossly overpaying for energy savings. This best practices report also notes that if incentives are set too high, free-ridership problems will increase significantly. Free riders dilute the market impact of program dollars.

[6] See "National Energy Efficiency Best Practices Study, Volume NR5, Non-Residential Large Comprehensive Incentive Programs Best Practices Report", prepared by Quantum Consulting for Pacific Gas and Electric Company, December 2004, page NR5-51.

3. Third, financial incentives are only one of many important programmatic marketing tools. Program designs and program logic models also need to make use of other education, training and marketing tools to maximize consumer awareness and understanding of energy efficient products. A program manager can ramp up or down expenditures for the mix of marketing tools to maximize program participation and savings.

While this new Vermont Energy Efficiency Potential Study provides an estimate of the budget increase that would be necessary if the incentive level were raised to 100% of measure costs, this study does not recommend an incentive level of 100% of measure costs for the above reasons. Furthermore, actual program experience has shown that very high levels of market penetration can be achieved with aggressive energy efficiency programs that combine education, training and other programmatic approaches along with incentive levels in the 50% range.

Appendices A, B, and C of this report provide detailed information on the costs, savings and useful lives of the electric energy efficiency measures examined in this study. Year-by-year information on mWh savings by sector and winter and summer peak demand (MW) savings are provided in Appendix D of this report. Appendix E lists assumptions for the discount rate, inflation rate, line loss factors, electric generation reserve margin, and power plant emissions factors. Appendix F lists avoided costs for electricity and natural gas; retail rate projections for fuel oil, natural gas, propane, kerosene, and water. Appendix G provides information on the benefits and costs of an early replacement programmatic strategy.

One of the factors causing the electricity savings potential to be lower than in the 2003 Vermont energy efficiency potential study is the enactment of new Federal and state standards for energy efficiency. Another factor contributing to lower savings potential than in the 2003 study is the large amount of energy efficiency savings already captured by Efficiency Vermont over the past six years. The most recent Efficiency Vermont Annual Report states that its programs have saved 261.7 million kWh[7] on a cumulative annual basis as of December 31, 2005. These actual savings are 4% of 2005 annual kWh sales in Vermont.

The cost effectiveness screening is based upon a long-term forecast for the rate of inflation of 2.25%[8], and a nominal discount rate of 7.975% provided to GDS by VDPS staff.

Table 1-2 below shows the technical potential, achievable potential, and the achievable cost effective potential for electricity savings in Vermont by 2015. The table provides these results for the major sectors combined, and broken down by sector.

[7] Efficiency Vermont, 2005 Annual Report Summary, from Efficiency Vermont web site.
[8] This long-term inflation rate was obtained from the December 2005 Avoided Energy Supply Component Study Group Report titled “Avoided Energy Supply Costs in New England”.

Table 1-2: Summary of Overall Electric Energy Efficiency Potential in Vermont for all Sectors (Residential, Commercial and Industrial Combined)		
	Estimated Cumulative Annual Savings by 2015 (kWh)	Savings in 2015 as a Percent of Total 2015 Industrial Sector kWh Sales
Technical Potential	2,294,594	34.6%
Achievable Potential	1,463,126	22.1%
Achievable Cost Effective Potential	1,286,824	19.4%

Summary of Residential Sector Only Energy Efficiency Potential in Vermont		
	Estimated Cumulative Annual Savings by 2015 (mWh)	Savings in 2015 as a Percent of Total 2015 Industrial Sector kWh Sales
Technical Potential	1,057,749	39.8%
Achievable Potential	677,894	25.5%
Achievable Cost Effective Potential	567,511	21.3%

Summary of Commercial Sector Only Energy Efficiency Potential in Vermont		
	Estimated Cumulative Annual Savings by 2015 (mWh)	Savings in 2015 as a Percent of Total 2015 Industrial Sector kWh Sales
Technical Potential	854,144	40.4%
Achievable Potential	516,303	24.4%
Achievable Cost Effective Potential	450,384	21.3%

Summary of Industrial Sector Only Energy Efficiency Potential in Vermont		
	Estimated Cumulative Annual Savings by 2015 (mWh)	Savings in 2015 as a Percent of Total 2015 Industrial Sector kWh Sales
Technical Potential	382,700	20.7%
Achievable Potential	268,929	14.5%
Achievable Cost Effective Potential	268,929	14.5%

The base case projection for the achievable cost effective potential electricity savings is based upon cost effectiveness screening using the Vermont Societal Test and assumes that Efficiency Vermont pays financial incentives equivalent to fifty percent of measure incremental costs. The net present savings for the State of Vermont for long-term implementation of energy efficiency programs throughout the State over the next decade are **$964 million.** The Societal Test[9] benefit/cost ratio for the achievable cost effective potential scenario is 3.45.

[9] According to the Final Order in Vermont Public Service Board Docket No. 5270, the Societal Test calculation in Vermont includes a 5 percent adder to program electric energy benefits for non-energy benefits (for environmental benefits), and a 10% reduction to program costs to account for the risk diversification benefits of energy efficiency measures and programs. The

This new study of the electric energy efficiency potential in Vermont is based upon data and forecasts that are different than those relied upon in the study published by Optimal Energy for Vermont in 2003:

- This 2006 study is based upon a new electric energy and peak load growth rate assumption for the State of Vermont provided to GDS by the Vermont Department of Public Service in April 2006. Before the impacts of energy efficiency programs are considered, the VDPS is assuming that annual kWh sales in Vermont will grow at an average annual rate of 1.5% for the period 2006 to 2015.
- The new ISO-New England load forecast for Vermont (the forecast after DSM impacts are reflected) is projecting slower load growth (only 1% a year) than occurred during the prior decade. From 1994 to 2004, annual kWh sales grew slightly faster, at 1.3% per year.
- The benefit/cost screening analyses in this report use a new forecast of avoided costs of electricity and fossil fuels just published in December 2005 by the New England Avoided Energy Supply Component Study Group. The new forecast of electric avoided costs is substantially higher than the forecast used in the 2003 study.
- As of April 2006, Efficiency Vermont has been in business for over five years and has already captured a significant portion of the available energy efficiency potential, more than had been captured by the beginning of 2003 when the Optimal Energy potential study for Vermont was published. The most recent Efficiency Vermont Annual Report states that its programs have saved 266.7 million kWh[10] on a cumulative annual basis as of December 31, 2005. These actual savings are 4% of 2005 annual kWh sales in Vermont.
- This 2006 study is based upon very recent and detailed market assessment studies for all sectors in Vermont prepared in 2005 by KEMA.
- This 2006 study uses a lower discount rate (a 5.6% discount rate in real terms in the new study instead of the 6.8% real discount rate used in the 2003 study). This study uses a forecast for the long-term general rate of inflation of 2.25%.
- The 2006 study uses well documented end use load shapes for residential electric space heat, electric water heating, refrigerators and other end uses obtained from Central Maine Power Company and other electric utilities in the region.[11]

Board subsequently adopted an environmental adder of $.0070 per kWh saved (in $2000). In this report, GDS has used the definition of the Societal Test calculation as specified by the Vermont Pubic Service Board in its final order in Docket No. 5270, and has used the $.0070 adder for environmental benefits, adjusted to current year dollars.

[10] Efficiency Vermont, Preliminary Annual Report for 2005, from Efficiency Vermont web site.

[11] Central Maine Power Company, Market Research and Forecasting Department, "Residential End Use Metering Project Report", August 1988. Provided to GDS Associates in April 2006 by John Davulis of Central Maine Power Company. Richard Spellman of GDS, a former CMP employee, directed this end use metering project while employed at CMP in the 1980's.